A Vibrant Economy?
Exploring Evidence of Economic Convergence in Post-Devolution Wales.

Richard Godfrey B.A. M.Sc.

Thesis submitted to the Cardiff School of Management in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

2012

The Cardiff School of Management
University of Wales Institute, Cardiff
Western Avenue
Cardiff, UK, CF5 2YB
Acknowledgements

I would like to express my thanks to my supervisory team; Professor Rebecca Boden, Dr. Molly Scott-Cato and Dr. Piers Thompson. Through the course of this research they were selfless with their time and generous with their support and encouragement and I will always be grateful for our association. Dr Eric Levin of Glasgow University kindly read an early version of this thesis and I benefited from his helpful advice.

My thanks also go to the Librarians at Colchester Avenue and in particular, Mr Colin Lockhart who assisted in finding data sources.

Writing a thesis is a time-consuming activity and this loss was borne with stoicism and humour by my wife, Eirwen, who is looking forward to the resumption of our family life.
## Contents

**Abstract** v

** Declarations** vi

** List of Tables** vii

** List of Figures** ix

### Part I. Public Choice Theory and Growth Theory - A Critical Analysis

1  **Devolution – Tribalism or Real Economic Change**
   1.1  Governance in Flux  1
   1.2  Devolution in Wales  4
   1.3  Research Questions  14
   1.4  Answering the Research Questions  17
   1.5  Structure of the Thesis  19

2  **Economic Development and Devolution in Wales**
   2.1  Introduction  23
   2.2  Wales: An Economic Appraisal  24
   2.3  The Policy Response to Unbalanced Regional Growth  39
       A Brief History of Regional Economic Policy  42
   2.4  The Theoretical Consequences of Devolution  48
   2.5  Financing Devolution: The Barnett Formula  52
   2.6  Government Failure, Fiscal Decentralization and Devolution  59
       The Welsh Assembly’s Expenditure Choices  66
       The Devolution Settlement and its Significance for Growth  71
       Spatial Inter-Relationships  74
   2.7  Conclusion  76

   *Notes to Chapter 2*  77

3  **Devolution and Growth: Theoretical and Empirical Perspectives**
   3.1  Introduction  78
   3.2  Theories of Economic Growth  80
       Growth Accounting and Total Factor Productivity  82
       Neoclassical and Endogenous Growth  88
   3.3  The Meaning of Convergence  99
   3.4  Empirical Evidence of Growth and Convergence  108
       Empirical Research into Economic Growth  108
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.5</td>
<td>Spatial Correlation and Regional Economic Convergence</td>
<td>272</td>
</tr>
<tr>
<td></td>
<td>in the UK</td>
<td></td>
</tr>
<tr>
<td>6.6</td>
<td>Estimates of Beta Convergence between UK Sub-Regions</td>
<td>280</td>
</tr>
<tr>
<td>6.7</td>
<td>Conclusion</td>
<td>285</td>
</tr>
<tr>
<td>7</td>
<td><strong>Endogenous Growth in Wales</strong></td>
<td></td>
</tr>
<tr>
<td>7.1</td>
<td>Introduction</td>
<td>287</td>
</tr>
<tr>
<td>7.2</td>
<td>Government Spending, Education and Economic Development</td>
<td>289</td>
</tr>
<tr>
<td>7.3</td>
<td>The Econometric Specification and the Data Used</td>
<td>292</td>
</tr>
<tr>
<td></td>
<td>The Education Data</td>
<td>296</td>
</tr>
<tr>
<td>7.4</td>
<td>The Theoretical Specification</td>
<td>300</td>
</tr>
<tr>
<td>7.5</td>
<td>Model Estimation and Diagnostic Tests</td>
<td>309</td>
</tr>
<tr>
<td>7.6</td>
<td>Conclusion</td>
<td>323</td>
</tr>
<tr>
<td></td>
<td><em>Notes to Chapter 7</em></td>
<td>326</td>
</tr>
<tr>
<td>8</td>
<td><strong>Spatial Econometric Analysis of Beta Convergence</strong></td>
<td></td>
</tr>
<tr>
<td>8.1</td>
<td>Introduction</td>
<td>327</td>
</tr>
<tr>
<td>8.2</td>
<td>Spatial Econometric Analysis of UK and Welsh Economic</td>
<td>329</td>
</tr>
<tr>
<td></td>
<td>Convergence</td>
<td></td>
</tr>
<tr>
<td>8.3</td>
<td>Estimates of Welsh Absolute Beta Convergence and Spatial</td>
<td>333</td>
</tr>
<tr>
<td></td>
<td>Autocorrelation</td>
<td></td>
</tr>
<tr>
<td>8.4</td>
<td>Modelling Welsh Endogenous Growth with Spatial Weights</td>
<td>342</td>
</tr>
<tr>
<td>8.5</td>
<td>Conclusion</td>
<td>348</td>
</tr>
<tr>
<td>9</td>
<td><strong>Conclusion: The Abstraction of What Might Have Been?</strong></td>
<td></td>
</tr>
<tr>
<td>9.1</td>
<td>Introduction</td>
<td>350</td>
</tr>
<tr>
<td>9.2</td>
<td>The Economic Consequences of Welsh Devolution</td>
<td>353</td>
</tr>
<tr>
<td>9.3</td>
<td>A Work in Progress</td>
<td>364</td>
</tr>
<tr>
<td>9.4</td>
<td>Time Present, Time Past and Time Future</td>
<td>369</td>
</tr>
<tr>
<td></td>
<td><em>Notes to Chapter 8</em></td>
<td>373</td>
</tr>
</tbody>
</table>

*References*
Abstract
This thesis investigates the consequences of devolved government in Wales for its economic performance. Economic theory is ambivalent concerning the consequences of changes in governance that are often considered as issues in fiscal decentralization or fiscal federalism. Economic growth theory however can be interpreted as dogmatic in expecting convergence between the economies of nation-states: for neo-classical growth convergence between similar states at different stages of development is considered to be inevitable; under endogenous growth theory, convergence is attainable through identifying and adjusting key policy variables.

I have examined UK regional economic data using a selection of descriptive statistics and have not found evidence of neo-classical economic convergence between Wales and other regions of the UK. I have investigated the possibility of endogenous growth in Wales in relation to other regions of the UK in terms of spending on economic development and differences in human capital within the workforce. The evidence suggests that public spending on economic development has not been effective in improving Welsh economic performance although there is evidence that it is positively influenced by education. I have also undertaken an investigation of spatial dependence in economic activity between Wales and other UK regions. This analysis indicates that an endogenous model augmented with a spatial lag based on the distance between regions does provide some evidence that spending on economic development and investment in human capital do contribute to our understanding of Welsh economic performance. However, the analysis that was undertaken has not found evidence that Devolution has yet been instrumental in improving Welsh economic performance in relation to other regions of the UK.
Declarations

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed………………………. (candidate)
Date…………………………

This thesis is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by explicit Harvard-style references. A full Reference list is included in the thesis.

Signed………………………. (candidate)
Date…………………………

I hereby give consent for my thesis, if accepted, to be available for photocopying and for inter-library loan, and for the title and summary to be made available to outside organizations.

Signed………………………. (candidate)
Date…………………………
## List of Tables

1.1 Policy Areas Devolved to the Welsh Assembly Government .................................................. 13

2.1 Regional GDP per Person in GB between 1871 and 2001 .................................................. 26

2.2 Annual Rates of Growth of GDP and GDP per head in GB Regions between 1871 and 1955 .... 28

2.3 Economic activity rates in the UK and its territories between 2000 and 2008 ...................... 29

2.4 Industrial Composition of Employee Jobs: England, Wales and Scotland 1999 and 2009 .... 29

2.5 Economic Inactivity in Welsh Local Authorities Year ending 30 September 2007 ................. 33

2.6 Regional Gross Value Added (GVA), by UK country excluding N. Ireland ......................... 34

2.7 Sub-Regional Gross Value Added (GVA), by Welsh NUTS3 area between 1995 and 2005 .... 36

2.8 Current Expenditure on Services in Wales 1996/7 and 2006/7 ........................................ 67

3.1 Classification of Long Run per Capita Income Convergence Types .................................. 104

3.2 Single Region Type I and Type II Output Multipliers for Scotland Wales and the Rest of the UK (RUK), 1999 ................................................................. 136

3.3 SAM Type II Inter-Regional Output Multipliers for Scotland Wales and RUK 1999 £million output per £million output. .................................................... 137

4.1 NAFW Measures Categorised by the Fields of Schedule 5, Government of Wales Act 2006 .... 164

6.1 Real GVA per Head, UK 1995-2008 at 1995 prices (£ and ratio) ......................................... 250


6.3 England (excluding Inner London West), Wales and Scotland - Summary Statistics of Real GVA per head between 1995-2008, (£ and ratios) .................. 254

6.4 Wales GVA per head as a percentage of England and Scotland ........................................... 257

6.5 Skew and Kurtosis of real GVA per head of England including and excluding Inner London West between 1995 and 2008 .................................................. 261

6.6 England (excluding Inner London West), Wales and Scotland - Skew and Kurtosis of Real GVA per head between
6.7 Jarque-Bera Test of the Normality of Real GVA per head 1995-2008 England (excluding Inner London West) Wales and Scotland.
6.8 Variance of Natural Log of Real GVA per head for UK NUTS 3 Regions 1995-2008 compared with those of Henley (2005)
6.9 Real GVA per Head; Welsh Sub-Regions and as percentage of UK average 1995, 2000 and 2008
6.11 Estimates of Beta Convergence for England, Wales, Wales and Adjacent Regions, Scotland, Core Regions, Inner Periphery (IP) Regions and Outer Periphery (OP) Regions

7.1 Intra-Regional and Inter-Regional Commuting of Employees and the Self-Employed within England and Wales in 1999
7.2 Test for Redundant Cross-Section Fixed Effects
7.3 Level Panel Unit-Root Tests 1995-2008
7.4 Level Panel Unit-Root Tests 1995-2008 Education
7.5 Fixed Effects Regression Estimates: UK NUTS1 Regions 1995-2008; Education variable: HE qualifications as ratio of no qualifications
7.6 Fixed Effects Regression Estimates: UK NUTS1 Regions 1995-2008; Education variable: no qualifications
7.7 Fixed Effects Regression Estimates: UK NUTS1 Regions 1995-2008; Education variable: HE qualifications
7.8 Omitted Variables Test
7.9 Fixed Effects Regression Estimates: UK NUTS1 Regions 1995-2008; Education variable: HE qualifications as ratio of no qualifications
7.10 Fixed Effects Regression Estimates Scotland: NUTS1 1995-2008; Education variable: HE qualifications as ratio of no qualifications
7.11 Test for Redundant Period Fixed Effects

8.1 Unconditional Beta Convergence Estimates UK NUTS 3 Areas
8.2 Unconditional Beta Convergence Estimates – Wales Convergence with England and Scotland
8.3 Conditional Beta Convergence Estimates – Wales
8.4 Conditional Beta Convergence Estimates – Wales and adjoining regions
List of Figures

6.1 An example of positive and negative kurtosis 259
6.2 Logarithm of Real GVA per Head in NUTS 3 UK Sub-Regions, 2008 and 1995 268
6.3 Spatial Autocorrelation in log real GVA per capita, UK sub-regions 1995 Moran’s scatterplot 279
6.4 Spatial Autocorrelation in log real GVA per capita, UK sub-regions 2000 Moran’s scatterplot 279
6.5 Spatial Autocorrelation in log real GVA per capita, UK sub-regions 2008 Moran’s scatterplot 280
Part I. Public Choice Theory and Growth Theory – A Critical Analysis
Chapter 1

Devolution – Tribalism or Real Economic Change?

1.1 Governance in Flux

In recent years the political map of Europe has exhibited rapid change with a growing trend towards supranationalism accompanied by the regions of sovereign states demanding greater autonomy to manage their own affairs. Devolution, or the decentralization of power from their central governments, has occurred in the countries formerly known as Yugoslavia and Czechoslovakia, Belgium, Italy, Spain and France. Within the UK, power has been devolved to Wales, Scotland and Northern Ireland.

The motivation for decentralization may be driven *inter alia* by political, ethnic or religious considerations. Whatever the driver, if it involves the decentralization of fiscal policy affecting the provision of public services and changes in their funding arrangements then, it has significant resource implications. Consequently, devolution is important for all a state’s citizens, not just those of the devolved territories. Changes in policy by devolved administrations may affect the level and mix of public services and changes in their funding by central government, may have a net effect on the rate of economic growth of the regions and the country as a whole.

The analysis of the economic consequences of decentralization by Tiebout (1956), Musgrave (1959) and Oates (1972) suggests broad agreement that the
provision of pure public goods such as defence and the legal framework are best provided by the central government of the nation state. However, beyond this there is uncertainty concerning the economic consequences of devolution for devolved regions. That the subject of devolution and its economic consequences is controversial can be seen from comments made before the devolution referendum in Wales and Scotland.

The starting point of our analysis is to suppose that from an economic efficiency point of view, separation of nations is never desirable. A unified nation is always more efficient since free trade among regions is guaranteed, duplication costs in defence and law enforcement are avoided, and local public goods provision...can be co-ordinated. (Bolton and Roland 1997).

Bolton and Roland are unambiguous about the undesirability of eroding the homogenous character of the nation state and others share their scepticism, arguing that devolution may be a retrograde policy (Prud’homme 1995; Rodriguez and Gill 2004; Rodriguez and Bwire 2004). Some observers are undecided: Alesina and Spolaore (1997) suggest that the growing number of countries granted regional autonomy is inefficient compared with the number of jurisdictions that is theoretically desirable. In other words, they do not necessarily disagree with the principle of devolution but suggest that it is not suitable for all regions. Certainly, the Welsh electorate appeared to be uncertain about the benefits of devolution as less than 51% voted in favour of it in the 1997 referendum. By contrast, the Welsh Assembly Government claims that
devolution offers the opportunity to improve the performance of the Welsh economy (Welsh Assembly Government 2002 and 2005).

This debate concerning the benefits of decentralization has encouraged a great deal of analysis of devolution and its consequences. However, empirical studies of the economic consequences of decentralization have tended to focus on cross-country studies (Barro 1991; Armstrong 1995; Bandyopadhyay 2003; Lessmann 2006; Barrientos 2007). In contrast, the analysis of the economic consequences for the devolved regions of a nation state has been neglected.

There are few studies that discuss the economic consequences of devolution in the UK (McGregor et al 2004; Cooke and Clifton 2005; McGregor and Swales 2005) and fewer still that do so by engaging in empirical analysis (Chatterji and Dewhurst 1996; Henley 2005). Furthermore, empirical studies tend to focus on the performance of a complete set of UK regions that do not distinguish between the differences of the English regions and those of the devolved territories. This is equivalent to assuming that all regions are homogeneous so that devolution and the accompanying decentralization will not affect their economic performance.

This discussion suggests that the analysis of devolution requires the investigation of the twin themes of decentralization and economic growth. I continue by discussing the background to devolution in Wales, which forms the central focus of this research.
1.2 Devolution in Wales

Within the economics discipline it took the many decades between the publication of *The Wealth of Nations* (Smith [1776] 1982) until the publication of *Das Kapital* (Marx [1867] 2007) and *The General Theory of Employment, Interest and Money* (Keynes 1936) to challenge the thinking of Smith’s laissez-faire economic policy prescriptions. Contemporary doctrine accepts that there is a role for government in monitoring, regulating and (controversially) proactively intervening in economic management. The presumption of government having such a role is now so much an article of faith that some authors fail to question or provide a rationale for government economic policy making (Froyen 2005).

UK economic policy is formulated by HM Treasury and one of its main objectives is to raise the UK trend rate of economic growth (HM Treasury 2003). A disaggregation of UK economic growth between the regions reveals a wide variation in economic performance and evidence indicates that the UK has experienced problems with the uneven pace of regional economic development for many years (ONS 2009). Differential performance in regional economic activity is undesirable as it represents an opportunity cost for the regions and for the national economy. The consequent cumulative loss of output, income, employment and tax revenue is probably greater for the national economy than the sum of the losses experienced by the individual regions. The difference is attributable to the likely multiplier effects of the lost output through inter-regional linkages in factor markets and final goods markets.
This problem of uneven regional economic performance can be traced back at least 30 years, when there were striking regional differences in GVA per head, unemployment and the spatial distribution and composition of industry (Griffiths and Wall 2007). Over this period regions were often classified as belonging to one of three groups that were considered to share similar growth rates: the most prosperous core group of regions comprising London, the South East, Eastern and East Midlands; the inner periphery group of three regions with lower incomes per head, West Midlands, the South West and Yorkshire-Humberside; and the remaining outer periphery group of the regions with the lowest incomes per head, Wales, Scotland, Northern Ireland and the North West (Brand 2003).

Proactive intervention for the purpose of counter-cyclical economic management of the UK economy has been eschewed as a policy doctrine since the late 1970s, but was reintroduced as a response to the financial and economic downturn in 2008/9. However, regional economic policy to address the spatial imbalance of economic activity and material opportunity among the UK regions has continued to occupy ministers’ attention since the end of the Second World War. Various policies have been attempted with the intention of influencing the location of industry within the UK (these are discussed in greater detail in chapters 2 and 4). Some success as measured by job creation was achieved, albeit at high cost. However, relative to other regions the Welsh economy continued to under-perform (Griffiths and Wall 2007).
The UK central government has significant leverage over aggregate economic activity by virtue of its power to vary taxation and public spending (fiscal policy), its ability to exercise control over credit creation (monetary policy) and influence over education and training and research and development (supply-side policies). Demand-side policy that attempts to influence the cyclical and secular trajectory of economic development by varying taxation and public spending is now considered subservient to the economic goals of fiscal balance and control of monetary growth. Central government economic policy instruments do not have the flexibility to take account of the differing circumstances of the UK regions and are applied to all the regions of the UK ubiquitously. However, such intervention has differential effects on the regions, stimulating some and weakening others, on account of variations between regions’ industrial structure, demography and labour-market participation.

The difficulty of addressing the problem of regional economic imbalance through national macroeconomic policy and the need for separate regional policy intervention was recognised as early as 1934 with the Special Areas Act. This Act identified locations within the UK that were named as depressed areas and which were selected as locations for the establishment of government trading estates offering subsidized rents and financial assistance. Since then successive political administrations have offered a variety of assistance and incentives to attract and encourage capital development and employment.
creation within areas designated as requiring assistance. Moore et al (1986) estimated that between 1960 and 1981 government intervention accounted for the creation of approximately 945,000 jobs. However, the costs associated with the creation of each job varied depending on the policy instrument used and was estimated to be between £17,000 and £73,000 per job.

From 1979 the Conservative government shifted the emphasis of regional policy towards promoting enterprise and self-employment. Since then the focus of policy has vacillated between incentives to encourage movement of labour or capital depending on the economic ideology of the government in power. However, interrogation of official statistics offers little evidence that regional policy of any type has been effective in promoting economic convergence between Wales and the rest of Great Britain. Official statistics (ONS 2009) suggest that GVA per head in Wales in 2007, after taking account of inflation, was lower than it was in 1971 and represented 74% of that of the UK.

In recent years the use of regional policy by central government to tackle the imbalance of regional economic performance was considered to be inadequate and the policy focus moved in favour of devolving greater economic autonomy to the regions and sub-regions (HM Treasury 2003). The essential idea supporting the anticipated benefits of local economic policy is based on the decentralization theorem (Oates 1972; 1999). This argues that within societies that practise representative government, local or devolved governance will enable a clearer and more focused articulation of the demand
for local services by the electorate. It is also argued that the provision of such services by locally elected political representatives will tend to be more efficient on account of their local focus and the incentive effect of being answerable to the electorate in subsequent elections. Additionally, it is argued that competition between regions (Tiebout 1956) for firms and residents to increase employment opportunities and tax revenue will bring about allocative efficiency in much the same way as is expected for the provision of private goods and labour in competitive markets.

The significance of devolution for economic activity lies in the decentralization of spending and tax-raising powers that is sometimes referred to as ‘fiscal federalism’. Decentralization means to distribute the administrative functions or powers of a central authority among several local authorities and differs somewhat from devolution in that there need not be a national or cultural dimension. Additionally, devolution differs from decentralization in that it may involve granting limited autonomy for the government of the devolved territory to enact legislation that is contained within its administrative boundary and subject to the approval of the state government. In these terms it would be possible for further decentralization to take place within the devolved Wales and Scotland but not further devolution. By contrast, federalism means a system of government in which power is passed between a central authority and its constituent political units (Oates 1999). It is a more general concept and a term that is often used synonymously with fiscal devolution.
Decentralization can take different forms, and although there is no consensual classification Klugman (1994) distinguishes between de-concentration, delegation and devolution. At one extreme, devolution involves a territory that could become a totally independent state with defined geographical borders, control over taxation and public expenditure, macroeconomic policy and responsibility for all legislation underpinning the rule of law for its territory. At the other extreme, de-concentration would maintain the region within the original government and grant it some administrative power that could involve some fiscal decentralization. Devolution permits fiscal decentralization, but the opposite is not the case.

Devolution also involves the creation of a new tier of locally elected policy-makers and legislators whose time and focus can be concentrated exclusively on the devolved territory and who may be more closely in touch with its key issues. When Wales was part of a unified UK and its affairs were managed within Westminster, policy was indivisible as it affected both England and Wales. At this time regional policy was exercised from Westminster, was more generally focussed and was not fine-tuned to distinguish the policy needs of each region.

However, there are different degrees of self-governance and regions may have different aspirations of the degree of independence that is sought. The extreme form of devolution would involve giving a Welsh government total independence to raise taxes and spend the proceeds according to the framing of
autonomous economic, civil and foreign policies. However the Government of Wales Act (1998) restricts the powers of the Welsh Assembly Government (WAG) to allocating public spending derived from a block grant from Westminster and limits its legislative powers to enacting secondary legislation.

Devolution that grants complete independence passes the responsibility for economic management of the region over to its citizens and their elected representatives and implies that they are in a better position to address their own problems than central government. It suggests that Welsh problems require Welsh solutions that can be formulated by local elected representatives who better understand the nature of the region’s problems and who will also be more receptive to the needs of the Welsh electorate.

Of the devolved UK territories only Scotland has limited powers to raise taxation. But they all have responsibility for the allocation of their regions’ budget and their choices over how the budgets should be spent affect the entire population of the newly created jurisdictions. The separation of the devolved administrations’ power to spend from its financing by central government is sometimes called into question as the ‘flypaper effect’ (Hines and Thaler 1995; Foreman-Peck 2003). It is claimed to lead to a loss of allocative efficiency as the separation of taxing and spending may lead to sub-optimal choices compared with what might be done if politicians had to simultaneously defend both their tax rates and spending choices at the ballot box.
In the absence of fiscal independence the territorial budgets of the devolved UK countries are determined by a top-down process from Westminster. Changes in UK departmental expenditures are agreed and then allocated between countries on the basis of population proportions consistent with the extant Census of Population. This method of determining budgets is known as the Barnett Formula (Twigger 1998) and was first applied to Scotland in 1978 and to Wales in 1980. The Welsh Devolution settlement allocates an annual budget to the WAG that is calculated by the Barnett Formula, and could be a severe restraint on future policy options. The significance of this method of funding is discussed in chapters 2 and 4 in greater detail.

Regional governments have to choose how to allocate funds among a range of competing public services dominated by the functional categories of social protection, health and education. In 2007/8, for Great Britain as a whole, these three categories accounted for 68.6% of total identifiable current expenditure on services. Economic management in the regions typically involves using part of the available funds to encourage economic development directly, through financing particular initiatives, or indirectly, through supporting education and economic development. These categories of spending on enterprise and economic development accounted for 1.33% of that of Great Britain as a whole (H. M. Treasury 2009). However, once account is taken of all spending that has a potential economic impact on regional economic prospects, a more accurate figure is 7.2% of total spending (H. M. Treasury 2009).
The Welsh Assembly Government (WAG) has no doubts about the expected benefits of Devolution (Welsh Assembly Government 2004, 2005):

The Assembly Government’s growing range of devolved powers, short decision chains, close partnerships, local knowledge and willingness to engage will help in building an ever stronger competitive advantage for Wales. (Welsh Assembly Government, 2005 para. 45, p.17).

But some observers are quite unequivocal in taking an opposing view. Prud’homme (1995) questioned the effectiveness of devolution to provide such benefits before this date and Rodriguez-Pose et al (2003; 2004; 2005) after the establishment of the Assembly.

For Wales the Devolution referendum resulted in the establishment of the National Assembly for Wales in 1999. It has responsibility for secondary legislation, has executive responsibility for a list of powers devolved from Westminster and must gain parliamentary approval for any changes in primary laws (Keating, in Adams and Robinson 2002). A list of the policy areas, devolved to Wales is listed in Table 1.1 below and is important for the analysis I undertake as it identifies those that can be used by WAG to exert influence on the performance of the Welsh economy.
Questions concerning the influence of decentralization and devolution on economic growth are important as it is often assumed that there is a relationship between economic growth and individuals’ material quality of life that can be measured by GDP or GVA per head (Barro and Sala-i-Martin 2004; Weil 2005). The pace of economic activity creates employment opportunities and consequent income growth, and while income may not guarantee contentment, it is fundamental for the provision of material standards of living and life opportunities such as education and health.

This section has highlighted that there is evidence of a persistent imbalance in the economic performance of the UK regions and that Wales has been one of the worst performing regions. UK economic policy towards the regions has been to encourage and promote greater autonomy and localization of decision-making. This policy has ultimately resulted in a limited devolution.
settlement for Wales that the Welsh Assembly Government expects will improve Welsh economic performance in relation to other UK regions. The economic performance of Wales is not the only justification and expectation of devolution but it has significance for the populations of both the devolved regions and the non-devolved regions of the UK. Given the national economic importance of regional economic growth it is important to investigate more closely the effect of devolution is having by means of a detailed case study. This is the focus of this thesis. Accordingly, in the next section I discuss the research questions that I address in this thesis and which shape my subsequent analysis.

1.3 Research Questions

The persistence of regional economic disparity within the UK in general and the poor economic performance of Wales in particular suggests that central government macroeconomic stabilization policy has proven to be too coarse to distinguish between the differing structures and needs of the regions. Official economic statistics also indicate that regional policy has proven to be ineffective in reducing inter-regional economic and social disparities. Perhaps because of this, the policy stance has shifted in favour of greater regional autonomy through the devolution of political power.

The central theme of my thesis is the consequence of devolved government for the devolved region’s economic performance and growth. The economics literature provides evidence that the mechanisms for influencing
economic control include the political structure of a region (Romer and Rosenthal 1978). I will present evidence suggesting that economic regional disparity appears to be entrenched within the UK economy despite proactive regional economic policy on the part of the UK central government over many years (a theme considered in more detail in section 2.2). Furthermore the Welsh economy has consistently been the worst - or one of the worst - performing regional economies in the UK. Regional economic policy now advocates devolving power to the regions in the expectation that local elected officials, who are answerable to the electorate, will deliver public services more effectively.

In the context of UK regional disparity in general, and Welsh economic performance in particular, the purpose of this research is to consider the effectiveness of devolution as a mechanism for closing the gap between regions’ economic performance by using Wales as a case study. The critically important issue that I address concerns the extent to which Welsh devolution empowers and enables the Welsh Assembly Government to improve the economic performance of the Welsh economy. This also has further implications for the expectations of devolution as a form of regional policy that will affect the UK economy as a whole. Accordingly, the principal research question I address is: to what extent can the policies of a devolved government affect the economic performance of a recently devolved territory? To answer this principal question I address the following ancillary research questions.
First, what is the policy context of devolution as an expression of regional economic policy in terms of the expectations of the theory of public choice and theories of economic growth? In short, the purpose of this question is to evaluate the significance of existing economic paradigms for the expectations of devolution as promoting regional economic change. I consider this question in chapters 2, 3 and 4.

Second, is there evidence of an improvement in the performance of the Welsh economy after Devolution based on the analysis of official statistics? This question is designed to consider the extent to which an improvement in the Welsh economy can be attributed to WAG policy in the decade following Devolution. Discussion of this question will establish a platform for the analysis of the extent to which Welsh relative economic performance is associated with WAG policies that are considered by economic theory to be instrumental as precursors of economic growth. These issues are addressed in chapter 6.

Third, is there evidence of spontaneous convergence occurring without the intervention of economic policy, which is predicted by neoclassical growth theory, or conditional convergence that is predicted under the assumptions of endogenous growth theory? Evidence of economic convergence that may be attributed to WAG policy is a central issue in this thesis, as any consequences of their policy intervention may be associated with fiscal decentralization and considered to be an expression of the tenets of endogenous growth theory. Finding evidence of convergence could be interpreted as a vindication of the
policy of devolution. This might engender its extension to English regions and affect the lives of many more people. The aim of this question is to explore such issues and it is addressed in chapter 7.

Fourth, is there evidence that the economic fortunes of the UK regions are independent or bound together in a mutual dependence? This is a question concerning spatial inter-dependence and its investigation can be used to extend the work undertaken in chapter 8 and evaluate to what extent the economic performance of Wales is related to that of other regions. This is important, for the extent to which Welsh economic performance is constrained by economic events in other regions will weaken the potency of the WAGs policy initiatives. It also has broader implications for the policy of decentralization as a method of economic renewal in poorer performing regions. I reflect on this final question in chapter 8.

1.4 Answering the Research Questions
The research questions discussed above are analysed using two complementary approaches. Clearly it is important to inform the analysis of the expectations of the theories of public economics and economic growth and their adoption by WAG in framing Welsh economic policy. This will contextualize the research questions and focus analysis on the extent to which there is a correspondence between the assumptions of these theories and their predictions. This will enable a clearer understanding of the extent to which the exercise of policy may
be successful in facilitating economic development. To do this I employ a critical review of the literature of public sector economics and economic growth theory to investigate whether the literature suggests an expected consequence for economic change arising from devolution or decentralization. This is accompanied by an analysis of Welsh economic policy that can be interpreted as an expression of the economic growth paradigm adopted by WAG to promote economic development. I use the results of my literature review to specify a hypothesis that I employ to undertake an empirical investigation of the research questions.

This hypothesis postulates the principal causes for Welsh economic performance that I investigate using empirical data and methods. I begin with a quantitative investigation of Welsh economic performance for evidence of convergence in levels of income per head or its growth before and after Devolution that is expected under neoclassical economic growth theory. I then investigate the predictions of endogenous growth theory and construct an endogenous model of Welsh economic growth relative to other UK regions by using variables often considered to be drivers of growth. I conclude my analysis of the research questions by modifying the endogenous model to incorporate spatial effects and estimate and test for evidence of spatial inter-dependence between Wales and other UK regions.
1.5 Structure of the Thesis

This thesis is in two parts: Part I (chapters 1 to 5) establishes a theoretical and methodological platform on which the second part (chapters 6 to 9) explores empirical evidence which is used to formulate a response to the research questions. Following this introductory chapter, in chapter 2 I review Welsh economic performance and prepare to set out the policy context by reviewing UK regional policy and the significance of governance for economic development. The policy context is important, as the efficacy of devolution in enabling a renewal of the political and economic Welsh landscape will be reflected in the devolution arrangements and the method of funding.

The discussion of the link between governance and economic performance echoes the distinction between the theories of economic growth described as the neoclassical growth paradigm and endogenous growth theory. Neoclassical growth theory considers that the potential or warranted economic growth rate of an economy is determined by the availability of productive resources and technological progress, and is invariant to policy intervention. Endogenous growth theory by contrast, accords a role to government and markets in promoting growth through stimulating research and development, and training and education to increase the productivity of capital and labour. Furthermore, the competing theories of economic growth have different expectations concerning the achievement of economic convergence and the effectiveness of economic policy in influencing economic convergence. The idea
of convergence is central to this thesis and it is necessary to investigate what we can learn from other investigations of a similar nature. Consequently, the choice of a paradigm of economic growth will influence future expectations concerning the ability of the Welsh economy to catch up with other better-performing UK regions and has to be made explicit at the outset of the analysis.

In chapter 3 I examine the theory of economic growth convergence and the empirical work that has been undertaken to test the convergence hypothesis. This chapter then develops the analysis to produce a testable econometric specification that is used to estimate and test the central research question of this thesis in Part II.

Welsh economic policy is discussed in chapter 4. I examine the emergence of a distinct articulation of Welsh policy that occurred some time before Devolution and continues to evolve as evidenced by the Welsh referendum in 2011 that extends the WAGs legislative powers without requiring the agreement of Westminster. Moreover, Welsh economic policy is the means by which WAG attempts to influence economic development and should be taken into account by the modelling strategy.

Chapter 5, the final chapter of Part I, discusses the issue of methodology by considering how social science in general and economic research in particular, can establish and extend our knowledge of the relationship between governance and regional economic performance. It then discusses the
methodology underpinning the empirical research that is undertaken in chapters 6 to 8 and its suitability as an appropriate methodology for this thesis.

Part II of the thesis moves the analysis to the empirical concerns of establishing what we can learn from available statistical evidence. It begins with chapter 6 in which I explore the raw statistics of Welsh economic performance for evidence of convergence between the regions of the UK. A variety of measures of convergence are used to achieve a triangulation of methods, with the aim of reducing the uncertainty associated with the estimates and my interpretation of them.

Chapter 7 contributes to the body of work investigating growth and convergence by developing and estimating an econometric model to test for evidence of economic growth convergence between Wales and the rest of the UK. This work can be described as parametric, and follows the traditional econometric approach suggested by Hendry (2000) that involves rigorous diagnostic testing and iteration of the model to develop a candidate specification. The results of the econometric modelling are then used to identify and quantify the transmission mechanism between WAG economic policy and its impact on the Welsh economic growth trajectory. This also permits a comparison of any changes that have occurred in this relationship before and after Devolution that can be used as evidence of change attributable to Devolution.
Chapter 8 extends the work of the previous chapter, by introducing the ideas and methods of spatial analysis to investigate whether there is evidence of inter-dependence and spillover effects between Wales and other UK regions. This is accomplished by using alternative spatial weights which are used to augment the previous estimates of absolute and conditional convergence that were undertaken in the previous two chapters.

Chapter 9 is the final chapter and draws together the evidence created by the analysis in the previous chapters in the context of goals of the thesis. In this chapter I demonstrate how this original piece of work offers fresh insights into a contested area of economic research. I synthesize my results and offer my overall analysis of the success of Welsh Devolution to facilitate growth convergence with other UK regions and reduce regional economic disparity.
Chapter 2
Economic Development and Devolution in Wales

2.1 Introduction

One of the striking features of contemporary state governance is the change towards unitary political and economic trading blocs together with the desire for regional devolution within nation states. This is frequently accompanied with the assertion of national and cultural identity that is often manifested in the aspiration for some form of political, social and economic self-determination. Consequently, fiscal decentralization and devolution have grown in popularity within the UK and Europe; examples of devolution or pressure for devolution in Europe can be found in Spain (Galicia, Catalonia and the Basque Region); France (the Basque Region); Belgium (the Flemish); Italy (the South Tyrol); and in a number of countries in Eastern Europe. In Wales, Devolution was granted in 1998, on a majority vote of just 51% following the result of an earlier referendum.

In this chapter I review Welsh economic performance, UK regional economic policy and devolution as an evolution of that policy. I begin in the following section with an introduction to recent Welsh economic history, focusing particularly on the country’s lagging economic performance relative to that of the UK, and continue in section 2.3 by describing and commenting on past efforts to address Welsh economic underperformance through UK regional policy. In particular I discuss whether devolution as the foundation of an economic
development strategy is fundamentally different from previous regional policy initiatives. In section 2.4 I consider the theoretical consequences of devolution and in the following section I investigate the relationship between devolution and fiscal decentralization as precursors of growth. Section 2.6 draws together the previous discussions and considers theoretically how devolution may affect Welsh economic prospects and section 2.7 concludes.

2.2 Wales: An Economic Appraisal

Evidence is presented below that the UK has experienced variations in the pace of economic development of its regions that goes back to the 19th century, when there were striking regional differences in GDP per head, unemployment and the spatial distribution and composition of industry. Over this period Wales was classified as belonging to the outer periphery of regions, on account of its poor economic performance (Griffiths and Wall 2007). The evidence suggests that Welsh underperformance in relation to the rest of UK is structural, endemic, and worsened up to 1998/9 (Mackay 2002) and this point is reinforced by Gripaios et al (2000) and Henley (2005).

One of the aims of the WAG is transforming the economy of Wales [into] a Welsh economy that is dynamic, inclusive and sustainable (Welsh Assembly Government 2004: 3). These goals are enshrined in a number of targets that are monitored over time (Welsh Assembly Government 2004) and the importance attached to economic regeneration by the Welsh Assembly Government suggests that they see this as one of their principal roles.
However, while devolution achieves a transfer of power and resources to subnational governments that can be employed to promote economic improvement (Prud’homme 1995), such political change may also be associated with non-economic motives such as enhancing cultural or national identity (Keating 1998). Consequently, economic performance per se is an insufficient measure of the WAGs overall performance and other factors are likely to be important to the electorate when electing representatives.

Wales is one of the smaller autonomous regional economies within the European Union. In 2005 the population was estimated at 2.96 million with GVA per head in 2007 of 74% of the UK average, while the unemployment rate was 6.5% (Welsh Assembly Government). The European Structural Fund Objective 1 aims to meet the economic development needs of the most disadvantaged regions or areas of Europe. It is targeted on those regions where Gross Domestic Product per head is less than 75% of the community average, and within the UK the eligible areas are South Yorkshire, West Wales and The Valleys, Cornwall and the Isles of Scilly. The Welsh area extends between the Isle of Anglesey in the North and the Valleys in the South taking in the densely populated wards of the South Wales Valleys, together with the more sparsely populated areas of Mid and West Wales. It excludes the more economically successful areas around Cardiff, and Wrexham.

The apparent Welsh economic underperformance relative to other regions of UK is not a new phenomenon. Table 2.1 and Table 2.2 below adapted from Crafts (2005) provide estimates of GDP per person and rates of growth in Wales
compared with those for UK regions for census years from 1871 through to 2001
and for growth rates between 1871 and 1954 respectively.

Table 2.1 Regional GDP per Person in GB between 1871 and 2001 (index: Britain =100)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>South East</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(incl. London)</td>
<td>116.2</td>
<td>121.7</td>
<td>124.6</td>
<td>112.7</td>
<td>116.5</td>
<td>118.9</td>
<td>126.1</td>
</tr>
<tr>
<td>London</td>
<td>141.9</td>
<td>154.9</td>
<td>166.6</td>
<td>123.4</td>
<td>126.0</td>
<td>129.4</td>
<td>133.9</td>
</tr>
<tr>
<td><strong>Rest of South</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>89.5</td>
<td>87.4</td>
<td>86.3</td>
<td>104.6</td>
<td>108.4</td>
<td>109.5</td>
<td>119.0</td>
</tr>
<tr>
<td>East Anglia</td>
<td>97.0</td>
<td>76.9</td>
<td>76.8</td>
<td>92.8</td>
<td>94.7</td>
<td>108.9</td>
<td>109.1</td>
</tr>
<tr>
<td>South West</td>
<td>88.6</td>
<td>81.5</td>
<td>86.7</td>
<td>93.9</td>
<td>91.8</td>
<td>92.4</td>
<td>88.4</td>
</tr>
<tr>
<td>West</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midlands</td>
<td>84.8</td>
<td>81.7</td>
<td>78.4</td>
<td>101.9</td>
<td>89.1</td>
<td>91.3</td>
<td>89.7</td>
</tr>
<tr>
<td>East Midlands</td>
<td>106.2</td>
<td>90.3</td>
<td>90.6</td>
<td>96.7</td>
<td>96.6</td>
<td>94.4</td>
<td>91.0</td>
</tr>
<tr>
<td>North West</td>
<td>106.0</td>
<td>97.9</td>
<td>97.2</td>
<td>96.3</td>
<td>92.9</td>
<td>90.2</td>
<td>89.3</td>
</tr>
<tr>
<td>Yorkshire and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humberside</td>
<td>94.1</td>
<td>91.9</td>
<td>89.5</td>
<td>92.5</td>
<td>90.2</td>
<td>89.5</td>
<td>86.5</td>
</tr>
<tr>
<td>North</td>
<td>91.3</td>
<td>82.9</td>
<td>79.2</td>
<td>86.1</td>
<td>92.2</td>
<td>83.1</td>
<td>76.6</td>
</tr>
<tr>
<td>Wales</td>
<td>88.6</td>
<td>90.7</td>
<td>90.1</td>
<td>87.5</td>
<td>82.0</td>
<td>82.8</td>
<td>78.2</td>
</tr>
<tr>
<td>Scotland</td>
<td>90.4</td>
<td>104.9</td>
<td>102.1</td>
<td>92.2</td>
<td>94.8</td>
<td>98.9</td>
<td>93.7</td>
</tr>
</tbody>
</table>

Source: Crafts (2005: Table 4)

The ranking of the index values of regional GDP per person for Wales in Table 2.1 shows it in ninth place (out of twelve) in 1871, in sixth place 1901 and 1911, and in twelfth place between 1981 and 2001. Crafts (2005) admits that the methodology used to derive the estimates of GDP per head is deductive and therefore speculative, but if the rankings are accurate it suggests that the origins of Welsh economic problems lie much farther back in time than the Second World War. Over this period the best that Wales achieved was GDP per head equivalent to about 91% of that of UK, although this was not sustained, and was only reported
for the year 1901. The sustainable level of Welsh GDP per head up until 1911 appears to have been approximately 90% of that of UK, and since this date it seems to have declined steadily and in 2009 the provisional estimate was 74.3%.

The growth rates encompassing the period up until 1954 are shown below in Table 2.2 and a comparison of the two periods exhibits an intriguing contrast. The figures in Table 2.1 show Wales ranked in the bottom quartile of the twelve regions but the growth rates shown in Table 2.2 indicate that Wales was ranked third behind London and the South East between 1871 and 1911. In this earlier period the evidence suggests that Wales was converging in growth towards the second and third quartiles of the regions. The regional figures are adjusted by a national price index and consequently may conceal greater differences between the more populous London and the South East and other regions. In the earlier period Welsh GDP growth and per capita growth is third highest behind London and the South East. Table 2.1 reveals that between 1911 and 1971 the ranking of Wales fell to that of the second worst position and this evidence is supported by the growth rates in Table 2.2 between 1911 and 1954 that suggest that over this period Wales was diverging in terms of growth per head from all regions with the exception of the South East, London and Scotland.

Table 2.2 Annual rates of growth of GDP and GDP per head in GB regions between 1871 and 1955, deflated using the national GDP deflator.
Table 2.3 Economic activity rates in the UK and its territories between 2000 and 2008 (percentages)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>79.0</td>
<td>78.6</td>
<td>78.6</td>
<td>78.8</td>
<td>78.5</td>
<td>78.6</td>
<td>79.0</td>
<td>78.8</td>
<td>78.6</td>
</tr>
<tr>
<td>England</td>
<td>79.6</td>
<td>79.2</td>
<td>79.2</td>
<td>79.0</td>
<td>78.8</td>
<td>78.8</td>
<td>79.4</td>
<td>78.9</td>
<td>78.8</td>
</tr>
<tr>
<td>Wales</td>
<td>74.5</td>
<td>72.8</td>
<td>73.3</td>
<td>76.5</td>
<td>76.9</td>
<td>74.9</td>
<td>76.0</td>
<td>76.7</td>
<td>76.7</td>
</tr>
<tr>
<td>Scotland</td>
<td>78.3</td>
<td>78.4</td>
<td>78.7</td>
<td>79.1</td>
<td>79.5</td>
<td>79.4</td>
<td>79.2</td>
<td>80.9</td>
<td>79.9</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>70.5</td>
<td>72.2</td>
<td>71.9</td>
<td>73.7</td>
<td>70.6</td>
<td>72.2</td>
<td>73.3</td>
<td>73.4</td>
<td>73.4</td>
</tr>
</tbody>
</table>

Source: Regional Trends Nos. 38, 40 and 41

Table 2.4 Industrial Composition of Employee Jobs: England, Wales and Scotland 1999 and 2009 (percentages)

<table>
<thead>
<tr>
<th>Sector</th>
<th>1999</th>
<th></th>
<th>2009</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>England</td>
<td>Wales</td>
<td>Scotland</td>
<td>England</td>
</tr>
<tr>
<td>Primary</td>
<td>1.2</td>
<td>1.1</td>
<td>3.0</td>
<td>1.2</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>16.6</td>
<td>20.2</td>
<td>16.5</td>
<td>10.3</td>
</tr>
<tr>
<td>Construction</td>
<td>4.2</td>
<td>6.8</td>
<td>6.1</td>
<td>4.8</td>
</tr>
<tr>
<td>Services</td>
<td>54.5</td>
<td>43.5</td>
<td>49.4</td>
<td>56.5</td>
</tr>
<tr>
<td>Public Sector</td>
<td>23.4</td>
<td>29.5</td>
<td>26.0</td>
<td>27.2</td>
</tr>
</tbody>
</table>

Notes:

1. Primary includes agriculture, hunting, forestry and fishing, mining and quarrying including oil and gas extraction.
2. Manufacturing includes electricity, gas and water.
3. Services include distribution, hotels and catering, repairs, transport, storage and communication, and other services comprising financial intermediation and real estate, renting and business activity.
4. Public sector includes public administration and defence, education, social work and health services.
5. The sum of each column exceeds 100 due to Financial Intermediation Services Indirectly Measured (FISIM) and rounding errors.

Source: Regional Trends No 41, Table 9.4.

Tables 2.3 and 2.4 suggest that these possible explanations of regional economic disparities have changed little over the last 10 years. A comparison of the UK countries’ industrial structure in Table 2.4 reveals that Wales relies
disproportionately on manufacturing and the public sector and derives less of its economic activity from the services sector. In short, the industrial structure of Wales may be described as a lower value-added economy as it represents a structure that was historically integrated into the UK economy and was not developed to achieve a sustainable output within a devolved Wales. Additionally, evidence suggests that this industrial structure is little changed from earlier years. For example, in 1984 the then Department of Trade and Industry (1984) reported that areas receiving regional assistance, ‘suffer from a disproportionate share of declining industries and …find difficulty in attracting newer, growing industries.’ At that time the DTI claimed that, ‘so far as manufacturing is concerned …the South East, South West and East Anglia were found to have relatively favourable industrial structures, whereas Wales, Yorkshire and Humberside and the West Midlands all had relatively unfavourable structures.’ This conclusion was based on a shift-share analysis of employment in manufacturing and services in the regions of UK between 1975 and 1981 (Department of Trade and Industry 1984: Table 13).

The concern for the economic and social costs of disparity between the English regions was raised in 2003 by the Office of the Deputy Prime Minister (ODPM 2003). Consequently an analysis of the variations in regional economic performance was undertaken by consultants for the Deputy Prime Minister (Frontier Economics 2004) and their report confirmed the importance of education and skills, enterprise, innovation and investment as explanations for regional
economic disparity. None of these factors is surprising and the analyses are dissatisfying as explanations of regional differences, as they could also be described as symptoms or covariates of regional variation. Demonstrating a correlation between each of these ‘growth drivers’ and some measure of regional performance is insufficient to explain the underlying causes of regional economic disparity.

On a variation of the same theme, Morelli and Seaman (2005) investigated the impact of Devolution on income inequality in Scotland and Wales, and confirmed evidence of ‘an influence on social inclusion’, that has been, ‘both weak and temporary’. Furthermore, they claim (Morelli and Seaman 2005:19) ‘that Wales has simply become more equal in its poverty’. Their work is based on the analysis of Gini coefficients, unemployment and income statistics, and social inclusion estimates derived from the British Household Panel Study (University of Essex 2009). In their analysis they compare Scotland with the English regions aggregated into three large groups of regions: England–South, England–Midlands and England–North. This analysis suffers from the paucity of data since Devolution and will also be sensitive to the choice of aggregation of the authors’ English ‘mega regions’. Furthermore, the use of the Gini coefficient is questionable for this analysis, as it is a static measure reflecting a snapshot at a point in time. It is implicitly assumed that the data representing the population of the regions is unchanged over the time-period of analysis, an assumption that may be flawed if households move between regions over the time span of the analysis. Also,
measured income may be a poor measure of income inequality, as it ignores households’ asset ownership, property rights and job security (for a thought-provoking article on measuring inequality, see Okun 2004). However, it does offer some limited comfort for Wales insofar as the authors report no worsening of the Welsh economy’s income distribution.

The lower economic activity reported in Welsh statistics may be related to a number of factors. Research undertaken on behalf of WAG (University of Wales, Swansea 2006; Experian 2008) suggests that the explanations of inactivity are varied and complex and extend beyond the loss of jobs in coal-mining and the legacy of industrial illness associated with work in the coal industry (Beatty and Fothergill 2005). However, the most recent research for WAG by Experian (2008) suggests that the main reasons are due to retirement and long-term sickness. Table 2.5 below shows economic inactivity in Wales by LAU (Local Administrative Units) 1 areas and demonstrates the strikingly high level of inactivity in the former coal mining areas of Neath Port Talbot, Merthyr Tydfil, Caerphilly and Blaenau Gwent.

| Table 2.5 Economic inactivity in Welsh Local Authorities year ending 30 September 2007 (percentages of the working | 32 |
The combination of lower economic activity and an economic structure that is more dependent on manufacturing and public services may partially explain the overall poorer relative performance of the Welsh economy. The most recent data for the economies of the UK from 1990 to 2007 are reproduced below as Table 2.6.

### Table 2.6 Regional Gross Value Added (GVA), by UK country excluding

<table>
<thead>
<tr>
<th>Area</th>
<th>Economic inactivity rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isle of Anglesey</td>
<td>23.1</td>
</tr>
<tr>
<td>Gwynedd</td>
<td>19.3</td>
</tr>
<tr>
<td>Conwy</td>
<td>19.1</td>
</tr>
<tr>
<td>Denbighshire</td>
<td>22.2</td>
</tr>
<tr>
<td>Flintshire</td>
<td>18.5</td>
</tr>
<tr>
<td>Wrexham</td>
<td>17.5</td>
</tr>
<tr>
<td>Powys</td>
<td>18.5</td>
</tr>
<tr>
<td>Ceredigion</td>
<td>24.9</td>
</tr>
<tr>
<td>Pembrokeshire</td>
<td>19.9</td>
</tr>
<tr>
<td>Carmarthenshire</td>
<td>23.4</td>
</tr>
<tr>
<td>Swansea</td>
<td>21.4</td>
</tr>
<tr>
<td>Neath Port Talbot</td>
<td>28.6</td>
</tr>
<tr>
<td>Bridgend</td>
<td>22.4</td>
</tr>
<tr>
<td>The Vale of Glamorgan</td>
<td>16.9</td>
</tr>
<tr>
<td>Cardiff</td>
<td>20.4</td>
</tr>
<tr>
<td>Rhondda, Cynon, Taff</td>
<td>24.0</td>
</tr>
<tr>
<td>Merthyr Tydfil</td>
<td>27.4</td>
</tr>
<tr>
<td>Caerphilly</td>
<td>26.6</td>
</tr>
<tr>
<td>Blaenau Gwent</td>
<td>26.4</td>
</tr>
<tr>
<td>Torfaen</td>
<td>24.0</td>
</tr>
<tr>
<td>Monmouthshire</td>
<td>16.2</td>
</tr>
<tr>
<td>Newport</td>
<td>18.3</td>
</tr>
</tbody>
</table>

*Source: Welsh Assembly Government*
Table 2.6 demonstrates that between 1990 and 2000 Welsh GVA per head declined significantly relative to the UK as a whole. In fact, though not shown here, from 1998 Wales was overtaken by Northern Ireland and in 2009 was the country with the lowest GVA per head in UK. It is also interesting to note that this period of time straddles the constitutional Devolution that took place in 1999, which does not seem to have interrupted the Welsh relative economic decline. The past disappointing Welsh economic performance is confirmed by Jones and Henley (2008), who also speculate that the demographics of an aging population together with the disadvantage of a less skilled workforce will make the achievement of economic convergence even more difficult.

There is no consensus among economists as to the reasons for the consistent under-performance of the Welsh economy. A number of issues are typically cited for

<table>
<thead>
<tr>
<th>Year</th>
<th>England Index</th>
<th>Wales Index</th>
<th>Scotland Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>102</td>
<td>83</td>
<td>97</td>
</tr>
<tr>
<td>1995</td>
<td>102</td>
<td>83</td>
<td>99</td>
</tr>
<tr>
<td>2000</td>
<td>103</td>
<td>77</td>
<td>94</td>
</tr>
<tr>
<td>2001</td>
<td>102</td>
<td>77</td>
<td>94</td>
</tr>
<tr>
<td>2002</td>
<td>102</td>
<td>77</td>
<td>94</td>
</tr>
<tr>
<td>2003</td>
<td>102</td>
<td>76</td>
<td>94</td>
</tr>
<tr>
<td>2004</td>
<td>102</td>
<td>76</td>
<td>94</td>
</tr>
<tr>
<td>2005</td>
<td>102</td>
<td>76</td>
<td>95</td>
</tr>
<tr>
<td>2006</td>
<td>102</td>
<td>75</td>
<td>96</td>
</tr>
<tr>
<td>2007</td>
<td>102</td>
<td>75</td>
<td>97</td>
</tr>
<tr>
<td>2008</td>
<td>102</td>
<td>74</td>
<td>98</td>
</tr>
<tr>
<td>2009</td>
<td>102</td>
<td>74</td>
<td>99</td>
</tr>
</tbody>
</table>

*Source:* Welsh Assembly Government
to explain this including industrial structural change, labour market frictions and emigration (Drinkwater and Blackaby 2004; Jones et al 2004; Scott-Cato 2004; Rice et al 2006; Graham 2006). These factors may contribute to historical under-performance but do not provide a satisfactory or coherent explanation of differential regional economic development and growth. Some analysts have attempted to explain regional economic differences using the idea of clustering, or the concept of self-sustaining growth arising from the agglomeration of firms and populations (Porter 1990). In the UK this phenomenon may explain the continuing relative economic success of London and the South East, whose economic growth continues to outpace that of other parts of the economy.

Closer scrutiny of activity within Wales reveals a significant difference in economic fortunes between the sub-regions and this is demonstrated in Table 2.7 below.

| Table 2.7 Sub-Regional Gross Value Added (GVA), by Welsh NUTS3 area between 1995 and 2008 (Index: UK=100) |
|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
There is no evidence that any of the Welsh sub-regions have achieved lasting economic success. Comparing the sub-regional performance over this period reveals that every area records a lower index value in 2008 compared with its previous peak value over these years. In terms of convergence, the sub-regions of Wales appear to be forming three clusters composed of: Cardiff and the Vale of Glamorgan, Monmouthshire and Newport and East Wales that are relatively successful; the Swansea region that appears to be declining towards the level of Flintshire and Wrexham; and the remaining areas that appear to decline towards a lower steady-state. It is interesting to note that the relatively successful sub-regions of Wales are on the eastern side of the country and that Monmouthshire

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Isle of Anglesey</td>
<td>54</td>
<td>52</td>
<td>54</td>
<td>55</td>
<td>56</td>
<td>55</td>
<td>56</td>
<td>56</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>56</td>
<td>56</td>
<td>56</td>
<td>55</td>
</tr>
<tr>
<td>Gwynedd</td>
<td>81</td>
<td>66</td>
<td>67</td>
<td>68</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>68</td>
<td>67</td>
<td>67</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>Conwy and Denbighshire</td>
<td>72</td>
<td>64</td>
<td>62</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>62</td>
<td>61</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>South West Wales</td>
<td>73</td>
<td>61</td>
<td>60</td>
<td>59</td>
<td>59</td>
<td>60</td>
<td>62</td>
<td>62</td>
<td>61</td>
<td>61</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Swansea</td>
<td>81</td>
<td>81</td>
<td>80</td>
<td>81</td>
<td>81</td>
<td>81</td>
<td>79</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td>Bridgend and Neath Port Talbot</td>
<td>86</td>
<td>71</td>
<td>68</td>
<td>66</td>
<td>65</td>
<td>65</td>
<td>67</td>
<td>68</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>Central Valleys</td>
<td>71</td>
<td>64</td>
<td>63</td>
<td>63</td>
<td>62</td>
<td>61</td>
<td>60</td>
<td>59</td>
<td>59</td>
<td>58</td>
<td>58</td>
<td>58</td>
<td>58</td>
<td>58</td>
<td>58</td>
</tr>
<tr>
<td>Gwent Valleys</td>
<td>69</td>
<td>62</td>
<td>59</td>
<td>58</td>
<td>57</td>
<td>58</td>
<td>58</td>
<td>58</td>
<td>58</td>
<td>58</td>
<td>58</td>
<td>58</td>
<td>58</td>
<td>58</td>
<td>56</td>
</tr>
<tr>
<td>East Wales</td>
<td>102</td>
<td>100</td>
<td>100</td>
<td>99</td>
<td>99</td>
<td>99</td>
<td>99</td>
<td>99</td>
<td>99</td>
<td>99</td>
<td>98</td>
<td>97</td>
<td>97</td>
<td>96</td>
<td>95</td>
</tr>
<tr>
<td>Flintshire and Wrexham</td>
<td>111</td>
<td>99</td>
<td>95</td>
<td>93</td>
<td>91</td>
<td>89</td>
<td>88</td>
<td>87</td>
<td>86</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>Powys</td>
<td>85</td>
<td>74</td>
<td>75</td>
<td>76</td>
<td>76</td>
<td>74</td>
<td>71</td>
<td>68</td>
<td>65</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Monmouthshire and Newport</td>
<td>91</td>
<td>99</td>
<td>100</td>
<td>99</td>
<td>99</td>
<td>99</td>
<td>98</td>
<td>97</td>
<td>96</td>
<td>95</td>
<td>95</td>
<td>95</td>
<td>95</td>
<td>95</td>
<td>95</td>
</tr>
</tbody>
</table>

Note:

1. Figures for Wales describe performance relative to the UK and figures for the Welsh areas show a breakdown of the overall Wales index.
2. Numbers have been rounded to the nearest integer.

Source: Welsh Assembly Government
and East Wales are on the English border. This suggests that part of the explanation for their relative success may be their proximity to England and the benefits derived from commuting to work there or from the proximity of a larger market for the sale of goods. Having a contiguous border with a higher income region may also provide economic spillover benefits for trade and I test this possibility in chapter 8.

Evidence that the income deprivation in Wales is persisting can be seen by comparing a measure of income deprivation data in Welsh Local Authorities. Inspection of the 2008 Welsh Index of Multiple Deprivation (WIMD) (Welsh Assembly Government 2011) provides statistics on income deprivation that is estimated using indicators of adults and children receiving financial support (WIMD 2011: 22). This information enables broad comparisons of income deprivation over time. It reveals that between 2005 and 2008 of the 1896 Lower Layer Super Output Areas (LSOAs that are effectively local authorities) that some LSOAs were changing their relative position in terms of the percentage of their population that are most income deprived. Over this period 195 LSOAs became more deprived and 199 became less deprived and the majority (1502) did not change group (WIMD 2011: 27). The overall index of multiple deprivation is 75% weighted by income, employment, health and education, skills and training and the remaining 25% of the weighting is provided by geographical access to services, housing, the physical environment and community safety (WIMD 2011: 15). This index reveals that the majority of LSOAs (1560) did not change their group; 168
LSOAs moved up their group position and 168 moved down, and the distribution of group changes suggest that they cancel each other out. Inspection of the geographical distribution of deprivation reveals a high correlation between income deprivation and the index of overall deprivation (WIMD 2011: 17 and 23) with most clusters in the south of the country. The polarization between rich and poor is also apparent in terms of a split between rural Wales and urban Wales: Midmore (1999) observes that in 1995 per capita GDP in rural Wales was some 7% less than Wales as a whole, and in the decade ending in 1999 grew by 0.5% p.a. more slowly.

The wide differences in the distribution of income may also reflect the historical consequences of the clustering of the population around different labour markets. Jones et al (2002) comment on the Welsh labour market in the decade up until 2001, and note that the overall improvement in employment within the UK did not improve the Welsh position relative to the rest of the UK. Regions previously associated with coal mining and heavy industry now experience higher unemployment due to the labour immobility resulting from the non-transferable skills of these occupations. These problems may also be exacerbated by occupational disease and an apparent absence of an education and entrepreneurial ethic in these areas (Dickens et al 2000; Nickell and Quintini 2001; Blackaby et al 2003).

The possibility of Welsh economic renewal is particularly important in relation to Welsh Devolution, as a change in political governance is associated by
WAG with expectations of material improvement (Welsh Assembly Government, 2002, 2003, 2004 and 2005). It could be argued that WAG would like to represent Devolution as a structural break with the past and the opportunity for Welsh economic renewal (Welsh Assembly Government 2002). Consequently an investigation of the efficacy of devolved government as the genesis of economic change begins with an appreciation of how the economy was evolving before Devolution. WAG have acknowledged their commitment to increase the material well-being of the Welsh people by setting a specific objective for their economic development policy to increase Welsh GDP per head to 90% of the UK average by 2010 by modernising the industrial structure of the Welsh economy (Welsh Assembly Government 2004). This is an ambitious goal in relation to the 2007 evidence that Welsh GVA per head was 74% of that of UK as a whole, and as we shall see, spontaneous convergence before Devolution was elusive in most conventional measures of economic progress.

2.3 The UK Policy Response to Unbalanced Regional Growth
The evidence above suggests that there is a persistent difference between the economic growth potential of regions of the UK that appears to be embedded in their economic structure. Variations in the economic performance of the regions are regarded as a problem for the citizens of regions and the country as whole as such persistent regional differences impose significant economic and social costs (Armstrong and Taylor 2000). Residents of the regions may perceive differences in
their standard of living, quality of life and expectations of life opportunities that
give rise to allegations that peoples’ life experience is determined by where they
are born and not by their skills, labour and enterprise.

For government, under-performing regions impair the overall economic
performance of the nation and reduce tax receipts, limiting macroeconomic policy
options. For relatively successful regions, there may be excess demand for
resources that will be exacerbated in the upswing of the business cycle. This may
lead to wage and house price inflation which affects inter-regional migration and
mobility within the labour market, and causes unbalanced regional demand for
public services. For example, the Confederation of British Industry (1995) has
estimated that the costs of congestion associated with large numbers of commuters
travelling long distances could be as high as £15 billion per annum.

The persistence of regional disparities in the UK and other countries attests
to the existence of the immobility of factors of production and the failure of the
price system to correct market distortions. The implied assumption of regional
policy intervention is that regions deemed to be under-performing are capable of
higher rates of economic activity, although the policy prescriptions to achieve this
transformation have varied over time. If every region of an economy was
identical, it would be reasonable to expect identical economic performance and
steady-state levels of income per head. Regional differences in topography,
climate, and geology together with the legacy of past differential economic
development have created UK regions that are very different in industrial nature
and economic performance. These areas, in which industry and commerce continue to be handicapped by the legacy of the past, may have as Scott-Cato (2004) puts it, ‘...a sense of learned helplessness that results from a history of paternalistic employment by nationalised industries and the public sector.’ Such a description is consistent with the observed occupational immobility that is manifest in higher rates of unemployment and lower activity rates.

There is also evidence that suggests a possible association between economic performance and the development of human capital through participation in education. There is a large body of research into the association between education and economic growth that demonstrates that education, in the widest sense taking account of experiential learning, is necessary for economic development (see for example, Becker 1964; Nelson and Phelps 1966; Mincer 1974; Jorgenson and Fraumeni 1989; Benhabib and Spiegel 1994; Krueger and Lindahl 2001; Kneller and Stevens 2002; Harmon, Oosterbeek and Walker 2003; Hanushek and WoBmann 2007). Education at different ages of human development together with industrial training is considered to enhance productivity. However, while considered necessary for economic development education by itself is not regarded as sufficient. Moreover the empirical investigation of education is complex because the belief in its potency to increase income may result in a growing demand for education services that makes it difficult to distinguish the direction of causation between them.
The WAG reports (Welsh Assembly Government 2007) that ‘Qualification levels in Wales [for 2007] were lower than in England, Scotland and the UK as a whole…’ and that ‘…qualification levels were highest in Cardiff, Monmouthshire and The Vale of Glamorgan and lowest in the South Wales valleys authorities.’ This suggests that in many areas of Wales there is a shortage of the human capital suitable for the high-value-added economic activity that is required to sustain higher rates of economic growth. This may have resulted in a cycle of economic underperformance as the indicators of under-achievement act as a disincentive to potential new employers who would prefer to locate in clusters of commercial achievement with skilled workforces.

2.3.1 A Brief History of Regional Economic Policy

The purpose of this section is to summarise the UK experience of regional economic policy and to assess its effectiveness as a means of exploring how devolution may facilitate economic development. It represents the preparatory background information for the analysis of Welsh economic policy that is undertaken in chapter 4. This summary draws on material sourced from Department of Trade and Industry (1984), Moore et al (1986) and Griffiths and Wall (2007).

Armstrong and Taylor (2000) note that regional policy intervention dates from the 1920s, and became central to economic policy, with the White Paper Employment Policy of 1944 that ‘committed post-war governments to a policy of full employment’. Since the end of the Second World War, regional policy has
waxed and waned, depending partly on the exigencies of the business cycle, industrial restructuring through the closure of coal-mines and the shrinking of the steel industry, and the policy response dictated by the political persuasion of the party in power.

The evolution of regional policy began in the 1930s with the encouragement of migration from areas of unemployment to more prosperous areas. Additionally, so-called Special Areas (South Wales, North East England, West Cumberland and parts of West Central Scotland) were designated with the purpose of improving employment prospects in depressed areas by establishing industrial estates and government loans to encourage business start-ups. By the outbreak of the war in 1939 these measures included, ‘finance to private industry, tax incentives, trading estates and a scheme of labour transference from depressed areas’ (Moore et al 1986). After the war the areas designated for assistance were extended and further supported by the introduction of Industrial Development Certificates that exerted control over the location of new factory building.

In general, regional policy between 1960 and 1990 concentrated on ‘taking work to the workers’ (Armstrong and Taylor 2000) by offering investment grants, to a lesser extent, labour subsidies, and relocating government offices to the regions. In the early 1960s increased financial inducements were introduced to encourage industrial investment in newly designated Development Districts, but in the latter half of the 1960s Districts were replaced with Development Areas that enlarged the areas targeted for assistance. Loans and grants for industrial
development continued and were strengthened by the introduction of the Regional Employment Premium that was effectively a pay-roll subsidy for manufacturing firms in Development Areas. In 1967 coal-mine closures and the resulting high localised unemployment, led to these areas being designated as Special Development Areas, receiving more generous building grants and five years of free rent for new businesses.

In 1972 a new regional classification known as Intermediate Areas was introduced to address localities where unemployment was not yet a serious problem but could be in the future (Moore et al 1986) and in 1975 the Industry Act established the Scottish and Welsh Development Agencies. These regional Agencies could be perceived as an early acknowledgement of the importance of local knowledge in regional regeneration. Subsequent regional policy can be interpreted as variations on the same theme. In the 1990s Development Area and Intermediate Area designations survived to attract targeted assistance; financial incentives were offered to encourage industrial development in particular areas, and these payments included grants for capital expenditure or could be job-related.

Features of regional development policy that emerge from this discussion are the attempt to distinguish between regions’ different needs by offering different incentives, the reclassifications of need and the different treatment of Scotland and Wales. The evolution of policy appears to have been attempting to distinguish between regions’ different circumstances and need. However, Allen et
al (2004) suggests that the term, regional policy, may be a misnomer, as it is difficult to argue that regional economic policy can be targeted with precision to encourage spatial economic development. When regions are inter-related through trade, regional assistance is difficult to contain in the targeted areas and leaks out to affect other areas.

Assessing the efficacy of regional economic policy is controversial, because of the difficulty of estimating what would have happened without intervention. Armstrong and Taylor (2000) argue that the assessment of regional economic policy requires a full cost-benefit analysis rather than a regional accounting of the number of jobs created and their average cost. Griffiths and Wall (2007) attempt to do this and present evidence that suggests that some 800,000 jobs may have been created since the 1960s albeit at a cost of £40,000 per job. These authors also argue that UK regional policy made the regions somewhat more attractive to foreign multinationals (Griffiths and Wall 2007). In Wales 356 foreign companies received Regional Selective Assistance between 1987 and 1997, a number in the UK second only to the 365 that chose Scotland as their destination (Griffiths and Wall 2007). Nevertheless, for Wales, the regional GVA per head statistics provide little evidence that such proactive regional policy has interrupted its lacklustre economic performance.

In theoretical terms, regional policy can also be explained as a set of micro-policy options that promote the mobility of labour and capital in favour of under-performing regions (Armstrong and Taylor 2000). Within an integrated UK
economy, macroeconomic regional policy options are limited by the difficulty of framing and enforcing regionally differentiated measures. For example, it is difficult to set interest rates and tax-rates that vary by region to induce industrial relocation and job-creation in favour of disadvantaged regions. A unified national macroeconomic policy that cannot distinguish between the different needs of regions may also have unintentional differential regional consequences: a unitary interest rate policy influenced by house price inflation in the South East may have a detrimental impact on areas like Wales which have a higher reliance on manufacturing industry. Even if it were possible, the ease of inter-regional movement would encourage taxpayers to relocate around regional boundaries to take advantage of regional differences; furthermore, it would be difficult to ensure that the benefit of using investment funds in an area was contained within that region’s administrative boundaries. Similarly, there is no guarantee that a subsidised industrial unit will employ labour from the labour market of a region targeted for assistance.

The formulation of regional economic policy may be compromised by these problems and also weakened by the difficulty of exercising sufficient discrimination in the distribution of financial inducements encouraging firms to relocate in areas of high unemployment. For example, some aspects of regional assistance varied the inducements available to firms to establish in areas of high unemployment, without assessing the suitability of the attracted firms for their long-term sustainability in the areas targeted for assistance.
There are however also advantages associated with centralized control of regional development that include the ability to maintain an overall national perspective taking account of inter-regional linkages and spillover effects that do encourage using development resources in a manner that is compatible with regions’ industrial structure or infrastructure. For example, in the 19th century, in the early days of railway development, it was wasteful and inefficient for each region to plan its own railway system using different gauges, or plan their own utility distribution systems independently of others. Nevertheless, while there is some evidence of success for centralized regional economic policy, the data presented above in section 2 suggest that Welsh relative economic performance has continued to deteriorate up to 2007.

In summary, post-war UK regional economic policy can be interpreted as an attempt to overcome market failure through Keynesian fiscal policy. The market failure arises because the price system is not adequately providing market inducements to encourage industrial and entrepreneurial activity to relocate within Wales and the other regions requiring aid. The funds used to induce new entrants into these areas can also be interpreted as fiscal injections into the regional economy that may have benefited in the short run from the potential multiplier-accelerator effects, but do not seem to have influenced regions’ secular growth (see for example, Thirlwall 1980).
2.4 The Theoretical Consequences of Devolution

The significance of devolution can be partly explained by the resulting fiscal decentralization that is expected to provide a more effective method of serving a population’s preferences for public sector services, along with greater electoral accountability (Oates 1972; Downs 1957). This suggests that devolution creates local markets for public goods and facilitates greater efficiency by enabling the local demand for public services to be met by locally elected officials who are more visible and answerable to the Welsh electorate, and by permitting WAG to diverge from the Westminster policy. Hence, the policy potential of devolution is partly achieved as supply-side economic policy: for example, Wales has diverged from England in its treatment of prescription charges and student finance. Balancing this is the possibility that, by reducing the population size of jurisdictions, devolution may reduce the economies of scale associated with the provision of services for large populations and result in higher per capita cost (Rodriguez-Pose 2004). However, closer examination of this proposition suggests that such additional costs may be illusory, as local services tend to be just that, and are typically not delivered by central government; for example, refuse disposal in Wales after Devolution, continues to be provided by unitary authorities. The funding of service provision may originate from Westminster, but service provision has been devolved to unitary authorities and councils before Devolution.
The significance of the theory of fiscal decentralization (FD) for expectations for devolution derives from the devolving of taxing and spending powers to sub-national government. FD can occur without devolution, but the opposite is not the case, as devolution also involves the political authority to manage essential services. For the purposes of this work it is assumed that the major economic consequences of devolution are associated with the exercise of fiscal policy by the devolved territory. Monetary policy is not easily devolved as the management of credit control and interest rate policy can only be exerted coherently by a single authority. It is possible for economic results to be associated with non-economic policy. It may be that that the ‘psychic’ income enjoyed by supporters of independence results in positive consequences for work effort and business growth, but these effects are difficult to quantify and are, we might hope, likely to be picked up within the residuals of any estimated econometric equations.

The Decentralization Theorem of Oates suggests that social welfare is likely to be enhanced if Pareto-efficient levels of public goods are provided by sub-national governments rather than by the provision of a common level of consumption determined by a national government (Oates 1972). The source of the benefits from the provision by sub-national governments depends on the existence of variations in the preferences of constituents for public and private goods between different jurisdictions. Majority voting in national elections may result in what has been termed the ‘tyranny of the majority’ that may be remedied by the
ability of sub-national jurisdictions’ to choose alternative electoral systems, mixes of goods and, by analogy, different tax outcomes. The antecedents of these ideas can be found in the Tiebout Hypothesis which postulates that local government provision of public services is more likely to correspond to voters’ preferences when voters can choose in which constituency they wish to live (Tiebout 1956). Central government provision can then be likened to a private-sector monopoly denying voters a choice. This raises a number of issues suggesting that the demographic characteristics of a population may be instrumental in voters’ choices regarding housing location. For example, families with children of school age and sufficient incomes will locate within the catchment areas of desirable schools while pensioners will be attracted to areas that offer services and benefits consistent with their needs.

Prud’homme (1995) is suspicious of the policy of decentralization and its effect on macroeconomic policies. Decentralization of taxing and spending reduces central government’s leverage over fiscal policy and there is no guarantee that the decentralized jurisdictions’ policies will be consistent with those of central government. This creates a potential for tension between central government and the devolved territories over sensitive issues such as health care and education that has been the case within the UK in recent years (for example, the provision of services for the elderly in Scotland and the payment of university fees by WAG for Welsh university students).
This proposition presents problems for this study as it aims to investigate the economic consequences of Devolution. As I discuss in chapter 3, social welfare is not directly measurable through secondary data; measures of aggregate income such as GVA are poor proxies for social welfare, particularly when social policy is targeted towards particularly vulnerable groups. Nevertheless WAG is committed to improving Welsh economic performance relative to that of the UK as a whole, and I shall use the evidence of convergence as an (albeit imperfect) proxy for welfare.

Just as competition in the private sector is expected to increase welfare, Brennan and Buchanan (1980) argue that competition for fiscal resources between sub-national jurisdictions, together with mobile citizens seeking to maximize their locational advantage, will result in efficient public-service provision. The source of the expected benefit is similar to that associated with increasing competition in markets for private goods. The centralized provision of public goods bestows monopoly power on the government; decentralization erodes this power and that of the potential for central government rent-seeking and will enhance growth prospects (Weingast 1995). In theory, voters will seek to live in jurisdictions offering the best services at the lowest cost, and jurisdictions have a vested interest in attracting voters as taxpayers to increase their tax-base by providing a range of attractive services. The fallacy of this argument is in the implicit assumption that everyone is mobile. Mobility is likely to differ between different demographic groups and over income and wealth, which in the UK housing market, could lead
to affluent groups congregating around areas with better services and inflating the tax base permitting further improvement and a resulting virtuous cycle. This in turn will leave less affluent economic agents clustering around areas of lower quality public services. Deprivation may become embedded by the lower tax-base and result in poorer educational and social services that perpetuate disadvantage through succeeding generations.

2.5 Financing Devolution: The Barnett Formula

These considerations may have a muted effect on Wales whose revenue is determined by the Barnett Formula (for a comprehensive explanation of the Barnett Formula see Twigger 1998). The devolution settlement denies the Assembly Government powers to raise tax; instead it receives annual expenditure grants calculated using the Barnett Formula that is used to allocate changes in public funds to all of the devolved authorities in Great Britain. The Barnett Formula was introduced in 1978 as a mechanism to fund the Scottish and Welsh devolved Assemblies and replaced the Goschen formula that dated back to 1888. It had originally provided a notional fiscal advantage to Wales and Scotland, whose shares exceeded the amount that would be consistent with a population-based share. The change to the Barnett Formula has not imposed a step-change in levels of expenditure per head, but is calculated on changes in population. It is argued that this will erode the initial block-grant advantage of Wales and Scotland (Bell 2001; Bell and Christie 2004). It will bring about a convergence towards a common
expenditure below the notional amount implied by a needs assessment of the devolved areas that was undertaken in 1979 (H M Treasury 1979). This process has been called ‘the Barnett squeeze’ and Bell (2001) has estimated that it will take, from 2001, eight years for Scotland, seven for Northern Ireland and fourteen years for Wales, for settlements under the Barnett Formula to decline to the levels implied by the 1979 needs assessment exercise. He qualifies his forecast by noting that the estimates are very sensitive to the rate of growth of public spending in England, with more rapid growth bringing faster convergence and vice versa.

Currently (2011) the UK economy is experiencing the combined effects of economic recession and cuts in public spending that may have the effect of slowing down the erosion of the initial block grant advantage.

A number of commentators have observed that the formula and its different treatment of longer term spending (Departmental Spending Limits determined every three years) and short-term spending (Annually Managed Expenditure) imply convergence of public spending per head between the devolved territories and the English regions (Christie and Swales 2009; Bell 2001; Cuthbert 1998; Kay 1998; Heald 1994). However, Christie and Swales (2009) point out that it is not possible to confirm the predicted convergence from published public expenditure statistics.

The limited fiscal devolution afforded to Wales raises issues of substance for economic development. First, in theory the size of the annual budget received each year by WAG is out of their control and currently determined automatically
by the Barnett Formula as described above (for details of the current funding see HM Treasury 2007). However this has been disputed by Heald (1994) and Midwinter (2002) who draw attention to additional payments that result from bargaining between representatives of Welsh interests and Westminster, and represent what Heald describes as formula by-pass payments. Such payments weaken the claim that the strict application of the formula achieves economic efficiency through its decoupling with the political process and that they represent a ‘hard’ budget constraint (Christie and Swales 2009). However, Budgets based on population shares are naïve since they make no allowance for differing levels of need associated with regional variations in demographics, economic structure or social welfare. The use of population shares to allocate funds transparently and objectively collides with negotiations based on need that require distributional judgements and render the achievement of consensus difficult and the application of the formula controversial.

In the absence of formula by-pass the Barnett Formula creates a linkage between changes in public spending programmes in England and the devolved authorities, on the basis of the authorities’ populations in relation to England. For example, in mid-2002 the populations of Wales and England were 2.919 million and 49.559 million respectively (Regional Trends 2004), in other words the ratio of the Welsh population to that of England was then about 6.9%. Hence any change in a specific expenditure programme in England would translate in Wales into that change in expenditure multiplied by (approximately) 0.059.
There is a growing disquiet concerning the financing of the devolved territories in England (Curtice and Seyd 2009); a reconsideration of the arrangements by a House of Lords Committee prompted by Barnett himself (HL 139/2009); the establishment of the Independent Commission on Funding and Finance for Wales (ICFFW) chaired by Gerald Holtham and a review of the Scotland Act 1998 under Sir Kenneth Calman that covers some of the same issues from the perspective of Scottish devolved governance. Changes to the Barnett arrangements are now proposed by the Holtham Commission in Wales (ICFFW 2009) and by the Calman Commission in Scotland (Calman 2009). I discuss the significance of these developments more fully in chapter 4 that focuses on Welsh economic policy.

The determination of funding through bargaining and the application of the formula may entail additional costs of administration and bureaucracy. Decentralization is sometimes criticized on the grounds that it is likely to result in an increase in layers of government and bureaucracy. Niskanen (1973) argues that it cannot necessarily be assumed that the bureaucrat contributes to allocative efficiency as the incentives associated with the rewards and trappings of office will increase the costs of the provision of public services. However, this view has been challenged by Jackson (1982) who argues that many public servants’ salaries are not linked to the size of the budget they administer and that many are motivated by public duty.
Olson (1982; 1983) argues that decentralization strengthens the hand of interest groups that compete for scarce resources and will erode the overall efficiency of the economy as a whole. Insofar as the devolved territories can be likened to powerful interest groups it can be argued that devolution will produce negative effects for the UK economy that have to be set against the potential benefits of some self-determination.

The degree of fiscal independence in devolution settlements is also of significance, as it contributes to the effectiveness with which a territory can aspire to meet the preferences of its voters (Oates 1974). In addition, the ability of a jurisdiction to be fiscally self-sustaining will result in less reliance on Westminster and less of a drain on resources. Taking account of the factors discussed above, I conclude that theoretically the consequences of fiscal independence for economic development are at best uncertain.

The econometric study that I undertake below is limited to a partial equilibrium analysis of the economic consequences of Devolution and we should not lose sight of the integrated nature of the UK economy and the strong input-output linkages that are expected to exist between territories (evidence in support of this assertion is provided in chapter 8). There are assumed to be significant feedback effects between all parts of the economy and regions that will have consequences for the overall performance of the UK macroeconomy, and that necessitate acknowledging the possible effect on macroeconomic performance. Ter-Minassian (1997) notes the limitations that decentralization may place on
macroeconomic management and concludes that decentralization may be a double-edged sword, improving regional economic performance and at the same time eroding control of the macroeconomy by the dominant jurisdiction.

More recently there has been growing interest in undertaking empirical analysis of the relationship between FD and regional disparity. King and Yue (2000) undertake an empirical investigation of decentralization by comparing the economic performance of centralized and decentralized countries in terms of GDP per head, inflation and unemployment and conclude that growing economic cooperation is associated with more uniform economic performance between centralized and decentralized countries. Canaleta (2004), Ezcurra and Pascual (2008) and Lessmann (2009) investigated this linkage using data of OECD or EU countries and conclude that the evidence suggest that FD is associated with reducing regional disparity. This means that evidence that FD can enhance regions’ economic growth will not be eroded by concerns over the resulting changes to the income distribution among regions.

The extent of the powers devolved to the fledgling autonomous territory and the resulting financial settlement is also likely to have an impact on public spending within the entire state. Tarzwell (1998) investigated the effect of decentralization on public-sector growth for Canadian states and concluded that a shift from the federal to the provincial lowers the relative size of the public sector. This suggests that for this sample of States, any loss of economies of scale is more than compensated by efficiency gains, at least in Canada. It cannot be assumed
that it would necessarily be true for the UK due to differences in the economy and culture between the two counties. By contrast Prud’homme (1995) regards decentralization in developing countries, as ineffective in relation to reducing inequality and the incidence of corruption, and achieving macroeconomic stability and economic efficiency.

For the UK the sources of the expected tangible benefits or the ‘devolution dividend’ are ill-defined. MacKay et al (1997) identify a number of reasons for regional inequality that support the expectation of benefits from Devolution in Wales. First, it is claimed that the relative economic success of Greater London and the South East is partly explained by the desire to be close to Westminster, the centre of political power, and by extension, the creation of a Welsh Assembly in Cardiff is expected to generate a similar dynamic clustering of economic activity. However, such a change may not be a clear-cut benefit for Wales as the establishment of a cluster around the Assembly may be at the expense of other parts of Wales and increase the overall imbalance of economic activity in Wales.

The second reason is based on the assertion that the regional funding of Wales (under the Barnett Formula) is inadequate in relation to other regions, and in particular Scotland. It is argued that devolution will strengthen the Welsh Assembly’s ability to negotiate a more favourable grant by legitimating its political authority, compared with that of the former Wales Office. Finally, it is argued that devolution will enable higher indigenous economic growth, although it is not explained how this will come about, and this will generate a so-called
‘virtuous cycle’ in which multiplier-accelerator effects benefit secular growth. The lack of analytical detail supporting the arguments of MacKay et al (1997) is echoed in Keaney and Hutton (2000) who draw attention to anomalies in the relative allocation of powers between London and Edinburgh, and circle the question of the efficacy of Scottish devolution without ever confronting it.

2.6 Government Failure, Fiscal Decentralization and Devolution

The data in Tables 2.1 and 2.2 above suggest that Welsh economic growth since 1870 and post 1999 has been significantly worse than that of England and Scotland. The failure of regional policy in this respect suggests the possibility of government or non-market failure as an explanation (Le Grand 1991; Cullis and Jones 1998; Gwartney et al 1998). This idea is analogous to that of market failure except that it is government provision that is considered to result in a more inefficient use of resources than would occur from private sector provision. Cullis and Jones (1998) attribute Government failure [in the UK] to several causes: it may arise from public sector spending crowding-out private sector spending that contributes to a reduction of sustainable economic growth. Secondly, Members of Parliament may exhibit myopia with respect to assessing the desirability of policy when there is a conflict of interest between the needs of the nation and policy that will contribute to their electoral advantage by favouring their own constituencies. Thirdly, Cabinet government in the UK may not provide sufficient information for MP’s to make rational choices and this may be exacerbated by the partisan and
confrontational nature of Westminster politics which is often polarized by the Whips intervention in voting choices. Finally, it is asserted that the constitutional time horizon causes a bias in favour of policies that can demonstrate results within the political cycle. Such problems do not disappear in a devolved Wales, and may be exacerbated by the separation of spending and taxing for the WAG. The absence of involvement in tax-raising may mean that the Assembly Government does not have a vested interest in economic growth as a means of raising funds to finance their spending aspirations.

The apparent inability of central government policy to alleviate Welsh economic disadvantage before 1999 begs the question as to whether allowing regions greater autonomy over their public spending could be a more effective policy tool (Brown and Jackson 1990). The criterion for the success of fiscal decentralization does not necessarily relate to the publicness of the services involved as, for example, the provision of street lighting in Cardiff could be administered from anywhere within or outside of Wales. Indeed, within the UK, there is a long-standing division of services between central and local government as local authorities are responsible for the provision of local public services (quasi public goods whose consumption is spatially limited, for example, roads and refuse collection); while defence, justice and macroeconomic management are pure public goods, provided by central government that are consumed and financed collectively.
Devolution in a political sense means the transfer of authority from central government to regional governments and its economic significance can be described as fiscal decentralization in which the power to tax and spend within a nation state is devolved to regions or sub-regions (Bogdanor 2001). The extreme form of devolution is complete political independence characterized by a spatially defined region having total control over primary legislation and fiscal and monetary policy. The model of UK devolution (referring only to Scotland and Wales) rests at the other extreme of regional autonomy. Both countries are able to exercise devolved power to decide on the division of their block grant between different spending departments. Wales has no power to raise taxation and Scotland has limited tax-varying powers that have yet to be exercised. They may also enact secondary legislation that can only be enforced within these countries subject to the agreement and the option of veto by the Westminster government.

The essential idea supporting the expected economic benefits of any political devolution is the principle of fiscal decentralization. Even in the extant case of the Welsh devolution arrangements excluding devolved taxation policy, it is seen by the WAG in *A Winning Wales* (2002) as the means of achieving an economic transformation of Wales. The literature of fiscal decentralization locates the associated economic benefits as accruing from the greater accountability of policy-making and the improved articulation of the electorate’s preferences for public services that are communicated to the government through the electoral process. This is strengthened by more effective representation of the electorate by
representatives from within the jurisdiction who are in closer touch with local issues and the electorate. This is thought to result in the framing of policy which will be more in tune with the needs of the region (Tiebout 1956; Oates 1972, 1993, 1999). In short, regional governance enables the electorate to more clearly articulate their preferences and their political representatives to focus exclusively on issues of regional import that will achieve a more efficient outcome.

Some observers are sceptical about the ability of devolution to achieve this end. In an open society that has devolved into a number of self-governing jurisdictions, significant differences in tax and benefits between regions may result in a spatial redistribution of both consumers and producers in favour of regions with lower taxation or more generous public good provision (Prud’homme 1995; Tiebout 1956). Prud’homme also provides evidence in support of the argument that national budgets will tend to be more efficacious in reducing regional disparities. By analyzing a set of countries that excludes the UK a similar point is made by Rodriguez-Pose and Gill (2003) who argue that income redistribution, as a goal of macroeconomic policy, requires national policy and that devolution will lead to greater polarization of rich and poor. This is an argument that resonates in the claim that evidence up to 2003 suggests that Wales has simply become more equal in its poverty (Morelli and Seaman 2005). However, the ability of centralized macroeconomic policy to reduce disparities of income and regional disadvantage has yet to be demonstrated.
Such discussions implicitly acknowledge the uncertainty surrounding the achievement of a net devolution dividend. In the context of Scotland, Ashcroft, McGregor and Swales (2005) attempt a simple calculation of the net benefits of devolution by comparing the potential benefits of devolution with their corresponding costs. They can only conclude that it makes the estimation of the net impact on the economy complex, subtle and difficult to measure.

The uncertainty in estimating the net benefits of devolution will partially depend on the degree of autonomy that is bestowed on the devolved territory. In the case of Wales, the absence of powers to levy tax restricts WAGs ability to influence economic development to the allocation of expenditure among spending departments within a budget determined in London by the Barnett arrangements.

Irrespective of the degree of independence, the appointment of locally elected representatives can be interpreted as the ultimate regional policy since it passes the responsibility for economic management of the region over to the elected representatives. In short, the implication is that Welsh problems require Welsh solutions, and that national economic policies are incapable of solving regional problems.

The absence of tax-varying powers available to the WAG may not be a policy disadvantage in improving the performance of the Welsh economy. The lower population of Wales together with lower level of economic activity and the lower income per head imply a lower tax base. A hypothetical tax-raising Assembly Government would likely be hesitant to set tax rates that were higher
than those of England because of the possibility of Welsh tax-payers relocating to England. The Welsh tax base combined with the need to maintain parity of tax rates with England might raise tax revenue that was lower than is received through the Barnett Formula. For example, in 2003 total Gross Value Added in Wales was £37.1 billion and for the UK as a whole, total tax on production and incomes in this year represents about 27% of GDP. Assuming parity of this proportion between the UK as a whole and Wales, suggests that the notional tax revenue of Wales would be £10 billion, which is less than the WAG Budget of £12.7 billion in that year. The ability of WAG to raise tax revenue if it were to achieve tax-raising powers is severely limited by its poor historic economic performance that depresses earnings relative to the rest of UK and limits the tax base (Cameron et al 2002).

Another problem associated with devolution noted by Cheshire and Gordon (1996) is that it increases regional competition for domestic resources and for inward investment. The allocation of revenue to the regions from Westminster could well become a point of contention; it is a zero-sum game if UK fiscal policy is constrained by spending limits, in which regions awarded larger shares are bound to be matched by reductions in others. Rodriguez-Pose and Gill (2005) support the use of a pre-determined formula as a better indicator of progressiveness, but the fairness of the Barnett Formula has been questioned in the past and could become a point of contention. For example, the claim that it is unfair because the calculation is based on population as opposed to need prompts
Bell and Christie (2004) to remind us that the HM Treasury (1979) Needs Assessment exercise was conducted to establish the cost of providing the same level of provision of government services across the four nations of UK. It established that at that time Northern Ireland, Scotland and Wales would require £131, £116 and £109 respectively for every £100 spent on comparable services in England. Without a change, it is argued that the continued application of the Barnett arrangement could ultimately adversely affect the economy of Wales by limiting the growth in aggregate demand (McGregor et al 2004). Nevertheless, the sustainability of growth that relies to a large extent on public spending is questionable irrespective of the growth theory one chooses as a vantage point. Public spending growth is constrained by outstanding public debt and the tax base and a region’s growth prospects will be less sensitive to the business cycle if growth is contributed broadly over other sectors of the economy.

Devolution has the potential to reduce bureaucracy at the national level and increase it at the local level and it is unclear whether the change results in a net cost. The Wales Office, the representative authority of Westminster in Wales that has replaced the former Welsh Office, employs around 60 people with a Budget of less than £5 million. In 1995-96, by comparison, the Welsh Office employed 2,400 full-time equivalent staff, with a total running cost budget of £76 million for 1995-96. After Devolution, most of the staff of the Welsh Office transferred to the WAG whose numbers were further increased by absorbing the staff of the WDA and ELWA. Meanwhile because of functional devolution, the budget controlled by the
Welsh Assembly government is considerably larger than previously, at £318 million in 2005-06. These figures provide a broad appreciation of the expenditures involved but invite closer analysis of how the costs of governance have changed.

### 2.6.1 The Welsh Assembly’s Expenditure Choices

In the absence of tax-raising powers, the WAGs leverage of the Welsh economy is limited to its spending choices, success in attracting inward investment and secondary legislation that is spatially limited to within Welsh boundaries and cannot repeal existing UK legislation. WAG also manages the delivery of European Structural Funds programmes through the Welsh European Funding Office (WEFO). The current programme runs from 2007-2013 and by 4 March 2011 221 projects had been approved representing £3 billion (with match spending). Of this total about £1.75 billion was allocated under the ERDF and £1.28 billion was ESF funds.

The WAGs budget (expressed as the Departmental Expenditure Limit) for 2011-12 is £14.68bn compared with the provisional estimate of Welsh GVA in 2009 in current prices of about £44.517bn (Welsh Assembly Government). A comparison of departmental allocations in 1996/7 with the WAGs planned spending for 2011/12 as announced as the Final Budget for 2011-12 by the WAG is presented below in Table 2.8.

<table>
<thead>
<tr>
<th>Table 2.8 Expenditure on Services in Wales 1996/7 and 2011/12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenditure categories</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
</tbody>
</table>

66
## Table 2.8

<table>
<thead>
<tr>
<th>Economic Development</th>
<th>£m.</th>
<th>Outturn 2011-12</th>
<th>£m.</th>
<th>Outturn 2011-12</th>
<th>£m.</th>
<th>Outturn 2011-12</th>
<th>£m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>General government expenditure</td>
<td>1,290</td>
<td>9.7</td>
<td>1,247.46</td>
<td>864.67</td>
<td>8.31</td>
<td>67.03</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>1,818</td>
<td>13.67</td>
<td>2,102.34</td>
<td>1,457.23</td>
<td>14.01</td>
<td>80.16</td>
<td></td>
</tr>
<tr>
<td>Health and social services</td>
<td>2,829</td>
<td>21.27</td>
<td>6,269.56</td>
<td>4,346.71</td>
<td>41.79</td>
<td>153.61</td>
<td></td>
</tr>
<tr>
<td>Total government expenditure</td>
<td>13,301</td>
<td>15,002.68</td>
<td>10,399.03</td>
<td>78.18</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes:

a at 1996/7 prices = 100 deflated by GDP deflators\(^7\);
the HMT forecast index value in 2011/12 = 144.27.

Source: HM Treasury

b at April 1996 prices as %1996/7.

c 1996/7 represents the sum of spending on agriculture, fisheries, food and forestry; trade, industry, energy and employment; roads and transport; figure for 2011/12 is the sum of Economy and Transport, Rural Affairs, Regeneration, Rural European Policies, Welsh Food and Drink Industry, CAP and the Countryside, Tourism and Match Funding and Local Government funding.

Source: Public Expenditure-Statistical Analysis 1998/9, Cm. 3901, Table 7.6A; WAG Final Budget February 2011.

What stands out from the final column of Table 2.8 is that, in real terms, total government expenditure in Wales has reduced by nearly 22 per cent between 1996-97 and 2011-12, and within that increased total, economic development has not grown as much as expenditure on education and health and social services.

There are two possible interpretations for the reduction in funds allocated to economic development over this period: either spending priorities are inflexible...
and the Assembly has little room for manoeuvre, or that the WAG is driven more by the desire to spend funds on social welfare now than by the long-run needs of the Welsh economy. In 2011/12, 21.27% of the budget was allocated to Health and Social Services, 8.31% to the Economy and Transport and other economic related spending and 14.01% to Children, Education, Lifelong Learning and Skills with the remainder split between the Environment, Social Justice, Central Expenditure, Culture and Sport and Heritage. Compared with 1996/7, this budget represents a real reduction on spending in economic development and education and a large increase in spending on health and social services. Spending on economic development is one of the principal means of WAG exerting leverage on the Welsh economy and its impact on economic growth will be analysed empirically in chapter 6.

The assumption that the WAG expenditure does reflect the median preferences of the Welsh electorate may be incorrect. Brown and Jackson (1990) remind us that the link between electoral politics and economic outcomes is far from direct. Representative democracy is an imperfect mechanism for achieving the economic goals of the electorate as it is believed that the electorate tend to vote for representatives of parties and not issues or manifestos. Electoral candidates present themselves aligned with bundles of policies marketed as manifestos and often the manifestos are unclear about the resource cost or the tax implications of manifesto aspirations (Downs 1957; Hardin 1999). In a ‘first past the post’ electoral system, a preference ordering of successful candidates that approximates that of
the electorate is unlikely to occur, and in any case, the electorate may choose not to reveal their preferences by abstaining from voting, which may be construed either as a vote of complacent confidence or disengagement caused by indifference. The problems associated with representative democracy at the national level are repeated at the sub-regional level. Successful electoral candidates in the WAG tend to be aligned with one of the major parties and electoral turnout in the May 2007 National Assembly of Wales elections was 43.7%, an improvement on the 2003 turnout of 38.5%, but still less than the turnout for the referendum that was 50.1% (Electoral Commission). Further evidence pointing to a lack of confidence by the electorate in the electoral process in devolved elections, is provided by evidence that the Scottish Parliament elections results tend to reflect voters’ views of the performance of the UK government at Westminster and not their policy preferences on devolved matters (Curtice 2005). There is no published evidence to determine if this is also the case for Wales.

Acknowledging the apparent alienation of much of the electorate suggested by low electoral turnouts, one can understand if there is a politically-driven pragmatic imperative to focus resources on health and social services that would account for them being the single largest component of expenditure. The electorate is more likely to be influenced by the waiting time for medical treatment now, than the promise of faster economic convergence at some future date. The apparent real reduction of resources made available for economic development that is demonstrated by Table 2.8 casts doubt on WAGs commitment to improve
the performance of the Welsh economy using expenditure on economic
development as a policy lever.

Table 2.8 also suggests that that over the decade ending in 2006/7 a real
increase in spending on education has occurred. As recently as 2002 evidence
suggests that Welsh employees were at a disadvantage in terms of their education.
For example, Jones *et al* (2002) report that the sample used in their research
suggests that the percentage of people of working age with a degree or equivalent
in Wales is significantly less, and the proportion of those in Wales with no
qualifications is much higher than a comparable sample in England and Scotland.
Educational attainment can be regarded as a proxy for the quality of human
capital within the labour force and evidence of a real increase of spending on
education suggests that WAG recognizes its importance as a factor influencing
regional development.

The reduced importance attached to expenditure on economic development
is surprising given that the Welsh industrial structure is generating less
employment and income than the other mainland territories. Using the percentage
employed in the tertiary sector (excluding public administration) as a proxy for
post-industrialization reveals that the Welsh figure of 40.6% is well below those of
Scotland (46.1%) and England (49.6%). The themes of education and spending on
economic development will be addressed in Part 2 of this thesis as part of my
empirical analysis.
2.6.2 The Devolution Settlement and its Significance for Economic Growth

The significance of devolution for economic performance is derived from the association between economic efficiency and economic organization in the public sector. The public sector can be organised to tax citizens and provide public services as a centralized monolith or decentralized to raise revenue and provide public services at different levels of sub-national stratification. The powers to tax and provide services are not necessarily linked; tax-raising and the provision of services can occur at different administrative levels. Oates (1993) argues that decentralization is a way ‘to break the grip of central planning that has bedevilled efforts to set poorer nations on a course of self-sustaining growth’, but qualifies this assessment by adding, ‘the potential of fiscal decentralization for facilitating economic development has to be evaluated largely in terms of the particular circumstances of the developing countries in their current state’ (Oates 1993).

While Oates’ qualification may be referring to extreme non-democratic and autocratic countries, the implication is that there is uncertainty concerning the realization of greater efficiency from decentralization. The expected benefits rest on the premise that local taxing and spending will be undertaken more efficiently. Local accountability is likely to result in spending decisions taken within the region that are more likely to align with electoral preferences than would be the case under a centralized authority (Bird 1986; Oates 1993).

This hypothesis linking fiscal decentralization with economic efficiency and growth has encouraged empirical investigation as a means of producing evidence
and clarity. Analysis has typically employed panel or cross-section data of countries or regions using a variation of the Barro (1990) endogenous growth model. Such specifications typically involve regressing economic growth against a number of variables thought to be positively related together with a measure of fiscal decentralization (Zhang and Zou 1996; Davoodi and Zuo 1998; Xie 1999; Mello 2000; Ebel and Yilmaz 2002; Darby et al 2003). This methodology is questionable, as during phases of growth the variables representing capital and labour utilization are likely to display multicollinearity, and result in an apparent statistical significance between growth and decentralization that could be spurious. A further problem arises from the data-sets used to represent different countries at different stages of development and at different points of the business cycle. For these reasons, the evidence to date has not provided compelling evidence one way or the other; as Roy (2006) observes, ‘it is clear that the existing empirical literature does not provide unequivocal evidence of a strong relationship between decentralization and economic growth in either direction’.

Since the current method of devolution financing in the UK is by grants from Westminster, this may weaken the case for the efficiency gains from decentralization owing to the so-called flypaper effect (Hines and Thaler 1995). The idea is that sub-regional government in receipt of grants from the central government will tend to spend more than would have been the case had funds been raised from local taxation to provide the same services. In other words, the separation of the providers of funding and the ultimate spenders detracts from the
process of utility optimization by creating the illusion (for those spending) that the there is no resource cost. Another criticism of the separation of taxing and spending is that the recipients of the funds do not have a vested interest in the growth of tax revenues. Apart from increases in the working population and raising tax rates, in the long run the growth of tax revenue depends on economic growth. Consequently, it can be argued that the current devolution funding arrangements remove the incentive to encourage economic growth within the devolved territories as the benefits of growth will accrue to Westminster and will not be shared with the devolved countries.

This may be why Foreman-Peck (2003) criticizes the Welsh devolution settlement on the grounds that devolved expenditure in a democratic system should be funded by devolved taxation. In a footnote he observes the likelihood of resistance to change from H.M. Treasury because it erodes their control over the UK economy. This tension between centralized macroeconomic policy and fiscal decentralization is always present even if devolved governments are limited to spending a block grant, but increases if fiscal devolution is extended to tax-raising powers. Tax-raising powers are not necessarily a panacea for Welsh economic problems; with a relatively small economy and tax base, fiscal self-reliance together with the fiscal rectitude of a balanced budget could result in a reduction in tax receipts and expenditure. Attempts to increase revenue through higher taxes relative to England and Scotland could result in net out-migration thus reducing the tax base. A policy of reducing taxes below those of England to
encourage inward investment may run up a large Welsh public debt, requiring further help from Westminster before the policy achieved the benefits of a larger tax base. While in theory, fiscal decentralization is associated with greater efficiency, the previous discussion suggests that the reality may be more complex over the short and long run. A piecemeal policy of fiscal decentralization, acknowledging the diversity of regional initial conditions, could handicap lagging regions’ ability to catch-up with the more prosperous regions.

2.6.3 Spatial inter-relationships
Administrative devolution does not bestow economic autonomy or economic disentanglement from trading relations and economic linkages with other regions. The UK economy has evolved over a long period of time as an integrated national economy and has developed complex regional linkages in factor and product markets that transcend administrative boundaries. Allen et al (2004) illustrate the significance of these linkages by estimating inter-regional output, employment and value-added multipliers between Wales, Scotland and the rest of the UK. This evidence suggests the idea of spatial dependence between UK regions (Anselin 1988) or in other words, that there could be an association between economic activity at different regional locations. This may represent trading relations based on the source or provision of raw materials, production of semi-finished products for completion at another location, or access to final goods markets. Furthermore, regions may specialize in economic activity through a comparative advantage, in
much the same way as countries (Bernard and Jones 1996). This may reinforce regions’ spatial dependence on other regions that represent the markets for their output or their source of materials. Welsh devolution cannot alter these dependencies in the short run although the WAG may be able to exert some influence over these dependencies through its spending on economic development.

The likelihood of spatial dependency introduces problems for the researcher as the regional configuration of economic activity is unlikely to correspond with administrative and regional boundaries (Rey 2001). Devolution cannot disentangle the spatial dependencies that have evolved in the past and suggests that economic development in Wales will continue to be strongly influenced and constrained by what happens in the other territories of the UK. The strong economic interdependence between UK territories evidenced by the work of Allen et al (2004) suggests that investigation of Welsh relative economic growth may benefit from spatial data analysis to investigate the extent that Welsh economic development is determined or constrained by its linkages with English regions. Such considerations suggest that an analysis of Welsh economic growth should take account of the relationship between the UK regions’ economic policy and economic performance compared with that of Wales. The implication of this insight is that the consequences of Welsh economic independence may be limited until the Welsh economy evolves greater independence that liberates it from the
constraints of the spatial distribution of industry in the UK that evolved within an integrated and open UK economy before Devolution.

2.7 Conclusion
The historical evidence suggests that Welsh economic under-performance, relative to the UK, has persisted for over a century despite a range of regional economic policy measures. Devolution is considered by WAG to be an opportunity to improve Welsh economic performance and living standards, and some aspects of the theory of fiscal decentralization provide support for this expectation, although theory also suggests potential negative consequences. Theoretically therefore, the consequence of devolution as regional economic policy is ambivalent as regards its potential to interrupt Wales’s long-term economic decline.

The theory discussed above, indicates that the transmission mechanism of devolution on economic performance may be associated with the WAGs greater control over public spending and education as precursors of growth. Discretionary public spending may be allocated for the purpose of current social spending or invested in the Welsh economy to increase its secular growth and future income. To achieve the latter WAG may allocate more resources to economic development to encourage the improvement of the industrial base, and encourage education and training to enhance human capital as a means of achieving a comparative advantage for Wales.
These conclusions represent the theoretical framework for the empirical investigation of the relationship between devolution and economic growth that I will undertake in Part II of this thesis. However an appraisal of the potential for political change to alter the long-run economic growth path of Wales would not be complete without considering in greater detail the theoretical foundations of economic growth and convergence. The precursors of growth can be used as policy instruments by WAG to promote economic development and I continue by investigating them in chapter 3.

Notes

1. This report does not explain the method used or produce numerical analysis beyond tabulated values, in support of its conclusions.
2. The Gini coefficient is sometime used as a measure of income inequality and relates the cumulative income share of a population to the cumulative population share.
3. I have omitted Northern Ireland from the analysis in view of the effect of political instability on its economic performance.
4. Psychic income represents non-monetary subjective utility, (see for example, Thurow 1978).
5. This idea was introduced by De Tocqueville in the 19th century and introduced into everyday speech by John Stuart Mill. In my terms the problem refers to the UK electorate expressing preferences representing the UK median voter that may not be representative of the median Welsh voter.
6. Tiebout in contemporary UK society can be construed as reinforcing an imbalance in the distribution of wealth, power and life opportunities. Fiscal jurisdictions perceive the benefit of having a population that swells the tax base and one that reduces dependence on public services. This may lead to the tyranny of the middle classes who monopolize the best performing scarce educational resources and impede educational inclusivity and economic development.
7. Using the GDP deflator is consistent with that used in the Treasury’s Public Expenditure Statistical Analysis
Chapter 3
Devolution and Growth: Theoretical and Empirical Perspectives.

3.1 Introduction
In the previous chapters I established part of the foundation of my thesis by
discussing the nature and significance of governance for growth and economic
development and the progress of policy formulation in the devolved Welsh
government. That material represents a necessary, but not sufficient preparation for
my empirical analysis that also requires an examination of the meaning and
application of economic growth and convergence and its association with a change
in governance.

In this chapter I provide a critical review of the literature that is relevant for
my research question by examining economic growth and convergence. I examine
the theoretical foundations and the empirical analysis that has been undertaken that
can inform and support my own research into the association between Welsh
Devolution and its consequences for Welsh economic growth.

The theoretical debate concerning growth and convergence is of practical
significance for the formulation of economic policy, and consequently for the
framing of welfare policy. Legislators’ choice of a growth paradigm will colour their
attitude to the policy tools available to them to influence economic events and this
in turn will affect the economic choices made by the electorate. For an example of
how the analysis of growth and convergence has political significance for economic policy see Wagner and Hlouskova (2001) in which the authors investigate the growth prospects of Eastern European countries in relation to their candidature for membership of the EU.

Contemporary thinking can be described as dichotomous in terms of theory when considering how macroeconomic management, the distribution of political power and economic growth are interlinked. In the western economies, the ideas of Hayek (1948; 2001; 2006) and Friedman (1963; 1992; 2002) were adopted by President Reagan and Prime Minister Thatcher. The prevailing orientation of economic policy moved to the right in the 1980s and governments in most of the developed western economies favoured laissez-faire policies characterized by balanced public sector budgets and non-accommodating monetary policy. This policy stance could be interpreted as a belief that governments cannot control long-run economic growth, and can only strive to ensure that the stability offered by orderly markets and low inflationary pressure, create the conditions for growth to flourish in the ‘real’ private economy. In short, it represents tacit conformity with the neoclassical paradigm of the exogeneity of growth and contrasts with the tenets of endogenous growth theory.

Nevertheless, it would be erroneous to conclude that all growth researchers fall neatly into the neoclassical/endogenous growth paradigm dichotomy; writers such as Perroux (1950; 1955), Myrdal (1957) and Kaldor (1970; 1981) predict that regional incomes will tend to diverge, essentially on account of market failure and
regional clustering. Furthermore, these disparities are claimed to be self-reinforcing as resources are attracted to more successful regions (Martin and Sunley 1996). This is a persuasive argument in the context of my thesis as it corresponds with the evidence associated with the apparent relentless growth in London and the South East of England. It is a pessimistic prognosis that increases the urgency of my research to investigate the implied inevitability of Welsh economic underperformance.

In the next section of this chapter, I investigate growth accounting and total factor productivity as a hypothesis suitable for explaining variations in regional growth. This is followed in section 3.3 by a discussion of neoclassical and endogenous growth theory and the different types of convergence. I continue by investigating the empirical research that has been undertaken into growth and convergence. In sections 3.5 and 3.6 I consider the importance of spatial analysis in understanding regional economic behaviour and its significance for fiscal decentralization. Section 3.7 discusses evidence of spatial effects between the nations of the UK. Section 3.8 discusses the implications of theory for economic policy and section 3.9 concludes.

3.2. Theories of Economic Growth

Economic growth theory continues to be an area of interest, study and controversy within the economics discipline. Governments may be judged on the economic growth achieved during their term of office, since for the electorate, growth
prospects influence security of employment, income and material standards of living (Markussen 2008). That economic growth is not completely understood and is controversial is graphically demonstrated by the IMF. They contend that economists are reconsidering what they really know about economic growth and policies to encourage it and question whether models of growth are reliable (Zagha et al 2006).

The classification of growth theory begins with the distinction between exogenous and endogenous growth. However this distinction is by no means clear-cut; Di Liberto (2005: 37) notes that the use of human capital as an argument in both exogenous and endogenous growth theory brings about a convergence of ideas between endogenous and exogenous models. The assumption of endogeneity also directs attention to the government as an influential agent that may impede or encourage growth through the size of the public sector, its choice of tax policy and tax structure, education policy and maintaining efficient markets. The overall effect of these policies upon resource allocation and social and economic stability may directly or indirectly influence the working of labour and product markets. Hence, changes in political jurisdiction such as those that occur with devolution create the possibility of differences in the regional policies of jurisdictions that may further influence regional economic differentials.

In summarising the literature on economic growth I concentrate upon three main areas. I begin by discussing growth accounting and total factor productivity that is useful in delineating the main factors considered to contribute to growth. In
the following section I critically review the contribution of neoclassical and endogenous theories to our understanding of differential regional growth in the UK. Finally, I address the implications of these theories for growth convergence.

3.2.1. Growth Accounting and Total Factor Productivity (TFP)

There appears to be universal agreement that the origins of growth are associated with the use of capital (physical and human) and labour together with technical progress (Solow 1957; Easterly and Levine 2001; henceforth referred to as E&L). This taxonomy lends itself to the dissection of growth originating from changes in labour and capital and the calculation of the associated technical progress as captured by TFP. Growth accounting dates back to the 1950s (Solow 1957) and its significance for understanding the growth process is the theoretical ability to distinguish between growth changes associated with factor accumulation or originating from other sources of growth that E&L describe as ‘something else’. This ‘something else’ can be interpreted as the unexplained component of growth regressions, or the residual, but it has come to be called TFP. However, growth accounting is not a theory explaining growth; it merely identifies statistical associations between factors and output, and consequently should be written as an identity and not as an equality.

Formally, following E&L:

We can assume a Cobb-Douglas production function with constant returns to scale of the form:
Chapter 3: Devolution and Growth

\[ y = A k^{\alpha} (n^{1-\alpha}) \]  \hspace{1cm} (3.1)

Where \( y \) = output per person, \( A \) is a scaling factor for technical progress, \( k \) is physical capital per head and \( n \) is effective labour input allowing for human capital and working practices. The index \( \alpha \) and its division between \( k \) and \( n \) reflects the effectiveness of changes in capital and labour on output per head.

E&L then develop this relation in growth rates, giving:

\[ \frac{\Delta y}{y} = \frac{\Delta A}{A} + \alpha \frac{\Delta k}{k} + (1 - \alpha) \frac{\Delta n}{n} \]  \hspace{1cm} (3.2)

TFP represents the difference between the growth of output per head and the sources of growth on the right hand side of the equation. Several problems are immediately apparent in employing this relationship to explain growth in the real world. Firstly, there is likely to be a difference between the embedded vintage of capital and the current state of technical progress; for example, the working stock of personal computers, or the median computer is unlikely to correspond to the latest technology of hardware and software. Also, changes in capital and labour are regarded as independent while the acquisition of new capital may entail retraining the workforce to equip them with the skills required for the effective use of the new capital. Furthermore, there may be unforeseen positive or negative synergy associated with the use of the new capital. Measurements of productivity may be
affected accordingly and can also be influenced by non-economic factors such as nationalistic fervour in times of crises or politically motivated labour disputes.

Finally, the output of each product is regarded as independent of the output of all other products. However, many products are related to the production of others and can be influenced by events in these markets, or indeed by national and international events or policy.

The value of TFP was estimated for the OECD by Christenson, Cummings and Jorgenson (1981) and Dougherty (1991) who estimate a value of $\alpha$ for the UK of about 0.39 between 1947 and 1990 and a TFP of 52%. This is to be interpreted as a claim that 52% of UK GDP growth, over this period of time, is unexplained by the use of technology, capital and labour.

E&L undertake their own research using panel data for 73 countries over the period 1960-95 and conclude that the TFP residual accounts for most of the cross-country and cross-time variation in growth (Easterly and Levine 2001: 37). In other words growth is not explained (statistically) by the accumulation of capital, labour or technology and improvements in human capital. This result may have limited relevance for my study as E&L’s research is a cross-country analysis, and does not adjust for differences in governance and culture that may account for part of the differences in growth observed between countries. Each nation of the UK, and to some extent each region, has its own identity, but it is assumed that most citizens of all countries of the UK subscribe to a common underlying British identity that mitigates the impact that regional diversity has upon economic activity. Equally,
regional governance is dependent upon Westminster for funding and bound by its primary legislation.

They also found that incomes across countries diverge over the long-run and the growth rates of rich countries do not appear to slow down (Easterly and Levine 2001: 1). This observation suggests that the productivity gains of technical progress may be larger than the incremental costs of capital replacement. However, the diffusion and use of new technology between sovereign countries that is the focus of E&L’s analysis is unlikely to be as rapid as within an open and integrated economy like the UK. Barriers to the application of new technology are not assumed to account for inter-regional variations in UK economic growth, unless the initial advantage afforded by existing clusters of specialist capital and labour skills act to ‘crowd-out’ other less-fortunate areas.

Growth was found by E&L to be highly unstable over time, while factor accumulation exhibited greater stability (Easterly and Levine 2001: 37). This observation provides further evidence of the lack of association between factor accumulation and growth. A possible explanation for this behaviour may be that factors accumulate without a perceptible effect on recorded growth until some critical tipping-point that is manifest in an acceleration of growth. E&L also test the standard neoclassical growth model augmented to capture the effects of national economic policies and schooling as a proxy for the development of human capital and found that national policies are strongly linked with long-run economic growth rates (Easterly and Levine 2001). They also find a positive and significant
correlation between schooling and economic growth a finding that I will pursue in my own empirical work in chapters 7 and 8.

E&L’s work also provides support for the ideas of endogenous growth, namely, that government policy and schooling in its role of augmenting human capital can influence growth prospects. If the effectiveness of government policy varies with the size or homogeneity of the jurisdiction, it also provides a vindication for the policy of devolution as a catalyst for economic growth. For Wales this suggests that although WAG may have limited powers to engage in macroeconomic policy it does have some influence over Welsh economic development. It can allocate funds for the purpose of economic development; lobby within the European Union for the receipt of regional assistance funds; and vary the allocation of funds among public services. This exerts some influence over capital flows and the development of human capital through education and training, and subsequently influence Welsh economic growth prospects.

My interpretation of TFP is that it represents the synergistic contribution to growth over and above the contributions arising from resource accumulation, and it may also represent the effects of the international business cycle that feed through the contribution of changing international trade to variations in economic growth. E&L claim that TFP accounts for the major explanation of growth and is associated with the pervasive tendency for all factors of production, including physical and human capital, to bunch together (Easterly and Levine 2001: 3). The bunching or clustering of economic activity often occurs to take advantage of scale and network
externalities and may explain some of the regional variation in levels and growth rates of economic performance.

When we turn from growth accounting to the theoretical hinterland occupied by the neoclassical and endogenous paradigms, we are confronted by the paradox of the disappearance of E&L’s ‘something else’. Growth accounting is not a theory, and its theoretical specification is really an identity since output growth can be broken down into its component parts in a production function, to a labour and a capital component, even though there may be uncertainty as to the accuracy of the break-down. As we shall see, there is some similarity between growth accounting and neoclassical growth theory, and moving to neoclassical theory involves turning the identity into an equation, and moving from attribution to association and causation.

Formally, recalling equation (3.2);

\[
\frac{\Delta y}{y} = \frac{\Delta A}{A} + \alpha \frac{\Delta k}{k} + (1 - \alpha)\frac{\Delta n}{n}
\]  

(3.3)

A change in output can be associated with a change in the use of the factors of production or a change in technology. Expressed in levels this relationship can be restated as:

\[
y = AF(k, l)
\]  

(3.4)

Equation (3.4) is a production function relating output to technology, capital and labour that is the foundation of neoclassical growth theory.


3.2.2 Neoclassical and Endogenous Growth

I choose as my starting point for considering the significance of growth theory the contribution of Robert Solow (1956) whose ideas were built upon those of Adam Smith, Thomas Malthus, Alfred Marshall, and Joseph Schumpeter and which were effectively synthesized by Roy Harrod (1948) and Evsey D. Domar (1946). Economic growth involve the relationship over time between economic output and factor inputs, so it is not surprising that the production function became the standard methodology of exposition and analysis. Solow’s model represents an explanation of growth that relates output to the generic inputs of labour and capital on the assumption of constant returns to scale, assuming that population growth is exogenous¹ (Gylfason 2003). The corollary of exogenous demographics and technological development is exogenous growth, and is associated with a long-run steady-state equilibrium path along which output, capital and quality-adjusted labour all grow at the same exogenously given rate (Gylfason 2003: 27).

Since the 1980s macroeconomic policy in the UK has eschewed direct macroeconomic intervention, favouring the suppression of inflationary pressure by means of monetary policy and maintaining orderly markets through anti-competitive monitoring and light-touch regulation. Such a policy stance can be interpreted as one that is in sympathy with the tenets of neoclassical growth theory which interprets growth as an exogenous process (Barro and Sala-i-Martin 2004). It is also argued that government policies can affect per capita output even though

¹ Exogenous growth is a type of economic growth that is not dependent on internal factors such as technological advancements or demographic changes.
convergence can be similar across economies, (convergence is discussed in section 3.3) (Barro and Sala-i-Martin 2002; 2004).

Until the financial/economic crisis of 2008/09, UK policy appeared to align with neoclassical exogenous theory, and play down the ability of policy to influence growth. Meanwhile the exercise of decentralized policy, at least in the Welsh context, appears to suggest support for the efficacy of government policy to influence the path of Welsh relative economic growth. This is not, perhaps, a surprising observation; I previously noted that decentralization is considered beneficial as it reduces the [political] distance between the electorate and their representatives. So in theory policy-makers may be more able to tailor policies to the ‘needs’ of the electorate.

In the past, economic policy-makers valued growth for its own sake more than it is today as it was considered synonymous with higher material standard of living, that were in turn associated with enhancing the quality of life. That perception, at least for the developed world, is now under critical appraisal, because of the twin experience of local congestion externalities, and claims of global climate change attendant upon economic development. Consequently, technological progress and its environmental consequences are no longer depicted as an unambiguously desirable policy goal (Schumacher 1973; Stern 2007).

Furthermore, the dissatisfaction with use of GDP as a measure of economic progress has stimulated interest in constructing indices of well-being and happiness (see for example, Frey and Stutzer 2001). However interesting and important the
contemporary discussions of these issues and those of the international disparities of income and growth, they will not be pursued here as they are outside the scope of my research questions.

Classical economic theory bequeathed upon neo-classicism the two crucial assumptions of efficient markets and rational economic agents whose behaviour is assumed to be driven by the desire to maximize their utility. These assumptions permit neoclassical growth theory to explain economic development as an exogenous phenomenon over which policy has little influence. Economic growth is considered to be driven by population growth, capital accumulation and technological change that are all assumed to occur exogenously. Consequently, a pure neoclassical perspective would deny that a change of governance could affect economic growth, but would be deemed unnecessary since economic growth convergence of economies at different stages of development is expected under these restrictive assumptions.

Formally, following Solow (1956) and Swan (1956) neoclassical growth is based upon a constant-returns-to-scale aggregate production function that explains output behaviour \( y \) upon labour \( l \) capital \( k \) and technology \( n \)

\[
y = nf(l,k)
\]  

(3.5)

Dividing the expression through by \( l \) explains output per head in terms of technology and the capital-labour ratio
\[ y/l = n f(k/l) \]  \hspace{1cm} (3.6)

Over time, capital accumulation may occur if households postpone current consumption and save, so rearranging and differentiating the expression with respect to time gives

\[ \frac{dk}{dt} = sy - \Delta k \]  \hspace{1cm} (3.7)

We can interpret this as meaning that the net change in the stock of capital over time equals saving \((sy)\) minus the proportion of the capital stock requiring replacement \((\Delta k)\).

Assuming that the savings ratio is fixed and no population or technological change occurs, the capital stock will grow until the change in \(k\) is equal to \(s\). Depreciation will be exactly balanced by savings and the capital stock will not change and neither will output per head. This situation is described as the steady-state.

Population growth \(\frac{dl}{dt}\) will increase output at a rate dependent upon the ability of the capital goods industry to tool up new entrants to the labour force by providing them with plant and machinery.

The neoclassical hypothesis may be challenged on the grounds of naivety and by exposing its hidden assumptions. One critical assumption is that of constant returns to scale that suggests that an equal increase in all inputs will result in an equal increase in outputs. In technical terms this describes a production function
that is homogenous of degree one in capital and labour (Barro and Sala-i-Martin 2004). The idea of increasing returns to scale in production is often described as the Verdoorn law (Verdoorn 1949) that posits a relationship between the growth of labour productivity and the growth of output, although the original idea may have originated with Clark (1940). This relationship is the basis of Kaldor’s growth model (Kaldor 1966; 1967; 1970) that asserts three growth ‘laws’ that highlight the importance of industrialisation in general and manufacturing in particular for explaining GDP or GVA growth. In particular, Kaldor’s second law associates the rate of growth of manufacturing productivity with the growth of manufacturing output and alludes to increasing returns as an explanation of economic growth (Thirlwall 1983: 350). However, a full explanation of the significance of increasing returns for growth requires making the distinctions between static and dynamic growth (Thirlwall 1983: 349). For example, it can be demonstrated that static increasing returns occur naturally in the ‘real’ world, for example when the cubic capacity of a container increases by more than the doubling of its dimensions (Thirlwall 1983). Additionally, dynamic increasing returns may result from changes that occur over time in a firm; labour may become more productive through the accumulation of greater experience, while synergies in production and distribution may be realized as firms grow.

There is also a problem with the theory regarding the consistency of its predictions at the micro and macro levels of analysis. The theory of marginal productivity states that labour and capital will earn a return (the equilibrium wage
and profit) consistent with their marginal product (Barro and Sala-i-Martin 2004).

However, translating this at the aggregate level given a change in output it can be shown that changing the stock of capital changes the distribution of income and that profit can then not equal the marginal product of capital (Bhaduri 1969).

The uniformity required of savings behaviour and capital depreciation could be interpreted as a circular argument as these conditions require a degree of homogeneity. Similar savings behaviour implies similar consumption and personal incomes, while the depreciation value will reflect a degree of homogeneity in the capital stock. The neoclassical model can therefore be described as implicitly tautologous, and this is compounded by the unstated assumption that each economy or region is identical in structure. UK regions are not so small as to permit a region to be solely urban or rural in character, but it is possible to distinguish broad differences between regions that condition our expectations of relative wealth.

It is also noteworthy that in the standard neoclassical model there is no explicit recognition of the economy having both a private sector and a public sector. The implicit assumption is, that either the economy is organized by the state, is a market economy, or, if there is a private and public sector co-existing, that the net effect is neutral upon output. In terms of my thesis, the neoclassical model has nothing to say about the significance of governance in the growth process. This is a strange hypothesis, since from the beginning of their economics education, undergraduates are taught that economic systems can be differentiated by their
degree of government intervention and government control, and that these
different configurations may be associated with a different balance of economic
efficiency and social justice. However, as I argued in chapter 2, when it comes to
adjudicating between the relative merits of different positions on the scale of
decentralization, there is no definitive conclusion that is suggested by the
theoretical literature. Furthermore, since the neoclassical model does not
distinguish between public and private resource usage, this implies that if we
ignore any adjustment lags, the loss of output in the public sector would be
compensated by an increase in private sector output. Of course, according to
neoclassical theory such radical policy is unnecessary, as convergence between
Wales and the UK would occur naturally, on account of the differences in the
marginal productivity of capital that would bring about a compensating regional
movement of capital and labour (Barro and Sala-i-Martin 2004).

Economists have become dissatisfied with the ideas of neoclassical growth
that relies solely upon exogenous technological progress. There is little evidence of
convergence when comparing the world economies and neoclassical growth fails to
explain the persistence of differences in growth between national economies or
between the regions of individual countries. Furthermore, the theory limits the
influence of government policy to interventions that affect technological growth
which is at odds with the reality that many governments attempt to influence
economic events through a wide range of policy interventions. Endogenous growth
theory acknowledges the intuitive expectations that technological change, labour
productivity through the acquisition of skills and knowledge and government policy may influence economic growth (Gylfason 2003; Barro and Sala-i-Martin 2004). The characteristic exogeneity of neoclassical growth theory implies that growth in that model can only be explained by changes in factor supplies (Jones and Manuelli 1990). Furthermore, economic growth in a neoclassical environment of perfect competition and constant returns to scale implies that factors of production are paid their marginal product and is equivalent to all output. Hence in the neoclassical model there are no surplus funds to finance research. Romer (1986) addressed this problem and introduced a new class of growth model that allowed investment in knowledge and human capital to affect growth.

Formally, following Rebelo (1995) and Barro and Sala-i-Martin (2004) a representation of endogenous growth can be constructed using the Cobb-Douglas production function introduced above as equation (3.1)

\[ y = Ak^n(\alpha + \beta - \delta) \] (3.8)

The neoclassical assumption is that the coefficients on capital and labour sum to unity. Relaxing this assumption and assuming that savings are a constant proportion of gross income and are required to finance capital accumulation, the capital stock will grow as

\[ \dot{k} = sAk^n\alpha - \delta k \] (3.9)

If population growth is constant and given by

\[ \frac{\dot{n}}{n} = \phi \] (3.10)

(3.9) becomes
\[
\dot{k} = sA k^{\alpha - 1} n^{\beta + \alpha - 1} - (\delta + \phi)
\]  
(3.11)

and

\[
\frac{\dot{k}}{k} = sA k^{\alpha - 1} n^{\beta + \alpha - 1} - (\delta + \phi)
\]  
(3.12)

Assume the model has a steady-state growth rate such that

\[
\frac{\dot{k}}{k} = \gamma
\]  
(3.13)

then

\[
\gamma = sA k^{\alpha - 1} n^{\beta + \alpha - 1} - (\delta + \phi)
\]  
(3.14)

Taking derivatives with respect to time it can then be shown that

\[(\alpha - 1) \gamma + \phi(\beta + \alpha - 1) = 0\]  
(3.15)

Endogenous growth occurs when \(\gamma\) is not zero and this expression permits us to consider all the possible combinations of \(\beta\) and \(\alpha\) that meet this condition. When there are constant returns to scale \(\beta + \alpha = 1\) and increasing returns to scale occurs when \(\beta + \alpha > 1\). When \(\alpha < 1\) is a special case that explains the inability of the neoclassical model to sustain long-run growth as it predicts that marginal product of capital tends to zero and becomes negative after allowing for depreciation as the capital/labour ratio grows.

Endogenous growth theory permits many factors to become potential accelerants of productivity growth (Fine 2009) permitting output per capita to grow in the absence of changes in exogenous technical progress. To impose coherence on the multiplicity of factors that have the potential of influencing growth the endogenous model is sometimes described as explaining long-term economic
growth as the consequence of investment decisions (Crafts 1996). In this context, investment is to be interpreted in the widest possible sense including capital investment in the private and public sectors, investment in human capital, and technological change. Furthermore, national governments and supra-national organisations by setting and changing the business environment, have the ability to influence all aspects of economic activity and ‘that institutions and policy may have stronger effects on the growth rate than would have been predicted using the traditional neoclassical growth model’ (Crafts 1996: 41).

A formal presentation of endogenous growth requires that all types of investment are incorporated into the model and that capital accumulation does not experience diminishing returns (Crafts 1995: 746). Proponents of neoclassical theory would deny that governance or any form of economic organization could affect an economy’s growth path. For them, the potential growth path is determined by the available amounts of capital and labour, technology, and the amount of saving and investment that can all be considered to be exogenous (Solow 1956). Wales, as a devolved state can be interpreted as an analogue of this exogeneity, since the WAG has no control over macroeconomic policy in Wales. It cannot, for example, exert any influence over the interest rate in Wales, the choice between saving and consumption or the other factors considered to be important for growth in the neoclassical model, apart from deciding how to divide the block grant it receives from Westminster between spending Departments. Nevertheless, an intriguing question arises by speculating on the significance of the spending allocated by
WAG for the purpose of economic development, together with the other spending categories that directly impact on the productive capacity of the Welsh economy, such as through transport, spending on science and technology, industry and agriculture and education and training. Certainly the WAG appears to attach importance to its ability to increase the knowledge, research and development, and innovation capacity in all parts of the Welsh economy to achieve a prosperous Welsh economy (Welsh Assembly Government 2005: 64). Such a belief in the efficacy of education and innovation as drivers of growth can be considered to arise from a policy compatible with the tenets of endogenous growth.

Empirically, neoclassical growth has had little success in explaining the disparity in growth that was evident between many countries, and Arrow (1962), Romer (1986), Barro and Sala-i-Martin (2004), and others introduced the theoretical underpinnings of what is now referred to as endogenous growth theory to recognise the possibility that human intervention can influence the ‘drivers’ of growth. The core proposition of endogenous growth theory is that growth is a complex process occurring within economic systems involving dynamic feedback mechanisms between decisions taken within the private and non-private sectors of the economy. Assuming that growth is endogenous also implies the same for convergence behaviour; appropriate policies can alter the growth paths of regions that are underperforming to close the gap with regions that are close to their steady state. For example, education and training may enhance labour productivity and investment, and the promotion of research and development can influence technical
progress. In equation 3.3 above this means that as an endogenous relationship output can be interpreted as a positive function of human capital and technological advancement. Both variables can be influenced by economic agents and policy-makers in contrast to the neoclassical assumption of exogeneity. Hence, growth theory became endogenous and recognises that economies’ potential output growth is open to influence by the choices made by economic agents and government policy.

3.3 The Meaning of Convergence

Ideas concerning growth and convergence are inextricably bound together. Barro (1997) associates the neoclassical model with the convergence property that real GDP per capita growth is inversely related to its level, or \textit{ceteris paribus}, the wealthier a country, the slower it will grow. Should we entertain this notion, it leads to the conclusion that all countries sharing similar growth-related characteristics can be expected to attain the same level of per capita income and the lower a country’s income from the notional steady-state, the faster it will grow. However, this result is conditional upon the assumption of homogeneity that is questionable, as cultural, political and economic diversity may partly explain why the nations of the world exhibit very different levels and growth rates of economic activity and why some of the wealthiest are also the fastest growing.

Within the neoclassical model the crucial assumption underpinning the convergence hypothesis lies in the assumption of diminishing returns to capital. It is argued that growth is propagated by using increasing volumes of labour and
capital and that as the capital stock expands ever more resources have to be allocated to maintaining it until there is a notional level of output at which depreciation and replacement of the capital stock absorbs all the available capital.

Invoking the assumption of technical progress permits the relaxation of the constraint on steady-state growth imposed by diminishing returns to capital and may partly explain the historical experience of continuous secular growth (outside periods of exogenous shocks) experienced by the leading industrialized countries. Differences in technological progress relaxes the convergence requirement, but paradoxically may also reinforce it, as the unimpeded diffusion of technology suggests that convergence of technology is a credible antecedent of the convergence of economic growth (Barro and Sala-i-Martin 1997). The absence of evidence of convergence between nation-states may be due to obstacles that impede the speed with which technology is transmitted between states. States at lower stages of development with less developed institutions, infrastructure and human capital may be less able or unable to introduce and sustain contemporary production methods.

The diffusion of technical or technological progress within an economy or political jurisdiction may also depend upon whether it is undertaken by the public sector or as Research and Development (R&D) within industrial corporations (Romer 1986). Research undertaken within corporations is more likely to be treated as commercially confidential and more rigorously protected as intellectual property. This is of interest within the present study, as it suggests that regional
variations in economic growth may also be partly explained by the regional
distribution of industry and the varying propensity of firms to engage in or absorb
R&D or new technology. Explaining variations between the economic growth of
different economies over time, whether national or regional, requires taking
account of inherited differences that are sometimes referred to as the initial
conditions (Aghion and Durlauf: 1B 2005).

The existence of UK regional economic heterogeneity places the weight of
the adjustment of convergence on key aspects of economic behaviour, such as
savings rates, government policies, and capital investment. Broadening the
definition of capital makes the model more forgiving of diminishing returns, and in
particular, the recognition of the significance of how differences in human capital
affect the labour/output ratio, permits the relaxation of the assumption of the strict
specificity of physical capital. In short, people have the capacity to be versatile and
innovative (Arrow 1962; Sheshinski 1967) and recognition of the influence of human
capital permits the relaxation of the constraint on growth imposed by the assumed

Growth theory introduces controversy of a political nature on account of the
predictions of convergence. Neoclassical growth theory predicts absolute
convergence in the sense that any national or regional economy will converge to its
own unique steady-state that will be zero if there is non-increasing technical
progress (Di Liberto 2005). However, under certain conditions we should expect
different economies or regions of the same economy, at different stages of economic
development, to converge on the same steady-state growth trajectory for a number of credible reasons. Expectations concerning convergence between economies, or of their regions, will differ depending upon the degree of homogeneity of the regional economies. Different types of convergence distinguish between these complications; absolute convergence is the expectation that all countries will grow at the same rate and conditional convergence acknowledges that there may significant differences between countries’ economic and social conditions that may affect the rate of convergence. Barro and Sala-i-Martin (2004) demonstrate that for a group of economies, or regions of an economy with a similar structure, regions or countries with lower starting values of the capital-labour ratio have higher per capita growth rates and tend thereby to catch up or converge to those with higher capital-labour ratios. Formally, following Durlauf and Johnson (2010) for two economies denoted \( i \) and \( j \) where \( y \) is per capita income, \( \rho \) represents the initial conditions and \( \theta \) denotes the structural characteristics, convergence can be defined as:

\[
\lim_{t \to 0} E(\log y_{i,t} - \log y_{j,t} | \rho_{i,0}, \theta_{i,0}, \rho_{j,0}, \theta_{j,0}) = 0 \quad \text{if} \quad \theta_{i,0} = \theta_{j,0}
\]

(3.16)

This expression postulates that the key determinants of convergence between two or more economies are the initial conditions and structural characteristics of the economies. Initial conditions are explained by Galor (1996) as any fixed features of an economy that convey an initial relative advantage and if there is an equivalence of structural conditions it is the initial conditions that are instrumental for convergence.
The contentious point in this idea is over what is meant by similar structure and how to distinguish the tipping point between sufficient and insufficient similarity. Additionally, when considering convergence between regions of the same country, there is a hidden assumption that regions are self-contained in the sense that there is a correspondence between those living within a particular area and those working and spending in that area. Within some areas certain conditions may impede economic progress or convey a relative advantage in others that will propel them faster: thus conditional convergence theory suggests that countries will not necessarily converge to a unique steady-state growth path (Henley 2005). The UK is an open economy and has experienced persistent differential regional economic development of the past 40 years or more. Although it seems reasonable to assume that the UK, in terms of the diffusion of capital (including human) and information among the regions is homogenous, we shall see that there is no historical evidence that suggests we can expect absolute convergence of UK regional growth.

As my research is concerned with using economic growth convergence as a test of the economic consequences of devolution it is necessary to explain the different meanings and shortcomings of the terms, excellent summaries of which may be found in Islam (2004) and Di Liberto (2005). A useful way of thinking about convergence is provided by Galor (1996) who presents a classification of convergence types according to three characteristics that may be illustrated in the following Table.
Table 3.1 Classification of Long-Run per Capita Income Convergence Types

<table>
<thead>
<tr>
<th>Convergence Type</th>
<th>Initial Conditions</th>
<th>Structural Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute</td>
<td>Independent</td>
<td>Independent</td>
</tr>
<tr>
<td>Conditional</td>
<td>Independent</td>
<td>Identical</td>
</tr>
<tr>
<td>Club</td>
<td>Similar</td>
<td>Identical</td>
</tr>
</tbody>
</table>

Source: Adapted from Galor (1996:1)

Initial conditions are those characteristics of an economy that convey an advantage or disadvantage that may influence future growth prospects and are fixed at the beginning of the period under examination. For example, Mello et al (1997) include the level and growth of per capita GNP, a measure of urbanization, the division of the economy between industry, agriculture and services, natural resource endowments and location as all contributing to initial conditions. Structural characteristics by contrast are expected to influence growth and convergence and may involve factors that were previously initial conditions. In terms of the example cited, it is possible for changes to occur in the structure of the economy and the extent of urbanization that will change GDP in future periods. Other prominent structural characteristics include economic policy, investment behaviour and the development of human capital.

This classification suggests that an expectation of absolute convergence is not suitable for researching Welsh relative economic performance. The regions of the UK evolved within the integrated framework of the UK central policy and cannot be described as having been independent during this period of time. Consequently the structural characteristics of the Welsh economy after Devolution cannot be said
to have been independent following this long period of integration with the UK regional economies.

However, it is equally difficult to argue that UK regions are all identical in character and it may be that the regions can be divided into clubs that can be distinguished by their degree of structural similarity. This idea of grouping regions sharing similar characteristics has been carried over into the practise of describing UK regions as belonging to the core or the periphery in terms of relative regional economic success (Brand 2003). Regions exhibiting similar economic performance may also be attributable to interdependence, a possibility that I investigate in chapter 8. Evidence of continuing regional interdependence may suggest that such correlation between the economic performance of groups of UK regions is further evidence in support of club behaviour.

The other distinction required to delineate the different convergence ideas, is the difference between convergence of a country’s regions, as opposed to convergence across a number of independent countries’ economies. The former group can be expected to be more homogeneous in terms of the use of capital, technology and the factors affecting the nature of human capital, and this leads to the expectation of unconditional or absolute convergence to a common long-run equilibrium (Di Liberto 2005). The application of this principle to the regions of a single economy is not straightforward. The principle of homogeneity could be interpreted as requiring that regional economies of a nation-state are similar in structure, but it is likely that the regions of a single country will exhibit different
characteristics in terms of population, culture and economic structure. Furthermore, the political devolution of Wales may influence economic agents’ locational decisions in the future but the inherited configuration of economic assets and linkages is the outcome of past decisions made within a centralized UK economy. Consequently, the assumption that regional economies can be considered to be distinct economies in their own right may be inaccurate. Devolution may accelerate the erosion and replacement of the economic structure that was inherited, but the turnover of social and economic capital is likely to take longer than the elapsed decade thus far. If so, the idea of conditional convergence represents a response to the likelihood that regions or countries may be sufficiently different to influence expectations in favour of different long-run equilibrium growth rates and levels. Indeed this appears to be the last refuge for researchers who have been unsuccessful in their search for evidence of convergence between nations. Diversity of what are regarded as key growth drivers, such as education and the development of human capital may mean that different countries will achieve different steady-state levels that will persist over time.

Di Liberto (2005: 34) observes that divergence is not the same as the idea of convergence clubs that allow for patterns of cross-economy interaction, leading to the idea that economies evolve within groups and not in isolation, Bandyopadhyay (2003: 5). Such ideas lend themselves to the analysis of regional convergence and I investigate below evidence in favour of powerful inter-regional linkages through factor and product markets. These linkages may also function as obstacles to
progress much in the same way that the runners in a three-legged race will perform according to the weaker member of each team.

Sigma convergence is an alternative measure of convergence that focuses on the cross-sectional dispersion of per capita income across countries or regions, and its evolution over time (Abreu et al 2005; Quah 1993b). This distinction is important because interpretation of beta convergence over time is flawed if significant changes are occurring in the distribution of income of the population. Hence, beta-convergence is a necessary, though not sufficient condition for the reduction in the dispersion of per-capita income over time (Abreu 2005: 5).

As has been shown, there is an intimate relationship between growth and convergence in the theoretical literature irrespective of the paradigm of choice. Consequently, it is pertinent to explore any factor that is suspected of having an impact upon growth, as this in turn may have implications for convergence. A prominent and controversial factor is inequality, and evidence of causality between income distribution and economic growth would have economic policy implications. Banerjee and Duflo (2003) empirically investigate evidence of this relationship using cross-country regressions on 46 countries of changes in growth regressed against the Gini coefficient. They conclude that their data offers little on the hypothesis beyond counselling against the automatic use of linear models in settings where the theory does not necessarily predict a linear or even a monotonic relationship (Banerjee and Duflo 2003: 29).
Research has also been undertaken exploring the link between politics or political systems and economic growth. Democracy is considered to be beneficial for growth (Tavares and Wacziarg 2001) while political instability is thought to impede growth prospects (Alesina and Perotti 1996; Alesina, Ozler, Roubini and Swagel 1996).

3.4 Empirical Evidence of Growth and Convergence
The investigation of economic growth and convergence has been undertaken by researchers who specify models based upon variants of the neoclassical and endogenous growth paradigms. They estimate econometric models for evidence of convergence and estimates of its magnitude. In the following two sections I discuss this work as a guide to developing a testable hypothesis for my thesis.

3.4.1 Empirical Research into Economic Growth
Much effort has been devoted to explaining differences between countries’ growth rates (Barro 1997; Barro and Sala-i-Martin 2004; Caselli et al 1996; Bleaney and Nishiyama 2000; Conley and Ligon 2002; Banerjee and Duflo 2003). Neoclassical growth theory suggests that economies with a lower level of economic development can be expected to grow faster than those that are more successful. Researchers’ efforts in undertaking empirical estimation of economic convergence under the neoclassical model have in general ignored consideration of the type of economic system, the scale effects arising from the size of a jurisdiction or the extent of economic decentralization. The typical method employed to test for (beta)
convergence is to collect sufficient cross-section data or panel data of a number of countries or regions within a country and regress the growth of income per head on the level of initial income. A (statistically) significant result and a negative correlation are interpreted as evidence of convergence. It is claimed that much of this work suggests evidence of convergence at a rate of 2 per cent (Abreu et al., 2005).

Following Caselli et al. (1996) this leads to an estimating equation of the form:

\[
\frac{1}{T} \log \left( \frac{Y_{i,t}}{Y_{i,t-\tau}} \right) = \frac{1}{T} \log \left( \frac{Y_{i,t-\tau}}{Y_{i,t-2\tau}} \right) + W_{i,t-\tau} \delta + \eta_i + \zeta_t + \varepsilon_{i,t} \tag{3.17}
\]

To estimate unconditional convergence this equation is frequently represented in the literature by the following expression:

\[
\frac{1}{T} \log \left( \frac{y_{it}}{y_{it-\tau}} \right) = a - \log(\nu_{i,t-\tau}) \left( 1 - e^{-\beta y_{i,t}} \right) \frac{1}{T} + \omega_{i0,T} \tag{3.18}
\]

where,

1/T is a scaling factor to estimate beta as an annual convergence rate

Y_{i,t} is GDP per head in country i in period t,

\( \beta \) is the speed of convergence to its steady state,

W_{i,t} is a vector of the determinants of economic growth,

\( \eta_i \) is a country specific effect,

\( \zeta_t \) is a period-specific constant,

\( \varepsilon_{i,t} \) is an error term,

a is intercept, and
\( \omega \) is an error term.

When the coefficient \( \beta \) is statistically significant and negative it is interpreted as evidence of convergence (hence the term, beta convergence), and the speed of convergence is assumed to be related to a country or region’s proximity to its steady-state output level, which I explained above in the naïve model, as a balance between savings and depreciation. When \( \beta \) is zero it is interpreted as evidence of no convergence and the independent variables measure differences in steady-state growth rates (Caselli et al 1996). The structure of this model, by including country-specific effects, acknowledges that there may be unique country characteristics that explain the cross-country variation in growth. Estimating these characteristics is not equivalent to estimating a model that tests for convergence between homogeneous territories, as I assume to be the case when comparing Welsh economic growth with that of the UK regions.

Casseli et al (1996: 5-7) report that this specification has a number of problems:

1. Cross-section analysis of rates of convergence using country-specific explanations of the variations in growth employ a dependent variable representing the average rate of growth per head over some time period. The independent or explanatory variables are typically averages of changes over the same period. Casseli et al claim that the independent variables may be correlated and will induce an upward bias in the coefficient estimates and hence a downward bias in the convergence coefficient.

2. The direction of cause and effect is not clear in a dynamic modern economy. Put simply, does economic growth result in real and human capital accumulation or vice versa? Circularity confuses the identification of the
direction of cause and effect and consequently the specification of testable hypotheses.

Tsionas (2000) uses a similar specification to estimate regional $\beta$ and $\sigma$-convergence for the U.S. for the period 1977-1996, concluding that there is no evidence to support the hypothesis that convergence occurred in this time period. This author acknowledges the controversy over the question of whether different regions become similar in economic structure and concludes that if it were so regional inequality should not persist (Tsionas 2000). This statement implies that convergence in income levels requires convergence in economic structure, and could be interpreted as a policy prescription. The application of this principle to the discrepancy in economic performance between Wales and England, suggests that WAGs economic policy, should be directed at emulating the economic structure of the more successful English regions. However, the implicit assumption of homogenous English regions may be inappropriate recognising their diversity of economic fortune as measured by GVA per head. For example, South East England compared with North East England is distant both in space and economic success, as are pair-wise comparisons in general between regions in the south and elsewhere in the UK.

The idea of path dependence offers a possible explanation for how past choices can constrain future changes and why regions might fail to converge (Martin and Sunley 2006). The application of strict path dependence would suggest that the differences between regions’ economic performance was embedded in their
economic structures and would persist over time. Reasons cited include the
existence of economies arising from clustering behaviour that engenders positive
feedback and benefits from increasing returns (Krugman 1991, 1994; Arthur 1994).
Path dependence offers an explanation for inertia in economic change but cannot be
described as a theory that is amenable to empirical verification or that offers policy
prescriptions. I have endeavoured to reduce the effect of these problems in my
empirical work by constructing the dependent variable of my equations as Welsh
GVA per head as a ratio of each of the other UK regions and this is explained below
in chapter 6 in greater detail.

Another expectation of neoclassical theory is the direct relationship between
an economy’s growth and its steady-state, so that for economies below their steady-
state, those that are further from their steady-state are expected to grow more
quickly than one that is closer to its steady-state. This also suggests the question as
to whether we can expect all economies or sub-regional economies to achieve a
steady-state at the same level of real per capita income. London and the South East
up until 2008 exhibit higher levels of per-capita income, but continue to grow faster
than other regions. For an economy such as that of England if the regions are not
homogeneous in terms of economic structure this may explain the absence of
convergence to the same steady-states. If this is the case, then the addition of
conditioning variables in the regression specification will have little explanatory
power of the variation in relative growth rates. In other words, an economy such as
England may demonstrate regional specialization that gives rise to different regional steady-state solutions that persist over time.

The (global) hypothesis of absolute convergence is rejected by Barro and Sala-i-Martin (2004) when estimated and tested with a sample of 114 countries’ growth rates over the period 1960-2000. Such a result is not surprising (as the authors admit) since the condition that the countries be structurally similar is an exacting one even if only applied to the characteristics of savings behaviour, population growth and the depreciation rate of capital that narrowly define structure in this model. Further experimentation by Barro and Martin (2004) using sample sets of OECD countries provide evidence in support of the hypothesis as these groups exhibit less heterogeneity in the structural variables.

Baumol’s (1986) claim of evidence of convergence for 13 advanced countries for 1870-1979, was subsequently criticized by Romer (1986) and Delong (1988) for being based on a biased sample. However, by augmenting the dataset with less successful countries, De Long reports that the evidence supporting convergence disappears (De Long 1988). Subsequent analysis has restricted evidence of convergence to a set of successful (homogenous) countries (Dowrick and Nguyen 1989; Barro 1991; Dowrick and Gemmell 1991; Barro and Sala-i-Martin 1992; 1997; Chatterji 1992; Mankiw et al 1992; Canova and Macet 1995; Sala-i-Martin 1996). More recently, interest in estimating convergence has been directed towards new entrants into the European Union (Matkowski and Prochniak 2004; Kutan and Yigit 2004).
Evidence of convergence among national economies sharing similar characteristics and appearing to converge to a common steady-state led to the idea of club convergence (Baumol 1986). The problem with this idea is that it is judgemental as to which characteristics and what degree of correspondence is to be the test of homogeneity. Every economy is likely to differ from every other in a number of ways, making it difficult to assign countries into clubs. The empirical practice appears to be pragmatically based upon assigning countries to groups on the basis of the log of income per head (Chatterji 1992). This method is unsatisfying by its circularity; it effectively explains the degree of similarity of income per head by appealing to a measure of the same thing. Approximate club convergence in income levels and growth rates may be evident among the regions of the UK, and if Wales is a member of such a club, one of the tests of the devolution effect will be evidence of club mobility.

Conditional (beta) convergence is the term used to describe economies whose convergence experience can be described using a common set of explanatory variables (Barro 1991; Mankiw et al 1992; Barro and Sala-i-Martin 1995). All claim to have found evidence of conditional convergence using cross-country analysis. Conditional convergence is particularly appealing as a research strategy for my research as the history of the unified UK economy creates expectations of an approximate homogeneity of relevant characteristics, such as technology, polity, tax legislation and institutions. Strict homogeneity is associated with the expectation of long-run absolute convergence, but the suspicion of regional differences as might be
expected between rural and urban areas, culture, population and regional specialization (London is an extreme example of such specialization in the provision of financial services) suggest that allowances should be made for these differences in the analysis. In this respect I am diverging from the views of Barro and Sala-i-Martin (1995).

Sala-i-Martin (1994), Barro and Sala-i-Martin (1995) and Armstrong (1995) have undertaken a number of studies estimating countries’ regional convergence. These studies have led to claims of evidence of long-run absolute regional convergence of approximately 2 per cent per annum. Remarkably, Martin and Sunley (1996) report that this rate of absolute regional convergence is identical to the rate of conditional national convergence Barro and Sala-i-Martin (1995) find for large samples of developed and developing countries.

In the 1990s the method of testing for convergence using cross-country and panel regression was subjected to critical scrutiny under suspicion of Galton’s Fallacy (Friedman 1992; Quah 1993a; Bliss 1999). Specifically, papers by Quah (1993a; 1996a; 1996b; 1997) suggested that the regression methodology used to estimate evidence of convergence is flawed. The essential argument is that a sample of countries or regions of a country may exhibit beta convergence or sigma convergence over a period of time that will conceal subtle movements within the individual cases. This is demonstrated by Epstein et al (2000) using a sample of OECD economies between the years 1870 and 1992. They show that contrary to the evidence of sigma convergence derived from measuring the coefficient of variation,
analysis of individual countries using a distribution dynamics approach makes it difficult to reconcile with the Williamson (1996) claim of strong convergence in this period caused by globalization. Quah’s innovation is to analyse growth and convergence within an explicit distribution dynamics framework (Epstein et al 2000). Quah’s approach involves the identification of discrete states between which economies can move, and estimating the transition probabilities of moving between these states over time periods. This methodology offers insights into countries’ and regions’ absolute and relative convergence behaviour. However, while it helps uncover the historical data generating process, it doesn’t help us to understand the economic factors that promote or inhibit convergence in relation to the neoclassical or endogenous paradigms. However Bliss (1999) discussing claims of sigma convergence using this approach argues that estimates may be biased for reasons which have more to do with standard econometrics than with Galton.

Investigating regional growth and convergence among the members of the European Union in 1993, Cheshire and Magrini (2000) acknowledge Quah’s (1993a; 1993b; 1997) suggested approach by investigating convergence as displayed by the distribution dynamics revealed in a Markov chain approach. They introduce a methodological innovation by eschewing NUTS as their spatial units in favour of functionally defined urban regions (FURs) (Cheshire and Magrini 2000). They produce data in support of and argue that NUTS data misrepresents the spatial identification of economic behaviour because of the mismatch between many workers’ place of work and residence. It is argued that FURs are a more desirable
data unit as they are similar to US Metropolitan Statistical Areas that are more economically self-contained, but the evidence provided in support of this contention is inconclusive.

Cheshire and Magrini (2000) conclude that their results provide further evidence that the concept of beta convergence is misleading and that the estimates are unstable to changes in the model specification. Their insights from the Markov chain method suggest that variations in the regional concentration of human capital [measured by student numbers enrolled in higher and further education and the number of R & D laboratories of Fortune top 500 companies per million population] may be a significant source of divergence across the urban regions of Western Europe. Such evidence is consistent with the tenets of endogenous growth theory and in chapter 7 I test the importance of human capital in explaining the variation in growth between Wales and other UK regions.

In an ambitious study, Durlauf et al (2008), empirically test different growth theories using panel data from over 50 countries over three different time periods. They test neoclassical theory and endogenous growth theory by taking account of demography, macroeconomic policy, religion, geography, ‘linguistic fractionalisation’, inter-country tension and institutional factors as possible explanations of variations in growth. They conclude that differences in countries’ macroeconomic policies and interaction within regional groupings are better explanations of differences in their growth rates (Durlauf et al 2008).
It is surprising in this work that the authors have chosen not to incorporate into their analysis the distribution dynamics [approach] pioneered by Quah (1993; 1996; 1997) and Epstein et al (2000). Cross-country regression analysis, using panel data, invites close analysis to determine whether there has been mobility of countries between income groups that may raise uncertainty as to the true significance of the estimated dependent variables. Setting aside this problem, the results regarding the use of macroeconomic policies and the heterogeneity of regional groupings is of interest for my research. WAG policy, in terms of economic development and education, may introduce regional heterogeneity, as a means of promoting economic convergence.

Until Quah’s contributions, the prevailing consensus was to investigate growth and convergence using cross-country regressions. Evans (1996) eschews this approach as invalid in favour of analyzing the time-series properties of cross-country variances. By examining the logarithms of 51 countries’ growth rates, between 1950 and 1992, Evans concludes that there is no evidence in support of different trend growth rates. Furthermore, he concludes that either endogenous growth models are fundamentally flawed, or else the effects that they predict must be relatively unimportant for the countries considered. This analysis, by nature of its cross-country nature, may not be applicable to my intra-regional analysis, but the methodology used suggests another approach that can be used in my work to achieve a triangulation of methods. Magrini (1999) adopts a similar approach when investigating income differences between 122 Functional Urban Regions (FURs) of
the European Union for 1979-1990. He concludes that there is evidence to support the conclusion of divergence of per capita incomes and that six prominent FURs appear to be growing away from the others.

The openness of an economy is sometimes considered of importance as a driver of economic growth (Dollar 1992). For Wales, the WAG has no powers to influence Welsh trade policy, and it is effectively governed by UK central government policy. However in this respect UK trade policy is important as it delineates the opportunities available for the Welsh economy through international trade. Proudman et al (1997) undertake a cross country analysis of 108 countries’ distribution dynamics from 1970 to 1989 using Markovian analysis. They conclude that openness does have an important part to play in the convergence process. This may be an important result for a country such as Wales that has little leverage over UK trade policy; however, while acknowledging the difficulty of measuring openness, in 2006 the UK was rated sixth in an international index of economic freedom by the Wall Street Journal. However, we must entertain the possibility, and one that I investigate in Part II, that it is the importance of the openness to trade with other UK regions that is a more important issue. In the analysis I undertake I shall assume that UK trade policy does not constitute a constraint on Welsh economic development.
3.4.2 Evidence of Economic Convergence in the UK

Confounding the neoclassical theoretical expectations of convergence, the economic geography of the UK continues to coalesce into a distinct broad three-way split of economic fortune. Wales (and other under-performing regions) have continued to languish in the lower end of the regional distribution of incomes per head and growth, in spite of many post-war initiatives to influence relative regional development and achieve a greater regional economic balance.

Research on economic growth and convergence in the UK suggests that evidence supporting the hypothesis of convergence is limited. Chatterji and Dewhurst (1996) concluded that there was limited evidence of convergence between counties and regions of the UK within sub-periods of time series when the economy is in recession. Using data for 1984-93, Dewhurst (1998) found that convergence of income per head for the counties and regions of the UK tended to occur during slumps and diverged during peaks of the business cycle. Such evidence suggests that output in the more successful regions is more sensitive and able to respond to upswings in aggregate demand. McGuiness and Sheehan (1998) tested for convergence between UK regions using data for the years 1970 to 1995 and found that out of 55 pair-wise comparisons of regional economic performance there was evidence in favour of only 11 cases of convergence. Using similar time-series data Gripaios et al (2000) rejected the hypothesis of convergence in GDP per head for GB counties for the years 1977-1996. Henley (2005), investigating sub-regional growth
convergence in GB between 1977 and 1995 concluded that evidence for GDP beta convergence is at best weak.

Using conventional regression analysis, Arena et al (2000) examined evidence of conditional beta convergence between the regions of the UK for the period 1975 to 1993 and for the Virginian counties in the US between 1969 and 1996. For the UK data they explore the regional distributional dynamics and found evidence of upward mobility within an arbitrary scale of regional GDP per capita for the Northwest, Yorkshire and Humberside, the North, East Anglia, East Midlands and the Southeast. Subjecting the data to further inspection suggests a lack of [absolute] beta convergence between the United Kingdom regions over the sample period. The authors also investigate the possibility of conditional convergence generated by regional differences in real capital stock and human capital, measured by the ratio of people of working age with post-compulsory education. Their conclusion of evidence for conditional beta convergence is qualified by the reminder that it refers to different steady-state levels of real income. The role of capital and human capital in this work is relegated to less importance than the national business cycle, and policy makers are counselled that the regional problem is perhaps best tackled by reducing the amplitude of the national business cycle rather than by specific regional policies. This conclusion is unfortunate for WAG and other poorly performing regions, as it denies them the possibility of making a significant change to their economic performance through the powers at their disposal.
3.5 Spatial Analysis of Regional Economic Behaviour

There is no reason, in principle, to harbour expectations of the proximate equality of economic development between regions and sub-regions. In a state of nature, economic development will be influenced by the spatial distribution of natural resources and spatial advantage. The qualitative nature of an economy’s evolving production function over time will begin strongly rooted to the attributes of spatial location and become less rooted to place as technological change and the clustering of human settlement become more important as factors of attraction and inertia.

Neoclassical theory avoids engaging the complexity that this introduces. The complexity arises by acknowledging inter-regional linkages that make regions’ economies sensitive to changes in activity outside of their own regional boundaries. This becomes apparent when conducting regional multiplier analysis or exploring input-output analysis (Armstrong and Taylor 2000).

Spatial analysis introduces explicit recognition of the advantages or disadvantages that geography, topology and spatial location can bestow upon a region. Consequently, regional economic differentiation can be expected to arise naturally, and can be explained within an economy partly by the time-varying advantage bestowed from the availability of some resource(s), such as mineral deposits or the strategic spatial advantage offered by a transport node. Extending this idea to the possibility of regional specialization on account of some comparative advantage also suggests the idea of regional inter-relations and dependency. Even so, in their work, Barro and Sala-i-Martin (2004) argue that
within a country, for regions with a common central government, absolute convergence is more likely to apply across regions. This expectation is conditional upon relative homogeneity, to ensure sufficient similarity between regions in terms of economic fundamentals such as industrial structure, productivity, investment and consumption characteristics. In an economy with a centralized polity, with identifiable and differentiated regions in which there are no institutional barriers to the mobility of resources, it is expected that, ceteris paribus, economic growth across regions will converge to the same approximate absolute level of growth. This may be considered simplistic by restricting the analysis to the neoclassical paradigm, but a spatial perspective does not necessarily suggest the implicit non-clustering of regional economic activity that is characteristic of neo-classicism (Armstrong and Taylor 2000). Hence there is a contradiction between the implications of the neoclassical model, that are strictly spatial-free, and the reality of regional economic heterogeneity.

Investigation of convergence between European regions has been undertaken by Fingleton and MacCombie (1998), Vaya et al (2000), Ertur et al (2006) and Badinger et al (2004) who all claim to have found evidence of spatial dependence. Spatial correlation has also been claimed to exist between US states (Rey and Montouri 1999). In other words there is evidence in support of the idea that regions are not economically independent and that a region’s growth is influenced by that of its neighbours leading to complex multiplier feedback mechanisms between regional neighbours.
Spatial effects can occur for a number of reasons as a consequence of economic relations between spatially distributed regions (Fingleton 2003: 44):

1. Regions that are contiguous or are not separated by restrictive travelling distances may be the origin or destination of sizeable commuting working populations;

2. Some regions may be the source of raw materials for other regions;

3. By virtue of relative income and population, regions may be more attractive destinations for final goods and services.

For whatever reasons regions engage in trade with one another, the comparative advantage enjoyed by regions will be affected by distance as it affects the cost of trade, so that we might expect regions that are closer to have developed more extensive trading links than regions that are further apart.

Regional convergence in the UK was investigated by McGuinness and Sheehan (1998) using cointegration analysis applied to real per capita output of 13 UK regions between 1970 and 1996. The authors do not make clear why this methodology is considered appropriate for the task, but claim to have estimated evidence of significant [pairwise] convergence in only eleven cases, namely, East Midlands and the North, East Midlands and Yorkshire and Humberside; the South West and Yorkshire and Humberside; Wales and the North, Wales and Yorkshire Humberside; Scotland and the South West, Scotland and the North West; and Northern Ireland and the South West (McGuinness and Sheehan 1998). The authors remark that these results are very difficult to interpret in relation to the distribution of regional industry. They fail to consider the tantalizing possible evidence of
spatial dependence between the adjoining regions of Scotland and the North West and between East Midlands and Yorkshire and Humberside.

Arena *et al* (2000) investigate the tendency for regional economies to converge using data for the UK between 1975 and 1993. They note that if we lived in a world that behaved consistent with neoclassical expectations, regional convergence would take place and there would be no requirement for regional policy. Using Barro’s (1991) regression approach, augmented to test for the effects of real and human capital (in other words, in the spirit of endogenous growth theory), they claim that there is evidence of conditional $\beta$ convergence of real GDP per capita over the past 20 years. The authors then make a statement that is highly pertinent to my study. Remembering that this period predates devolution, they remark that it is important to emphasize that this does not imply that real regional income will converge on the same value but, rather, that there will be convergence to different steady-state levels of real income. In other words, conditional convergence is equivalent to sustained differences in the levels of regional incomes per head (Arena *et al* 2000).

Analysis of such effects can be undertaken in a number of ways including spatial econometric models that introduce a spatial weights matrix to estimate some metric of spatial association through models involving a spatial lag; investigating cross-regressive regional characteristics or by modelling using a spatial error (Le Gallo *et al* 2003). I explain this in more detail in chapter 7 where I specify and estimate a spatial model as part of my empirical analysis.
Another approach to estimating spatial effects is offered by the economic gravity model (Tinbergen 1962; Poyhonen 1963; Anderson 1979; Brun et al 2005). It was first suggested by Tinbergen (1962) and inspired by Newton’s law of gravity as an analogy for relative trade flows between countries. The essential idea is that bilateral trade is related to economic gravity (where economic size is measured by GVA) and economic distance measured by cost. The model has the merit of being intuitively appealing and testable by virtue of plentiful data, even though it has been criticized on account of its questionable theoretical basis (Anderson 1979). Exploration and use of the gravity model has been confined to the analysis of international trade; it may be suitable for experimental regional research but owing to the absence of sound theory, it will not be undertaken as part of this work.

3.6 Fiscal Decentralization and the Question of Space

There is little published literature that investigates the relationship between devolution and economic growth convergence (a similar observation is made by Arena et al (2000) who note the paucity of research on regional divergence or convergence). However, the terms devolution and decentralization are sometimes used interchangeably, and the typical methodology employed in its investigation is to use a panel data set of a number of countries to estimate the relationship between growth and some measure of fiscal decentralization, using some conditioning variables to capture other effects. The employment of panel data methods is warranted because the use of cross-section data estimates the effect of cross-
regional variations in fiscal policy and their effect on growth. However, these effects are likely to be dynamic: the initial change may have an immediate step-change effect on growth and result in changes in the pattern of cyclical growth and the underlying sustainable secular growth.

More recently, McGregor and Swales (2005) admit to restricting their analysis to provide a non-technical account of some of the recent research that is relevant to the economics of devolution/decentralization in the UK. There is however a considerable literature focusing upon investigating economic performance and convergence that may be associated with fiscal decentralization. Much of this literature is concerned with the analysis of other countries and it is hazardous drawing conclusions from studying the effects of fiscal decentralization in one country and suggesting that they may be valid for another. The cross-country variance in cultural characteristics and institutions may render a fiscal or political model unsuitable for transplanting. Nevertheless it is instructive to undertake such research in other countries, to determine if there is any commonality of experience that suggests universal generalizations concerning the efficacy of fiscal decentralization for economic performance.

Freinkman and Yossifov (1999) investigated the effect of fiscal decentralization on 89 Russian regional budgets between the years 1992 and 1996 employing panel data. Using the ratio of local government revenues to consolidated regional budget revenues and a similar ratio employing expenditures, they claim to have found evidence that decentralization has a positive effect upon growth but
also that it is associated with weaker fiscal control in decentralized regions.

Specifically, they claim to have found evidence that:

The analysis provides quite robust and statistically significant estimates of the impact of decentralization on fiscal and economic performance. In particular, when we control for other social variables such as real per capita income, fiscal decentralization is positively related to the share of education spending in regional consolidated budgets. Regions with more decentralized finances tend to have a lower economic decline. These results seems [sic] to be fully consistent with conventional predictions of the decentralization theory that underline potential positive growth impact of decentralization. (Freinkman and Yossifov 1999: 42)

In this particular study the authors omit potentially key variables of interest such as geography and industry structure and do not investigate the possibility of bias arising from the distributional dynamics. Nevertheless it does represent support for the supposed efficacy of decentralization in encouraging education expenditure in support of human capital benefits.

Davoodi and Zou (1998) test such hypotheses by using ordinary least squares regression analysis for a number of countries. They measure the degree of fiscal decentralization as the spending by sub-national governments as a fraction of total government spending (Davoodi and Zou 1998). Their data set spans the period from 1970 to 1989 and includes 46 countries that are identified as developed or developing and they conclude that there is evidence to clearly reject the hypothesis of a positive relationship between fiscal decentralization and growth.
Xie et al (1999) test the importance of FD for the U.S. economy between 1948 and 1994 using the sub-national governments’ share of federal government spending and conclude that the evidence suggest that further FD may be harmful for the United States. A similar conclusion emerges from a study by Lall and Yilmaz (2000). Using a dataset of US States between 1969 and 1995 they employ a spatial econometric approach to investigate regional growth performance in relation to public capital or infrastructure and human capital as measured by the percent of each state’s population that had completed four or more years of college. They conclude that there was no evidence to suggest that these policy variables contribute to increasing the speed of convergence, once regional and temporal factors are considered (Lall and Yilmaz 2000).

Fiscal decentralization or devolution within a region notionally confines that region’s economic policy to a prescribed geographical area. However, a common economic history that is shared by the regions of a country is likely to mean that there will be a legacy of infrastructure and trading relations that will endure after the political separation occurs. The spatial memory will persist after devolution which means that economic devolution will not necessarily occur with political devolution as the initial conditions after devolution continue to reflect the disadvantage that was current before devolution. If devolution has a muted effect upon regional trading relations then the economic performance of the devolved regions will continue to depend upon the economic performance of other regions. Additionally, the proximity of regions may be of importance in creating synergy in
processes or products, and complementarity in final markets. Furthermore, a global economy (or nation-state) can be described as more than the sum of its regions in explaining dynamic growth, as synergy may result from the shared integrated infrastructure and complex inter-regional flows of production and consumption. Consequently, regional analysis lends itself for spatial investigation to determine how important a region’s absolute placement and relative placement to other regions is in explaining its economic performance.

It was noted elsewhere that Welsh economic performance, by any conventional measure, has fallen behind that of the UK average and a potential explanation of this persistent behaviour may be that it is an indication of conditional beta convergence. With its available real and human capital perhaps this is the best that Wales was able to achieve given the strong inter-linkages and high expenditure leakages that are indicated in the regional input-output coefficients estimated in Allen et al (2004). This suggests the tentative hypothesis that Welsh poor performance is a manifestation of convergence to a different steady-state level of income per head than those of other UK regions. Furthermore, the maintenance of different steady-state levels of income between Wales and the UK may be explained by differences in the real capital stock and/or the human capital stock. This discussion has implicitly assumed the existence of regional inter-linkages within the UK. The following section introduces evidence supporting this assumption.
3.7 Input-Output Evidence of a Spatial Lag between the Nations of the UK

Input-output analysis of a single economy identifies and quantifies the linkages between different parts of the economy. Regional income-output models extend this analysis by identifying the regional locations of industry and quantifying the different economic flows between industry and region. The significance of this for the present work is that it permits estimates of regional output multipliers that quantify the propagation of economic change through industry and regions resulting from an exogenous change anywhere in the country. Evidence of regional output multipliers indicate spatial dependence where economic values in one area depend on values in neighbouring areas and is consistent with the theoretical expectation of spatial externalities causing neighbourhood effects. This can be interpreted as spatial correlation in economic activity and confirmation of its presence suggests the use of a spatial lag modelling strategy that accounts for spatial correlation in the dependent variable of an econometric specification (Fischer and Wang 2011).

Ideally I would pursue evidence of spatial association by investigating both inter-regional and inter-industry linkages within the UK. This would permit us to identify spurious associations between industries and regions that arise on account of the common trending of data that may obscure evidence of economic linkages. Unfortunately the experimental regional input-output tables that are available do not go down to this level of disaggregation and I can only refer to and discuss the

However, a considerable amount of work has been undertaken to investigate the expenditure impacts of Higher Education Institutions (HEIs) and their students on regional economies. The impact of Scottish HEIs has been investigated by Blake and McDowell (1967), Brownrigg (1973), Battu et al (1978), Kelly et al (2004) and Hermannsson et al (2010a). The investigation of the impact of HEIs in Wales was undertaken by Hill (1997) and more recently by Hermannsson et al (2010b). The significance of the most recent Welsh study for this thesis is that it estimates the expenditure impact of Welsh HEIs in 2006 was 2.33% of GDP (Hermannsson et al 2010b: Table 2). This estimate represents type II multipliers across Welsh HEIs within the range 1.99-2.03 that take account of the combined effect on intermediate inputs and household consumption (Hermannsson et al 2010a: 13). However, Welsh HEIs are partly funded by the Welsh Government that may change in the future, so a more accurate estimate of the impact of Welsh HEIs on the Welsh economy is achieved by deducting Welsh Government funding from the expenditure impact of each Welsh HEI (Hermannsson et al 2010b: 18). This exercise derives the balanced budget multiplier net of Barnett-funding and reduces the estimated impact of the HEIs (the balanced budget multiplier) to the range 0.31-0.81. This range of estimates represents the institutional component of the multiplier to which must be added the student consumption component. Once the two components are added the range of the balanced expenditure multiplier of the 12 Welsh HEIs is 0.7-2.2, although 10 of
the 12 institutions lie within the range 1.1-1.6. This insight has implications for the empirical analysis that is undertaken below as the estimates of GVA that are used in the analysis reflect the expenditure impact of the HEIs in all UK regions and makes it difficult to separate out the effect of educational achievement on variations in GVA.

Table 3.2 below presents estimated output-multipliers for the UK territories in 1999. The cell contents represent estimates of the amount of output, in each sector, generated by each £1 of final demand, where Type I multipliers estimate only the direct effects and Type II multipliers include induced effects from (say) further household expenditure. In general, the values of a multiplier are an indication of the leakages out of that territory’s circular flow of income. In a closed economy, which did not trade with other nations, the value of the leakages would be determined only by the tax rate and savings ratio (Allen et al 2004). Comparing the multipliers between UK territories that have common tax rates, the variations in the multipliers are explained by savings behaviour and inter-regional trade.

National Savings and Investments (NS&I 4 December 2009) report that on the basis of five years of its Saving Survey data there is little evidence of significant differences in regional savings behaviour. For example, the range of the average percentage of monthly take-home income saved by regions in 2009 was between 5.51% (the South East) and 6.37% (Scotland); in Wales the percentage of after-tax income saved in 2009 was 6.16%, which suggests that savings behaviour does not contribute significantly to leakages out of the Welsh economy, compared with other
regions. Nevertheless, it is interesting to note that any discrepancy between savings by regions and the subsequent recycling of savings could represent a source of regional divergence. The implication is that, personal savings by households in regions with below average house prices may be financing house price inflation in regions with higher house prices. Insofar as consumer demand may be driven partly by housing sales through wealth effects, the variation in regional housing markets may be a source of regional economic variation (Boone and Girouard 2002; Benito et al 2006). Nevertheless, it will be assumed that leakages arising from inter-regional trade are the main factors explaining variations in country multipliers.

Other things remaining equal, it is also assumed that the more a regional economy is self-sufficient the higher will be the income multipliers, as leakages by way of imports, out of the regional circular flow are reduced. I also assume that the greater the density of population and industry (representing potential economies of agglomeration), the greater will be the incentive for further indigenous development that will be encouraged by the profit motive and the possibility of achieving economies of scale. Population density can work to both enhance and diminish growth prospects by encouraging in-flows of labour and capital. The population density will increase until congestion externalities are experienced that incur costs for residents and migrants and will consequently reduce the attraction of the region. As a result, the propagation of growth may be a self-fulfilling prophecy as income and wealth encourages more income and wealth until some critical tipping-point when negative externalities and regional price disparities begin to
erode a region’s attractiveness to new entrants. This phenomenon may be an
explanation for the persistent growth of London and the South East, although
labour shortages and high house price differentials in these regions compared with
other regions, may signal the approach of such a tipping-point.

Table 3.2 reproduces estimates of UK territorial multipliers for each
industrial sector for the year 1999 derived from Allen et al (2004); these values are
consistent with the above expectation. Without exception the multipliers for the
regions of England exceed those of Scotland and Wales, and this applies to Type I
and Type II multipliers. Additionally, with a couple of exceptions the Welsh
multipliers are lower than those of Scotland. The two exceptions are for
manufacturing and wholesale and retail in which the Welsh figures exceed those of
Scotland by a small amount. In general the Welsh multipliers are the lowest,
suggesting perhaps that in the year in which these figures were collected, the
structure of the Welsh economy could not prevent rapid leakages of expenditure to
other parts of the UK.
**Table 3.2 Single Region Type I and Type II Output Multipliers for Scotland Wales and the Rest of the UK (RUK), 1999.**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Scotland Type I</th>
<th>Scotland Type II</th>
<th>Wales Type I</th>
<th>Wales Type II</th>
<th>RUK Type I</th>
<th>RUK Type II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary &amp; utilities</td>
<td>1.741</td>
<td>2.128</td>
<td>1.299</td>
<td>1.556</td>
<td>1.767</td>
<td>2.495</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1.311</td>
<td>1.634</td>
<td>1.338</td>
<td>1.750</td>
<td>1.718</td>
<td>3.033</td>
</tr>
<tr>
<td>Construction</td>
<td>1.865</td>
<td>2.389</td>
<td>1.503</td>
<td>1.929</td>
<td>2.024</td>
<td>3.218</td>
</tr>
<tr>
<td>Wholesale &amp; retail</td>
<td>1.295</td>
<td>1.798</td>
<td>1.308</td>
<td>1.820</td>
<td>1.742</td>
<td>3.179</td>
</tr>
<tr>
<td>Transport &amp; communication</td>
<td>1.657</td>
<td>2.220</td>
<td>1.308</td>
<td>1.855</td>
<td>1.753</td>
<td>3.136</td>
</tr>
<tr>
<td>Financial</td>
<td>1.484</td>
<td>1.901</td>
<td>1.252</td>
<td>1.623</td>
<td>1.706</td>
<td>2.883</td>
</tr>
<tr>
<td>Public admin., educ., health &amp; social work</td>
<td>1.517</td>
<td>2.258</td>
<td>1.368</td>
<td>2.088</td>
<td>1.658</td>
<td>3.454</td>
</tr>
<tr>
<td>Other services</td>
<td>1.638</td>
<td>2.194</td>
<td>1.405</td>
<td>1.975</td>
<td>1.680</td>
<td>3.061</td>
</tr>
</tbody>
</table>

*Source: Allen et al 2004: Table 8.*

The output multipliers provide an insight into the structure and sectors of the economy of each individual region. Analysis of the estimates of the inter-regional output multipliers can provide an indication of the economic linkages between them.

Estimates of inter-regional shock coefficients for each sector of the economy are reproduced below in Table 3.3 based on 1999 data and presented as Social Accounting Matrix (SAM) type II multipliers. SAM multipliers are distinguished from input-output multipliers by encompassing all ‘transactions and transfers.
between all economic agents in the system’ (Allen et al 2004: 11). The designation Type II indicates that the multipliers take account of direct, indirect and the induced effects of ‘changes in the expenditure by workers employed in the sectors experiencing the exogenous demand change are included’ (Allen et al 2004: 20).

**Table 3.3 SAM Type II Inter-Regional Output Multipliers for Scotland Wales and RUK 1999 £million output per £million output. (Originating region named first)**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Scot/Wales</th>
<th>Scot/RUK</th>
<th>Wales/Scot</th>
<th>Wales/RUK</th>
<th>RUK/Scot</th>
<th>RUK/Wales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary &amp; utilities</td>
<td>0.038</td>
<td>0.837</td>
<td>0.140</td>
<td>1.237</td>
<td>0.078</td>
<td>0.045</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.046</td>
<td>0.921</td>
<td>0.089</td>
<td>1.011</td>
<td>0.069</td>
<td>0.046</td>
</tr>
<tr>
<td>Construction</td>
<td>0.044</td>
<td>0.904</td>
<td>0.101</td>
<td>1.14</td>
<td>0.064</td>
<td>0.043</td>
</tr>
<tr>
<td>Wholesale &amp; retail</td>
<td>0.037</td>
<td>0.773</td>
<td>0.086</td>
<td>1.024</td>
<td>0.065</td>
<td>0.034</td>
</tr>
<tr>
<td>Transport &amp; communication</td>
<td>0.039</td>
<td>0.841</td>
<td>0.089</td>
<td>1.054</td>
<td>0.065</td>
<td>0.031</td>
</tr>
<tr>
<td>Financial intermediation &amp; business</td>
<td>0.034</td>
<td>0.802</td>
<td>0.078</td>
<td>0.962</td>
<td>0.055</td>
<td>0.027</td>
</tr>
<tr>
<td>Public admin, educ., health &amp; social work</td>
<td>0.042</td>
<td>0.847</td>
<td>0.087</td>
<td>0.999</td>
<td>0.054</td>
<td>0.032</td>
</tr>
<tr>
<td>Other services</td>
<td>0.033</td>
<td>0.721</td>
<td>0.075</td>
<td>0.894</td>
<td>0.059</td>
<td>0.030</td>
</tr>
</tbody>
</table>

*Source: Allen et al (2004: Table 15).*

A number in a cell indicates an estimate, based on 1999 data, of how the change in output in a sector in one region affects the same sector in another region. For example a £1 million change in the manufacturing sector in Scotland gives rise to a multiplier of 0.046 for the manufacturing sector in Wales, or a change in output of £46,000. Comparing the Scottish/Wales column and Wales/Scottish column is
instructive as it is the only numerical comparison between individual regions that can be made at this level of disaggregation.

Depending upon the accuracy of the data, it reveals the disproportionate effects arising out of a regional imbalance in industrial sectors. The multipliers are reflective of the extent of leakages from one region’s sectors into another region’s corresponding sectors. A region with a more comprehensive industrial structure will contain the multiplier effects of economic transactions for a longer period of time, and this will be manifest in higher own-multipliers. The columns reveal that without exception the sector multipliers for Wales/Scotland exceed those of Scotland/Wales so that, for example, a £1 million change in output or expenditure in public administration in Wales will leak out to increase Scottish output by £87,000 while a similar change in Scotland will give rise to a £42,000 change in Wales.

Turning to the relationship between RUK and Wales, the aggregation of English regions reveals a greater contrast. The effect of an exogenous £1 million change in any Welsh sector on the RUK never drops below £894,000 and for the primary and utilities sector, it rises to £1.237 million. However, the benefit to Wales of an exogenous £1 million in RUK does not exceed £46,000. This may not be surprising as we might expect larger regions to develop greater self-sufficiency in providing for their own populations. Larger markets, in principle, provide greater incentives of expected profitability and economies of scale and may become part of a virtuous cycle as growth encourages more immigrants from other regions and the consequent additional economic activity.
These figures are a reminder of the distinction between a political jurisdiction and an economic area. In an open economy like that of the UK, the spatial configuration of economic activity does not neatly correspond with the regional boundaries, so that relative flows of income and expenditure are more likely to reflect the spatial distribution of capital and labour. Specifically for Wales, the granting of political devolution will not necessarily erase the economic linkages with other regions that were developed in earlier years.

The extent of leakages between the UK territories is also an indication of the extent of their inter-relation and a dependence that is embedded in the UK national economy. It also gives an insight into how autonomous shocks in a single territory or the UK as a whole will propagate throughout the economy. For Wales, comparing bilateral multipliers with Scotland and RUK reveals that the Welsh multipliers are consistently lower than those for Scotland and the RUK. In other words, while Wales benefits from growth in the other territories it does so to a much lesser extent than the other regions benefit from growth in Wales. The estimates of regional multipliers have significance for the exploration of regional convergence. The present relative position of Wales among UK regions in terms of GVA per head suggests that Wales must grow faster than the UK average growth rate to achieve convergence. The regional multipliers shown above suggest that increases in the output per head of UK regions may result in a net negative regional multiplier across all industrial sectors. Assuming a continuation of this pattern of
inter-regional trade indicates that convergence of income per head will continue to be difficult to achieve.

Regrettably, data is not yet available to further disaggregate this analysis to the NUTS 3 level of disaggregation for inclusion in the econometric analysis that follows. However, the significance of this data is that it represents evidence in favour of the expectation of spatial linkages in economic activity at the country level and by extension at the NUTS 3 level. Consequently the input-output evidence presents evidence of spatial externalities that guides my choice of a modelling strategy using a spatial lag that accounts for spatial dependence in the dependent variable. I continue in Part II by augmenting the analysis to take account of spatial inter-dependence and investigate Welsh economic performance relative to other UK regions after taking explicit account of possible regional interaction. It can be concluded that the extent of inter-regional trade and the resulting multipliers indicate evidence of patterns of economic activity that have implications for regional convergence. Consequently, in chapter 6 I report estimates of beta convergence that explicitly model spatial spillover using a spatial lag.

3.8 Theoretical Expectations for Policy
The structural assumptions required to ensure the achievement of Pareto optimality in a competitive economy are unlikely to occur or ensure that all regions of an economy can optimize their economic performance. Economic sub-optimality provides a role for policy-makers to intervene by attempting to reallocate resources
to achieve a more desirable outcome (see for example, Arrow 1951; Hart 1975). It was previously argued that the expected benefits of devolution are derived from the predictions of the theories of fiscal decentralization and endogenous growth and that there is scant evidence of naturally occurring regional economic convergence without some policy intervention.

Devolution is commonly understood to mean the decentralization of governance and Musgrave (1959) portrays the functions of government as having three roles: stabilization, resource allocation and distribution that may then change as the consequence of decentralization. The Welsh model of devolution does not neatly transfer these roles to WAG as the role of macroeconomic stabilization remains with Westminster while the other roles are imperfectly transferred owing to the block-grant financing that is divorced from local tax-raising.

Nevertheless, devolution that falls short of total independence may still offer a territory such as Wales substantial allocative influence since it has control over a budget of some £14.68 billion in 2011-12 (Welsh Assembly Government) Such fiscal influence may serve as a tool for policy-intervention, even if it does not permit the exercise of macroeconomic policy and the provision of pure public goods. Consequently, the absence of powers to exercise overt macroeconomic policy does not preclude the possibility that allocative and distributive decisions taken by a devolved government may result in unexpected macroeconomic results. After all, WAG and the Scottish Parliament perceive devolution as an opportunity to improve their economic performance and hence this could have consequences for
the UK in terms of economic growth, inflationary pressure and tax receipts. Welsh devolution restricts the influence of government to fiscal decentralization and secondary legislation and provides WAG with the ability to impose its own influence upon the policy instruments of economic development. These policy instruments are largely unchanged from those that were inherited in 1999, but the difference is that they are being manipulated by local representatives elected solely by a Welsh electorate. It is this change that is central to the expectation that localism can produce better outcomes than centralized government and was discussed in chapter 2.

The instruments available for regional policy intervention are suggested by the theory of the production function that was discussed above. Output growth and productivity growth can be influenced by changes in the quantity and productivity of capital utilized (Stiroh 2001). The concept of capital used here is inclusive of physical and human, public and private, and technological change and information technology that may enhance productivity. Capital that originates in the public sector may not be directly associated with economic output that is captured in official measures of GDP/GVA, but may still contribute indirectly through its influence on the economic environment that affects the propensity of the workforce to learn and work and firms to invest (Hall and Jones 1999).

Endogenous growth theory accords a key role to government for the formulation of policy strategy and its implementation. But its effectiveness may be further improved through the possible benefits of collaborative behaviour between
the principal economic agents who have the ability to influence the key drivers of growth. The term ‘triple helix’ has been used to refer to the potential collaboration between government, industry and education (Etzkowitz and Leyesdorff 2000). However, as we saw in chapter 2, government intervention is not a guarantee of success owing to the possibility of government failure (Le Grand 1991; Cullis and Jones 1998; Gwartney et al 1998).

One of the desired outcomes of such collaboration is the production of new knowledge that offers opportunities for stimulating entrepreneurial activity (Acs et al 2004). Universities are regarded as particularly important in the process of creating new knowledge through research and encouraging and facilitating its use by business and society (Roper 2004; Benneworth and Hospers 2007; Pickernell et al 2008; Pickernell et al 2009; Malecki 2010). Universities’ knowledge creation cannot be regarded as a universal panacea for regional development as the potential for a positive result will depend upon the extent to which knowledge transfer can occur and a region’s industry can absorb the new ideas (Roper et al 2007).

However, where domestic policy intervention is considered to be inadequate, policy-makers may attempt to accelerate the process of economic development by seeking to attract investors from abroad through foreign direct investment (FDI). The attraction of FDI lies in the potential for employment generation and the possibility of positive externalities through knowledge spillover of technology that may not yet have become embedded in the economy. However the success of such policy is not guaranteed if there are impediments to the
diffusion of information or the ability of the domestic economy to absorb new technology (Acs et al 2007; Blomstrom and Kokko 2003).

Further evidence of the significance of growth theory for policy can be found in Boddy’s (2006) recent analysis that identifies variations in the capital stock, industrial structure and educational qualifications as accounting for half of the differences in productivity between Wales and London. These categories correspond with the theoretical factors discussed above and provide a further justification for the research strategy that follows below. However, his analysis was unable to account for nearly 20% of the difference that could be interpreted as TFP that we discussed in the previous chapter.

This brief reprise of the theoretical underpinnings of regional development suggests that regional economic development policy is likely to focus upon interventions that stimulate the quantity and productivity of the physical capital stock and the productivity of human capital. The implicit justification for devolution is its expected potency in the framing of local policy to achieve these outcomes. Devolution in Wales provides the administrative decentralization to exploit local knowledge to direct resources that will enhance the industrial structure, improve the productivity of the workforce and encourage entrepreneurship. In chapter 4 I will address each of these elements in turn and discuss their significance as an expression of Welsh economic policy.
3.9 Conclusion

The theory of decentralization that was discussed in the previous chapter identified potential benefits for economic development. The assumed benefits are derived from devolving power to local representatives who are expected to make more effective resource allocation decisions. Such an expectation is consistent with the tenets of endogenous growth theory and in particular with the suggestion that economic growth can be influenced by varying the structural characteristics of the economy.

Nevertheless, the search for robust empirical evidence of convergence between nations and regions is unresolved in spite of the significant effort that has been expended (Barro 1996; Barro and Sala-i-Martin 1991, 2004). The research methods employed have to be sensitive to the differences between economies’ stage of development and also to a large number of potential catalysts of development, and this is accommodated by the different variants of the convergence concept. Countries are more likely to differ in their structural characteristics than the regions of a single country and consequently, a stronger form of conditional convergence is more likely for the former. There is little evidence supporting the idea of unconditional convergence between nations in general or with respect to the regions of the UK. Variations between regions’ structural conditions may lead to them converging to different steady-state growth rates and explain the apparent emergence of convergence clubs (Alexiadis and Tomkins 2004). The existence of such clubs has profound implications as it means that some regions are unable to
accelerate their economic growth rates to catch up with the wealthier regions. This implies that to achieve a higher equilibrium growth rate requires pro-active intervention to change the region’s structural characteristics. Club behaviour may also have a geographic dimension through the possibility of spatial autocorrelation between the regions who are members of each club. In other words, the geographical proximity or past trade links between one region and another may be associated with economic inter-dependence and could be part of the explanation of regions’ conjoined economic growth trajectories.

The achievement of regional economic convergence based upon the ideas of endogenous growth theory is partly conditional upon technological and political convergence to achieve proximate regional economic homogeneity. Convergence in this sense does not mean that regions should be identical, but only that their chosen development path will provide similar growth potential as other regions. Devolution cannot rapidly change the initial conditions that represent the starting point for the devolved region’s growth trajectory. However, the new devolved government may identify and influence the structural characteristics that underpin that region’s economic growth. It may then be able to facilitate a higher steady-state growth path than the region was able to achieve under the previous unified governance and devolution may then result in the convergence between regions.

Often the structural conditions that are thought to be instrumental in enhancing growth prospects are associated with a region’s physical capital and human capital. Together they contribute to reducing differences in capital: output
ratios and permit poorer regions to benefit during the upturn of the business cycle when aggregate demand is increasing. To the extent that devolution may permit and empower a region to improve its economic structure the presumption must be that devolution introduces a greater possibility of growth convergence.

Serious doubts concerning the validity of estimating convergence from cross-regional or cross-country regressions have also been introduced by Quah and others. This has led to the introduction of non-parametric methods involving the investigation of convergence by examining regions’ propensity to change position within cross-regional distributions. This analysis is accomplished using the method of Markovian analysis of transitional probabilities used to measure regions’ or countries’ persistence and probability of change within an ordering. However such analysis has so far proven to be sterile in illuminating our understanding of the process of growth and convergence.

In the next chapter I discuss the evolution of Welsh economic policy and how WAG has sought to realise its aims to promote Welsh economic development.
Chapter 4

Economic Policy for a Semi-Autonomous Wales

4.1 Introduction

The evidence presented in chapter 2 suggests that Welsh economic performance relative to other UK regions has been disappointing for much of the last century. My discussion of economic theory in chapter 3 revealed that decentralisation and devolution are expected to contribute to regional economic development and economic convergence. The expectation of improved economic performance is based on the opportunities for the application of WAG economic policy to stimulate economic development. A comprehensive understanding of the empirical analysis undertaken in Part II requires a discussion of WAG policy: firstly, to investigate if there is evidence that the nature of Welsh economic policy has changed since Devolution and secondly, to analyse Welsh economic development for evidence that policy has contributed to changing economic performance. The first question is considered in this chapter, Part II of this research is devoted to considering the second question.

This chapter presents an analysis of WAG policy-making that is undertaken to inform the empirical investigation that follows in Part II. We shall see in the discussion that follows that the policy instruments available to the WAG to influence Welsh economic development are for the most part the
same as those that were available before Devolution. In part, this can be
explained in terms of the idea of the ‘hollowing out’ of the state (Jessop 2002).
‘Hollowing out’ can be understood as ‘the transfer of some functions upwards
to supra-national institutions and downwards to local and regional agencies,
including devolved governments’ (Shaw and MacKinnon 2011). This means
that the National Assembly of Wales and the Scottish Parliament can be
understood as the consequences of the process of the ‘hollowing out’ of the UK
government and are the inheritors of regional development policy tools that
were previously used by Westminster. However, as I shall explain below, these
same processes have a limiting effect upon the exercise of policy-making in a
devolved Wales that is constrained by the UK Devolution settlement and by the
supra-national influence of the EU. The potent mix of the devolution
arrangements, UK regional policy and EU regional policy may have provided
policy continuity irrespective of whether Wales has been administered from
Westminster or Cardiff Bay. However, it also suggests that independent Welsh
economic policy may not yet exist in a real sense and may be more properly
described as the continuing administration of economic policy that is
unchanged in terms of its themes and application when compared with policy
before Devolution. Nevertheless, it is argued that there is a qualitative
difference between the same policies depending upon whether they were
undertaken by the Welsh Office (WO) or by the WAG that is explained by the
idea of ‘filling in’ and is discussed below (Jones et al 2005). This chapter asserts
that the complexity presented by the many strands of Welsh policy promoting economic development, and the apparent inconsistency of expecting change using the same policy tools can be understood by the use of the concepts of ‘hollowing out’ and ‘filling in’.

This chapter is organised as follows: in the next section I discuss the policy tools used by the UK government to promote regional development in Wales. In section 4.3 I identify and analyse the constraints imposed by the Devolution financing arrangements and European Union policy to the formulation and application of WAG policy that limit WAGs room for manoeuvre. Section 4.4 explores the evolution of policy before and after Devolution to consider if change has occurred. This theme is further developed in the following section by discussing WAG policy since Devolution. Amongst items dominating WAG spending choices, spending on economic development and on education are particularly relevant to the themes of this thesis and so form the focus of some specific analysis in section 4.5. In section 4.6 I conclude my argument that the ideas of hollowing out and filling in explain how WAG economic policy derives its distinctive character and effectiveness.

4.2 National Aspiration and UK Regional Policy
The research questions posed in chapter 1 suggest a fundamental question facing researchers of UK regional development policy. In the context of devolution why should we expect the application of the same policy
instruments to be more effective after Devolution than before it? To answer this question we can invoke the concept of the ‘hollowing out’ of the state that has been advanced by Jessop (2002) to describe the process of the transfer of some state activities to super-national and sub-national authorities. For Wales the super-national availability of EU development aid has been a significant resource and is discussed in detail below. At the UK sub-national level, the establishment of the Welsh Office (WO) before Devolution can be interpreted as the beginning of the process of transferring the governance of Wales from Westminster to Cardiff Bay. This process is on-going and involves the election of decision-makers who are, theoretically, more in tune with the problems and diagnosis of Welsh society. These developments are associated with the concept and potential benefits of decentralisation that were discussed in chapter 3 and can be augmented by the ideas of ‘filling in’ (Jones et al 2005). ‘Filling in’ describes the process of replacing decision-making and resource allocation of the sovereign state by sub-national governance. Hence the ideas of ‘hollowing out’ and ‘filling in’ provide a possible solution to the conundrum as to how Devolution can be expected to make a difference to the application of similar policy instruments in the pursuit of regional economic development either side of Devolution.

Welsh Devolution in 1999 marks a step-change in the approach to Welsh economic policy, for reasons that will be explained below, Devolution is frequently described as a process and not an event, suggesting that it is a
dynamic evolutionary process (Davis 1999). Welsh economic development is crucially influenced by regional policy devised in London, which has shaped and continues to influence Welsh economic policy before and since Devolution. UK economic policy and its approach to regional development have changed over time and are manifest in different forms of intervention (Pike et al 2012). Furthermore many other factors can be identified as influential for the Welsh economy before 1999, including the activity of the WO in its role of furthering Welsh interests and UK membership of the EU. These interventions are largely responsible for shaping the Welsh economy that WAG inherited and, as we shall see, continue to be influential as policy instruments in the post-Devolution period. Indeed, very recently the Welsh Affairs Committee at Westminster undertook an inquiry into inward investment in Wales (Welsh Affairs Committee 2012). It is a significant Report as it provides commentary on different aspects of WAG economic policy that I discuss below, but of equal significance, the Report provides evidence of the continuing involvement of Westminster in Welsh economic policy.

I presented evidence in chapter 2 that Welsh economic underperformance can be traced back to the 19th century. However, it was in the 20th century that the UK government acknowledged that regional economic imbalance presented a problem, a concern motivated by social concerns as well as for reasons of allocative and productive efficiency (Robinson 1988). By the 1930s inter-regional imbalance had become a pressing political concern leading
to the first overt regional economic policy intervention by the UK government that had significance for Wales. The effects of the global economic depression following the crash of 1929-30 resulted in the rate of unemployment in Wales in 1933 rising to 37.8%, while in London and the South East it was 14.2% and 17.0% respectively (HMSO 1971). The UK government responded by passing the Special Areas Acts (1934 and 1937) and South Wales was recognised as one of several regions requiring assistance. The high unemployment at this time encouraged the provision of government funds to finance investments such as the Ebbw Vale steelworks (Martin 1988). The steps taken are noteworthy as they represent the beginnings of a regional policy that recognised the undesirability of regional disparity in levels of wealth across the UK and attempted to influence the location of industry as a palliative measure (Armstrong and Taylor 2000).

After the Second World War ‘Spatial Keynesianism’ was the preferred policy approach to regional economic development (Martin and Sunley 1997); so-called because it involved managing aggregate demand and employment in the regions (Kaldor 1970). The Barlow Report 1940 (Cmd. 6153) had argued that there was a connection between ‘over-development’ in the south of the country and ‘under-development’ in the north. The Labour Party’s subsequent commitment to full employment and the Distribution of Industry Act 1946 led to the creation of Development Areas (DAs) in regions of high unemployment (Scotland, Wales, the Northern Region, Northern Ireland, and Merseyside and
the South West) and made these areas eligible to receive loans and grants designed to encourage the construction of factories and industrial estates (White Paper 1944 Cmd. 6527). Such positive inducements to influence the location of industry were also supported by negative controls when in 1947 the Town and Country Planning Act introduced the requirement for planning permission before the building of industrial projects greater in size than 5,000 sq. ft., effectively controlling the location of such developments. Behind this intervention was some notion of the ‘proper distribution of industry’ an ill-defined concept that seemed to relate to regional unemployment rates (Thirlwall 1967).

It is at this time that we can discern the early signs of ‘hollowing out’ expressed as the partial divestment of Westminster’s authority over economic policy promoting Welsh economic regeneration. The Ministry of Welsh Affairs was established in 1951 with the potential for developing a distinctive approach to policy which was followed by a marked increase in investment in the Welsh economy (Deacon 2002). Wales was the beneficiary of further UK ‘hollowing out’ in 1964; the potential for Welsh policy intervention was increased by the creation of the Welsh Office (WO) that introduced: the post of the Secretary of State for Wales; the Welsh Economic Planning Board; and the Advisory Economic Council for Wales. Nevertheless, as an expression of Welsh aspirations, policy-making at this time is considered to have suffered from a
lack of resources and from the excessive influence of Westminster (Griffiths 1999; Loughlin and Sykes 2004).

During the 1970s, the UK economy faced problems of ‘stagflation’, industrial unrest and public finance imbalance (Nelson and Nikolov 2004). In 1979 a Conservative government was elected that was committed to an economic policy that relied more on free-market principles and sought to reduce the scope for state intervention in the economy (Darby and Lothian 1983; Gudgin 1995). This policy focused attention on increasing the efficiency of the supply-side of the economy through measures designed to improve the flexibility and mobility of factors of production (Martin 1989; Pike et al 2012). The shift in policy was reflected in the 1983 White Paper on Regional Industrial Policy (White Paper 1983 Cmd. 9111) that set the tone for regional policy in the 1980s. Part of the motivation for the review of regional policy was that the White Paper estimated the cost of a job created as a result of regional policy at about £35,000 (White Paper 1983; Committee of Public Accounts 1984), and the provision of subsidies to reduce regional imbalances was considered wasteful (Wren 2005).

Social unrest was evident in England in 1981 by rioting in Brixton in London and Toxteth in Liverpool. This may have influenced the increase in spending on urban redevelopment that occurred around this time, and it is believed that this expenditure was partly financed by the transfer of resources from regional spending for urban redevelopment (Martin 1992). Urban
redevelopment was strengthened by the establishment of Urban Development Corporations in Inner Cities that had powers to raise finance and undertake development. Although overt attempts were made to move away from a reliance on inward investment, there was little evidence of this being put into practice with a continuing commitment to inward investment throughout the 1980s and beyond. Policy did attempt to shift the emphasis of regional development from reliance upon inward investment to indigenous development ‘to enable those who live there [in the regions] to help themselves’ (White Paper 1988: 29). In spite of reduced spending on regional development, between 1984 and 1990 it is estimated that there was an increase in the share of UK manufacturing employment as a proportion of total UK employment, and this has been explained by increased inward investment and by lower wage costs relative to value added per employee (Gudgin 1995). The commitment to inward investment as a policy response continued through the 1980s and beyond (Cato 2004). This policy is credited with some success: from 1988 it is calculated that Wales was the most successful region, attracting 14 per cent of the UK total inward investment (Hill and Munday 1994). Nevertheless the overall tenor of regional policy in the 1980s has been described as one of decline as there was a reduction of real expenditure on regional industrial assistance (Taylor and Wren 1997: Table 2). This reduction in spending was accomplished by the abolition of locational controls and by reducing the number of areas that were eligible for assistance (Taylor and Wren 1997). Also, the differences
between aid available to Special Development Areas (SDAs), Development Areas (DAs) and Intermediate Development Areas (IDAs) were widened. In 1983 the government published Regional Industrial Policy (DTI 1984) that emphasised the need to reduce regional disparities for social rather than economic reasons. The policy of retrenchment was reinforced by abolishing SDAs, reducing DA coverage from 22% of the UK population to 15% of population, although the coverage of IDAs was increased from 6% to 22% of the UK population. Enterprise Zones were also established in the early 1980s for the purpose of catering for the differing needs of localities even within the same region (Potter et al 2000).

In the decade before Devolution, concern for the competitiveness of UK companies in world markets brought about a change in the emphasis of regional policy (Armstrong and Taylor 2000). The UK government continued to offer targeted regional assistance using the policy tools of Regional Selective Assistance (RSAs) and the Regional Enterprise Grant (REG), however, the intent was to support the policy of improving the UK economy (White Paper 1988; House of Commons 1995). Additionally, some financial assistance was offered only within Scotland and Wales by a number of rural-based agencies located in Scotland and Wales (Taylor and Wren 1997; Brooksbank et al 2001). The continuing availability of grants and subsidies is considered to be the most important factor explaining companies’ decisions where to locate at this time (Huggins 2001). The cost of offering financial inducements to attract inward
investment in Wales was considerable: in the decade up until 1998, it was calculated that £800 million was paid to firms in RSAs to induce them to locate in Wales (Tewdwr–Jones and Phelps 1999). We can get a sense of the scale of this amount by noting that the total spending of all English regional development agencies between 1994-5 and 2000-01 was £1.4 billion (National Audit Office 2003). Over this period there was a reduction in the total spending on UK regional assistance, but this was more than compensated by the receipt of EU Structural Funds whose importance is discussed in greater detail below (Pike et al 2010).

In spite of the benefit from the receipt of UK government regeneration funds, the receipt of European Structural Funds and success in attracting FDI, Wales approached Devolution with rates of deprivation higher than those of the UK (Parkinson 1998). The WO and the WDA were actively engaged in economic development and policy and continued to focus on creating jobs by attracting inward investment. For example, in 1992 the WDA published the Urban Development Wales Programme (Alden et al 1992) and in 1997 the WO agreed to provide grants of over £87 million to the Korean company LG who had plans to build TV, monitor and semi-conductor factories on a Greenfield site outside Newport (Wales Audit Office 2005). This policy is credited with some success not only on account of the evidence of job creation. Foreign owned companies were expected to expose Welsh employees to new attitudes to work and industrial relations (Morgan et al 1988; Morris et al 1993). In 1997
the Government White Paper, *A Voice for Wales* was published, preparing the way for the referendum that narrowly supported the establishment of the National Assembly for Wales in 1999.

An assessment of the efficacy of UK regional economic policy in general and of the relative economic performance of Wales in particular before Devolution is by its nature speculative, owing to the difficulty of knowing what might have occurred in the absence of regional assistance. This problem is compounded by the changes that occurred in the prevailing orthodoxy of economic theory and its application to regional policy instruments (Bachtler and Yuill 2001).

Before the advent of the new economic geography (NEG) (Krugman 1991; 1998), the high growth areas of the UK in the South East may have been considered to be examples of market failure on account of factor scarcity and high house prices (Martin 1988). Regional policy to encourage the relocation of labour and capital from successful to unsuccessful regions was defended through the expectation of reducing congestion costs in regions exhibiting excess demand and in favour of increasing economic activity in regions where demand was deficient (Martin 1988). There are now doubts concerning the realisation of such benefits. For example, employment created in an assisted area may benefit skilled and experienced workers migrating from non-assisted areas rather than the intended beneficiaries. Workers in non-assisted areas may have an advantage in the employee selection process on account of their
experience and the assisted area’s indigenous unemployed will not benefit from the employment opportunities (Pissarides and Wadsworth 1989). It is also argued that the overall impact of UK regional policy was neutral over this period of time, as the ending of the policies over locational control and the reduction of expenditure on regional policy in the 1990s do not appear to have weakened the poorer regions; this observation has led to the claim that these policy interventions made little perceptible difference to the less well-off regions (Gudgin 1995).

This scepticism regarding the efficacy of regional policy is supported by Taylor and Wren (1997) and Driffield and Taylor (2000) who conjecture that such policy spending at best represented a zero-sum game or at worst a negative sum game. A zero sum game would result if the benefits achieved by regions from regional policy were offset by the resulting costs of the regions who were not recipients of regional assistance. A negative sum game would result if the latter exceeded the former because, for example, those who are relocated for employment in regions receiving regional aid are less skilled employees. However, the most obvious reasons for a negative sum game would be the transfer and administration costs of intervention.

4.3 The Limits of Fiscal Autonomy
I argued earlier that the ability of nation-states and, by extension, their regions, to exercise autonomous policy is restricted by supra-national organisations. For
example, the conduct of international trade is governed by rules operating in favour of free markets under the World Trade Organisation. The European Union is focused on achieving a single market with a similar commitment to open markets and this may limit the role for national government and increase the influence of sub-national governance (Tanzi 1998). There is internal tension in the EU between the desire for community cohesion on the one hand and the rivalry arising from members’ conflicting self-interests on the other, a rivalry exacerbated by the provision of financial assistance to weaker members (Belka 2009). Membership of the EU requires that signatories to the Treaty abandon policy that will provide the country or regions of the country with additional assistance from their own government (or in other words they have to agree to ‘hollowing out’) (Treaty of Lisbon 2011). This is to ensure that member countries do not receive aid from their national government that would give them an unfair trading advantage and to avoid the possible consequences by way of retaliation and protectionism. However, the blanket application of a rule prohibiting that member governments can assist their domestic industry ignores the heterogeneity of members’ development and their development needs. Furthermore it would be inconsistent with the distinctions made by the EU in choosing which members were to receive assistance from the ERDF, the ESF and the Cohesion Fund. For these reasons national governments are permitted to provide aid to domestic industry under limitations referred to as State Aid Rules (Williams and Fasianos 2011). These regulations restrict the
ability of the government of a member state from providing subsidies that distort competition within the EU (Department of Business Information and Skills 2009). It is not always straightforward to determine the dividing line between distortion of competition and support and regeneration of struggling areas. Consequently, the provision of financial support by the public sector of member states is scrutinised to determine whether it is legal. The determination of legality is not entirely prescriptive as the EC Treaty contains exemptions to the rules. Some exemptions are granted as the financial support provided is not considered to represent a significant distortion of competition and regional aid falls within this area (Department of Business Information and Skills 2010).

This demonstrates that even though ‘filling in’ occurred with the establishment of the Welsh Assembly that brought decision-making and resource allocation within the ambit of the Welsh electorate, Wales continued and continues to be affected by influences beyond Cardiff Bay. The Welsh government is also limited by ‘hollowing out’: the continuing influences of Westminster, the European Union, and Welsh linkages with other regions continue to provide the backdrop to the challenges and opportunities facing the Welsh economy. Furthermore, as has been demonstrated by the foregoing discussion of UK regional economic policy, in a free-market context, the WAG policy remit is limited to exhortation and inducement that, at best, can influence behaviour in a preferred direction (Armstrong and Taylor 2000). This suggests
that the Devolution settlement represents a significant constraint on WAG policy-making.

4.3.1 The Political Bind on the Welsh Political Economy

Devolution is concerned with enabling the Welsh Assembly to administer and govern Wales in a manner consistent with the wishes of the Welsh electorate. WAGs ability to do this is prescribed by the Government of Wales Act 1998 that was succeeded by the Government of Wales Act 2006 (GoWA 2006). This has two provisions of note that consolidate the authority of the Welsh Government: its separation as the executive body from the National Assembly for Wales, and the assignment to the Assembly powers to enact Welsh Laws (known as ‘Measures’). The Act also created the potential for the adoption of further legislative powers and formal separation of the Executive and Assembly through the decision of a referendum of the Welsh electorate (Holden 2007). On the 3rd March 2011 a majority of those voting in a Welsh referendum voted in favour of the WAG extending its legislative powers to pass Acts of the Assembly in all of the 20 subject areas (these are described as ‘Fields’ in the 2006 Act) over which it can exert authority, without requiring the approval of the UK parliament. It is instructive to consider the measures that were made after 2006 as an indication of policy priorities. I have categorised the primary legislation of the National Assembly for Wales (NAfW) for the years following 2006 by Field in Table 4.1 below.
Table 4.1 NAfW Measures Categorised by the Fields of Schedule 5, Government of Wales Act 2006

<table>
<thead>
<tr>
<th>Field</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health (1)</td>
<td>Education (3)</td>
<td>Social Welfare (3)</td>
<td>Welsh language (1)</td>
<td></td>
</tr>
<tr>
<td>Education (1)</td>
<td>Local Govt.(1)</td>
<td>Food (1)</td>
<td>Social Welfare (1)</td>
<td></td>
</tr>
<tr>
<td>NAfW (1)</td>
<td>NAfW (1)</td>
<td>Fire and Rescue Services(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sport (1)</td>
<td>Local Govt. (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environment (1)</td>
<td>Transport (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health (1)</td>
<td>Housing (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Education (1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: http://www.legislation.gov.uk/mwa

Numbers in brackets indicate the number of Measures by Field.

There are few examples of NAfW primary legislation since 2006, but experience to date suggests that education, social welfare and health are most representative of WAGs legislative focus over this period. This appears perverse in relation to the importance attached to economic development in the WAG publications that are discussed below. Schedule 5 of the GoWA 2006 provides details of the ‘matters’ or sub-divisions of the 20 areas in which Welsh legislation may be enabled. Field 4 which is entitled ‘economic development’ does not have any ‘matters’ associated with it, and Schedule 5 was added ‘…providing more policy areas in which it is possible to make measures.’ (National Assembly for Wales website; preamble to Schedule 5 of the Government of Wales Act 2006). Economic policy is asserted through expenditure on Departmental spending and the potential for policy innovation through primary legislation has yet to be attempted. The explanation for this lacuna may be associated with constraints on policy that are discussed below.
4.3.2 *The Barnett Arrangements as Constraints on Policy*

The resources available to policy-makers determine their ability to exercise economic policy. The process of ‘hollowing out’ did not divest Westminster of its authority in determining the financial resources that would be available to the devolved regions. The resources available to WAG are limited by the devolution funding arrangements I have previously explained in chapter 2, but their significance also has a policy dimension for a number of reasons. Her Majesty’s Treasury (HMT) continues, in theory, to have unlimited discretion with regard to any significant changes proposed by the devolved territories, although financial relations between the HMT and the devolved administrations are governed by consensus in a spirit of mutual respect (HM Treasury 2007). Departmental Expenditure Limits (DELs) are set for a number of years and are further distinguished between the assigned budget and the non-assigned budget. WAG has full discretion over the assigned budget and this is governed by the Barnett Formula (explained in chapter 2) that allocates the funding of the devolved territories in relation to changes in expenditure in England and population changes within the UK territories. Expenditure that is reviewed annually, Annually Managed Expenditure (AME) cannot be moved between programmes or carried forward from one year to the next. The policy implications of this arrangement are that UK spending on public goods such as infrastructure may not benefit devolved areas according to the application of
crude population shares and that this discrepancy may be exacerbated by multiplier effects (Keating 2005).

The Barnett arrangements are now under critical scrutiny. Survey evidence suggests that there has been an increase in the number of people who believe that Scotland ‘receives more than its fair share of public spending’ (Curtice and Seyd 2009). This is perhaps the consequence of the divergent social policies evident between Scotland and England over such issues as care for the elderly, different treatment of prescription charges and university fees (Curtice and Seyd 2009). Further evidence of a desire for change was also evident in 2009 when a Select Committee of the House of Lords, created on a motion of Lord Barnett, recommended changing to a new system of allocating resources to the devolved administrations that should be based on relative need (House of Lords 139/2009).

In Wales an Independent Commission on Funding and Finance for Wales (ICFFW) chaired by Gerald Holtham has reviewed the arrangements for Wales (ICFFW 2009a). A review of the Scotland Act (1998) was undertaken by Sir Kenneth Calman that covers some of the same issues from the perspective of Scottish devolved governance (Calman 2009). Holtham has criticized the financial arrangements for Wales for using a block grant that does not permit borrowing and tax-raising. Further he considers the Barnett method of funding as unfair as it ignores the different circumstances and needs of the devolved regions. While in favour of a degree of self-financing through raising taxation
he recognizes that not all taxes are suitable for a devolved government but that a limited devolution of income-tax-varying powers could make a significant difference to the accountability and revenue of the WAG (ICFFW 2009b). The importance of a change in funding based upon need is emphasised and the ICFFW has recommended changes in the calculation of the block grant that would incorporate a needs-based element. The Commission has also recommended limited tax devolution that would permit the WAG to vary income tax rates and property taxes (ICFFW 2009b). Furthermore while noting the complexity and difficulty of WAG varying corporation tax the Commission does not dismiss the possibility and recommends that further discussions on its viability are worthwhile. Expenditure data indicates that total identifiable spending in Wales in 2009 was £25.309 billion (PESA 2009) and Holtham reports that total tax paid to the Treasury originating from Wales in 2007-08 was £17.1 billion. Data regarding other sources of WAG finance (such as receipts of Council Tax and Non-Domestic Rates) are required for a full financial assessment, but these early estimates may indicate that there are problems posed by a potential fiscal deficit under current financing.

A step towards increasing the independence of WAG decision-making was achieved in March 2011 when a referendum was held in Wales to give the WAG direct law-making powers instead of the previous requirement that such changes had to be scrutinised by Westminster before becoming law. On a
turnout of 36.4% of the electorate a majority of 63.5% voted in favour of the change (Jennings 2011).

It will take some considerable time before we know if the referendum result and the ICFFW recommendations influence the governance of Wales, but they do set in relief the discontent with the present funding arrangements and the background to the empirical analysis and results that I discuss later. There have already been interesting initial reactions to the Holtham proposals as they continue to explore the limits of fiscal autonomy and by extension the boundary between devolution and independence (Bowers and Webb 2012; Bardens and Webb 2012). Such discussions and their resolution will ultimately determine the limits on WAG policy-making. In particular, it will determine the feasibility of complete fiscal autonomy whereby Welsh public spending could be financed solely from taxes levied on Welsh firms and households. In theory such financing is considered to be desirable on grounds of fiscal accountability (Blow et al 1996). However, the initial conditions of the UK jurisdictions when making such a change would involve significant welfare differences owing to the variations in the size of the populations and the economic performance in Wales, Scotland and England (Blow et al 1996; McLean 2010). The tax-base of each country, based upon a balanced budget would probably result in very different levels and quality of public services and taxation. The ICFFW have also calculated that about 90% of the Welsh population live within 50 miles of the English border and the equivalent figure for Scotland is over 20%. The ease
with which significant numbers of the population can commute, engage in cross-border trade or ultimately emigrate to avoid differences in taxes or services may serve to limit the opportunities offered by fiscal autonomy (ICFFW 2009b; Warren 2010; Trench 2010; Aldridge 2010; Bowers et al 2012).

Assessing the consequences of implementing the Holtham proposals for Wales is not straightforward; whether there would be an increased likelihood of economic convergence between Wales and England resulting from fiscal autonomy would depend in part on the detailed settlement that was to accompany further separation of the UK territories. For these reasons the recommendations of Calman and Holtham are under examination while the different conditions in Scotland and Wales are tending to shape preferences in Scotland towards greater fiscal autonomy and those in Wales towards a larger block grant (McLean 2010; Heald and McLeod 2010). Some commentators have expressed disappointment with the terms of reference of the Holtham Report and its focus on finance that gives insufficient attention to overall welfare and sustainability (Jones 2011). One of the key points made is that the architecture of devolution determines the boundary of the policy tools available to WAG. Even if it can be shown that the Holtham recommendations make a significant change to Welsh funding they do not necessarily promote the transformation of Wales that is required (Jones 2011).

This discussion illustrates the pragmatic significance of the concept of ‘hollowing out’ for the Welsh Government and the choice of the words ‘semi-
autonomous’ used in this chapter’s title. WAGs powers to exert policy limit its ability to influence Welsh economic development. This means that in my empirical analysis the results should not be interpreted solely as the result of WAG policy. The GoWA (2006) and the subsequent Referendum results in 2011 increase the authority and powers of the Welsh Government. Nevertheless the continuing involvement of Westminster, evidenced recently by the Report of the Welsh Affairs Committee (2012) indicate an ongoing policy relationship between Cardiff Bay and Westminster that continues to retard the development of a unique and distinctive Welsh Government policy ‘brand’.

4.3.3 European Policy
The process of ‘hollowing out’ is perhaps most apparent in the relationship between WAG and the European Union. Since 1973 Welsh policy-makers’ room for manoeuvre has also been constrained by the wider economic policy framework of Europe. The European Union aims to reduce economic and social disparity amongst its members. It does this by allocating funds from the ERDF, the European Social Fund (ESF) and the Cohesion Fund (Wise and Croxford 1988; Stabinow 1979; Bachtler and Wren 2006). These funds are used to support objectives of achieving convergence among member states, increasing regional competitiveness and employment and improving European territorial co-operation. Convergence funds are available for regions that have GDP per head less than 75% of the EU average. The somewhat artificial area of West Wales
and the Valleys qualified for convergence funds and for the period 2000-2006 were awarded a total of £3.2 billion, made up of £1.2 billion from the Structural Funds Programme and the balance was matched by funds from the public, private and voluntary sectors (Bristow and Blewitt 2001; Boland 2004). In the current programme that covers the years 2007-2013 West Wales and the Valleys has been awarded about £1.1 billion from the ERDF and £730 million from the ESF. East Wales has been awarded £64 million from the ERDF and a further £56 million from the ESF to improve its competitiveness and employment (WEFO 2009a; 2009b).

The significance of these funds for economic policy arises from interaction with the Barnett funding arrangements. The funds available from the EU are provided to support the EU policy objectives. Given the apparent correspondence of WAG and EU policy goals this may not be a problem now but could be in the future if WAG policy was to change and target different outcomes from those of the European Commission. A collision between EU policy and that of the UK is possible since the EU funds must be seen to be spent in the UK region for which they were targeted by the EU, and may not correspond with the priorities of the WAG. Furthermore the EU funds have to be matched by additional UK funds and these arrangements give the impression that the receipt of EU funds represents the recipient successfully bypassing the UK government application of the Barnett rules. Indeed, the distribution of EU Structural Funds (SF) is based upon the principle of
additionality, meaning that SF may not be used to replace the equivalent expenditure by a member state. The application of this principle is problematic as the UK is a member of the EU, negotiates the funding and contributes money to the EU. The payments to the devolved territories can be interpreted as the return of part of the UK’s contribution (Bell and Christie 2001). HM Treasury argues that additionality applies to the member states and not their regions (Keating 2005) and the ESF receipts go into the notional Barnett general pot. Consequently, it could be argued that the devolved regions in fact, only get half the funds and still have to find matching funding. On account of the ambiguity surrounding the interpretation of EU Structural Funds they are omitted as an explicit part of the modelling that is undertaken in Part II of this work and are implicit in the time-dummies used for each year of the modelling after Devolution.

The Single Programming Document (SPD) for Wales, 2000-2006 sets out the strategy for the Objective 1 programme over this period. The three main targets for the programme were to: raise GDP per capita from 73 per cent to 78 per cent of the UK average; create 43,500 net additional jobs; and reduce the number of those economically inactive by 35,000 (WAG 2000: 6). Some of these funds were used to finance the Entrepreneurship Action Plan (2000), the Knowledge Exploitation Fund and Finance Wales. These initiatives are now regarded as having produced disappointing results owing to the under-achievement of targets and poor administration (Cooke and Clifton 2005).
Comparing the SPD targets with the results suggests that these targets were not achieved as GVA per head in Wales in 2006 is now estimated to have been 75.2% of that of the UK (Jones-Evans and Bristow 2010). Jones-Evans and Bristow (2010) used information from the Welsh European Funding Office (WEFO) to compare the programme target for jobs with the outturn results. They estimate that this target was not achieved and that the programme has failed to raise the innovation potential of West Wales and the Valleys as measured by new jobs in high technology industries and the creation of new companies in high technology sectors. These authors conclude by endorsing the economic development strategy of *A Winning Wales (AWW)* (WAG 2004) but suggest that the policy initiatives should work more closely together.

The current period of EU Structural Funding over the period 2007-2013 has again provided generous funding for West Wales and the Valleys and East Wales. The priorities for their use in both regions continue to be those of promoting economic growth by improving knowledge and innovation (DTI 2006). This is noteworthy once we remember that the funding for West Wales and the Valleys is to support the strategy for the convergence objective in Wales (DTI 2006), while the funding for East Wales is to support the strategy for the competitiveness and employment objective in Wales (DTI 2006). In 2009 the GDP per capita of East Wales was 99.3% of the EU27 members’ average and that of West Wales and the Valleys was 68.4% (Eurostat News release 38/2012). In spite of their different levels of economic performance and the differences in
Chapter 4: Economic Policy for a Semi-Autonomous Wales

population size, population density and industrial structure, the same policy priority is considered to be appropriate for both sub-regions.

This discussion is a reminder of the influence of ‘hollowing out’ on regional development policy-making by Westminster. WAG is the beneficiary of this process through Devolution but it also illustrates that WAG is also subject to external constraints that impede its attempts to promote Welsh economic development, even though large sums from the EU are targeted for this purpose. For my thesis it raises the expectation that significant injections of finance into the Welsh economy may affect the empirical analysis that follows in Part II. Other obstacles continue to curtail WAG policy-making and I continue by investigating the importance of inward investment for WAG economic policy.

4.3.4 Inward Investment but Elusive Structural Change

Policy to attract Fixed Direct Investment (FDI) predates Devolution and has endured into the post-Devolution period. This policy is considered to be a means of attracting multi-national enterprise (MNE) that will enhance employment, income and growth and encourage technology transfer to encourage innovation and productivity in Welsh local firms (Crawley et al 2011). Encouraging inward investment to redress disappointing income and employment continues to be a recurring theme in Welsh economic policy, and one that is claimed to be a policy response to a failure of indigenous private
investment (Morgan 1997). During the lifetime of the Welsh Office, Wales was particularly successful in attracting FDI (Hill and Munday 1994; Begg 1995) and its success in attracting multinational companies has variously been associated with improving infrastructure, competitive wages, and the availability of grants and other financial incentives (Hill and Munday 1995; Hill and Keegan 1993; Huggins 2001). Yet, conventional macroeconomic indicators suggest that Welsh relative economic performance has not improved as a result of this approach (Jones and Henley 2008). Welsh relative economic performance continued to deteriorate in the decade before Devolution and the index of Welsh GVA per head relative to that of the UK declined from 84.3 in 1989 to 77.3 in 1999. Of course, in absolute terms the Welsh economy was growing, but it was certainly not growing as fast as the economies of England or Scotland.

In the pre-Devolution period Wales seemed to have had many things working in its favour that encouraged FDI: support from the European Regional Development Fund (ERDF) and UK regional policy, the work of the Welsh Office, and the WDA, which were all intended to contribute to Welsh economic regeneration. Indeed an independent assessment of Welsh regeneration concluded that ‘By the 1980s the economic base of Welsh industry had been almost completely restructured away from traditional industries’ but that this investment, ‘did not lead to a congruent increase in Welsh prosperity’ (Wales Audit Office 2005: 14). The common thread linking these various initiatives is based upon the principle of attracting inward investment, which
means providing incentives for non-indigenous firms to invest in areas that, presumably, they would not have considered without the additional inducements.

The reasons may be many and complex but the failure of the LG project near Newport was emblematic of the loss of confidence in this policy and the eventual winding up of the WDA whose powers were taken over by the Assembly in 2006 (Cato 2004). Nevertheless inward investment as a regional development policy has not entirely lost the confidence of policy-makers. The Welsh Affairs Committee at Westminster recently undertook an inquiry into inward investment in Wales (Welsh Affairs Committee 2012). It is an interesting report as it highlights the importance of the links between inward investment, education and transport infrastructure for regional economic development. It concludes that inward investment should continue to be regarded as an important element of economic policy (Welsh Affairs Committee 2012 para. 25; para. 80). In this regard it stresses the importance of partnership between universities and industry in attracting companies to Wales (para. 44). In terms of strategic policy, the Report calls on the ICFFW to take account of the Committee’s conclusions when examining the devolution of fiscal powers to the National Assembly for Wales (para. 120). We can conclude from this Report that the policy of attracting inward investment continues to be regarded as a tool of economic development. It is also evident that the support of education, in
particular higher education, and investment in transport infrastructure are also regarded as important for this process.

The policy of attracting FDI is interesting on account of the implications for the Welsh economy. It suggests that autonomous indigenous entrepreneurial activity and investment will not be sufficient to achieve a satisfactory rate of economic growth. It also suggests that there are doubts about the ability of the Welsh economy to achieve technological progress in industrial output commensurate with best practice. Such doubts concerning the efficacy of the policy of attracting inward investment to Wales resulting from Objective One status were voiced soon after Devolution. For example, Brooksbank et al (2001) drew attention to the importance of configuring development aid to the different needs of the Welsh sub-regions.

Doubts continue to emerge about the long-term viability of the attraction of FDI as policy tool. Recent evidence suggests that it is increasingly difficult for Wales to compete effectively for FDI against the lower labour costs in the countries of China and South East Asia (Evans et al 2008). Within the OECD, Rodriguez et al (2007) investigated the existence of productivity spillovers in the manufacturing sector originating from foreign firms that benefit the UK. They compared the productivity (measured as the value added per employee) of foreign firms with that of local firms for the years 1995 and 1998. The data confirm that foreign firms appear to have a higher rate of productivity but that the differential has fallen over the period of analysis (in the UK in 1995 the ratio
of foreign firms productivity to local firms was 1.811 which fell to 1.306 in 1998). More significantly, for the entire OECD sample, depending upon the industry analysed, evidence of negative productive spillovers from foreign to local firms was found, and this may be associated with the crowding-out of less efficient local firms by the more competitive foreign firms.

The analysis above suggests that the policy to attract FDI has had mixed results and is likely to continue but with a changed emphasis (Welsh Affairs Committee 2012). The persistence of the Welsh policy focus that appears to look outside of Wales to address problems within Wales may be associated with the lack of policy manoeuvrability arising from the unique character of Welsh Devolution. I continue by investigating this possibility in the next section.

4.4 Devolution: Hollowing out or Filling in?

Wales began to feel the effects of the ‘hollowing out’ of Westminster before Devolution. Welsh affairs were run by the Welsh Office (WO) from 1965 as part of the Home Office of the UK government and the WO was responsible for implementing Whitehall policy (Shortridge 2002). The scope for divergence between policy framed for England and that for Wales depended largely on the Welsh Secretary in office. For example, the interventionist economic policy adopted by Peter Walker (Welsh Secretary 1987-1990) stands out when contrasted with the policy of reducing the influence of the state promulgated by the Thatcher government. However, Welsh Office policy may be a misnomer
insofar as it gives the impression that the Welsh Office was the sole influence upon the Welsh economy before Devolution (Walker 1991; Deacon 2002). In reality Westminster continued to be the main influence on UK regional economic policy and was responsible for granting the regions’ Development Area status. In 1973 when the UK joined the European Common Agriculture Policy, Welsh farmers were affected to the same extent as those in the agricultural sector elsewhere in the UK. In 1973 the decision of the UK government to join the Common Market was also a significant change affecting all regions.

Throughout this period Welsh influence over policy affecting the Welsh economy waxed and waned depending upon the Secretary of State in the Welsh Office (Walker 1991; Deacon 2002; Osmond 2004). But in spite of the differences with which holders of the office interpreted their brief, during the 35 years of its existence, the Welsh Office grew in size and influence, until the last Secretary of State, Alun Michael, had over ten times the number of staff as the first (Deacon 2002; Royles 2007). Despite the differences in the execution of their Office, there is evidence to support the belief that all Welsh Secretaries were united in the cause of an improved Welsh economy but differed in the means of achieving this end (Deacon 2002). Indeed based upon personal communications with Deacon (2002), seven of the twelve Welsh Secretaries who held office claimed that their main policy objective was economic in nature. However, translating a commitment to Welsh economic improvement into policy could not have been
facilitated at this time by the division of responsibility in the Welsh Office between two Parliamentary Under-Secretaries of State. This involved the separation of ministerial responsibility for agriculture, industry, urban and rural policy and transport on the one hand, from education, training, small businesses, fishery and energy on the other. Neither was the framing of Welsh economic policy promoted by the distraction of having to maintain consistency with and achieve the support of the Westminster government. In this respect the Welsh Office economic policy remit invites comparisons with Janus, as one head may have been focussed upon improving the Welsh economy while the other was pre-occupied with the scrutiny of its activities at Westminster by the Welsh Grand Committee, the Public Accounts Committee, The Welsh Affairs Select Committee and other Standing Committees (this could be expressed as ‘consultation overload’, see for example, Loughlin and Sykes 2004).

Consequently, an appreciation of Welsh economic policy before Devolution in 1999 begins with the recognition of the many participants in the process that include the Westminster Cabinet and a large number of elected representatives and their advisors in England and Wales. To get some sense of the economic influence of the Welsh Office on economic development it is worth noting that its total expenditure per head on economic development in 1996-97 was £1094. This figure compares with the range of similar expenditure by the English regions of between £670 per head in the South West and £995 per head in London (calculated from Public Expenditure Statistical Analysis 2000).
It has been previously claimed that the process of Devolution can be understood in terms of the idea of ‘hollowing out’, or ‘the transfer of national state functions ‘upwards’ to supra-national institutions like the EU and ‘downwards’ to local and regional agencies’ (Jessop 1997; Shaw and MacKinnon 2011). The consequences of Devolution in turn can be understood as a reconfiguration of the ways in which power is exercised and policy developed; a process that has been called ‘filling in’ (Goodwin et al 2005; Jones et al 2005).

The significance of the process of ‘filling in’ for economic development in Wales is the creation of new structures of governance to address and co-ordinate policy to promote economic development, by for example, the establishment of a Ministry and Committee for Economic Development and a Ministry and Committee for Education and Lifelong Learning. Central to the implementation of policy was the Welsh Development Agency (WDA) and Education and Learning Wales (ELWa) (Jones et al 2005). The notion of ‘filling in’ also provides clarity to the apparent policy puzzle of how WAG can be expected to deliver improved economic performance using the same policy tools that were available to the WO. The manner in which governance is exercised in a devolved Wales throws into relief the significance that is attached to economic governance and economic development (Hazell 2000; 2003).

The manifestation of the WAGs engagement with economic development was soon apparent after Devolution. In 2002 the WAG published the Plan for Wales (WAG 2002) that identified the challenges facing Wales and
published *A Winning Wales (AWW)* (WAG 2002) in the same year that established an economic development strategy and associated targets. Policy aspirations in these documents were ambitious involving a relative improvement in economic performance, measured as GVA per head relative to the UK, to 80% within ten years and to parity with the UK within a generation.

Language emanating from the Bay in the early days of Devolution was bullish, aspiring to nothing short of a ‘transformation’ of the Welsh economy *AWW* (WAG 2002).

The Welsh Assembly’s preferred instruments for achieving its economic targets could be described as being derived from both neoclassical and endogenous growth theory that were discussed in chapter 3. The key ‘drivers’ of growth were to be innovation and enterprise, improving the quality and volume of the capital stock, the development of human capital through education and training and the application of information and communications technology. To achieve the goals of *AWW* a number of supporting key documents addressed the tasks of improving: education (Learning Country: Learning Pathways 14-19; Reaching Higher); skills (The National Basic Skills Strategy for Wales; Skills that Work for Wales: A Skills and Employment Strategy); entrepreneurship (The Entrepreneurship Action Plan for Wales) and innovation (Wales for Innovation: The Welsh Assembly Government’s Action Plan for Innovation).
The Wales for Innovation (WfI) plan (2003) committed an investment of £260 million to this end. Encouraging business innovation and closer links with higher education was to be achieved through the Technium network that was conceived as providing incubator space for high technology (Abbey et al. 2008). The greater part of this sum involved spending £150 million on further Technium projects to function as business ‘incubators’. Additional spending of £60 million was targeted towards universities and colleges with the aim of facilitating ‘knowledge commercialisation and entrepreneurship activities within our academic base’ (WfI: 5). The Technium initiative is a prominent feature of Welsh economic policy designed to encourage knowledge-driven innovation and business formation. The first Technium centre was built in Swansea in 2001 and the WDA constructed nine others to support WAGs Innovation Action Plan (IAP) (WAG 2003). The IAP acknowledges the importance of the knowledge economy and states the intention to invest £150 million in the Technium concept over the following three years (IAP: 5). In 2010 WAG announced that six technium business centres are to close as they did not represent value for money and were not creating sufficient jobs (Griffiths 2011).

Analysis of the strategy that was to achieve the WAG economic goals that is revealed in the various WAG publications suggests that the WAG is well aware of the limitations of its influence. The language of strategy that is used in WAGs published documents makes liberal use of words like ‘encouraging’ and ‘supporting’ while omitting to explain the means of their achievement. Where
there is an explicit target such as that of making Wales a ‘learning country’, the means of monitoring progress towards their achievement is also ill-defined (WAG 2002; 2003; 2004; 2005; 2007; 2009).

In 2004 the Welsh Development Authority (WDA), the Welsh Tourist Board (WTB) and Education and Learning Wales (ELWa) were absorbed within the Welsh government as the means of achieving more coherent and ‘joined up’ policy formulation (Thomas 2004). In the following year the WAG published Wales: A Vibrant Economy (WAVE). In this document, in the first paragraph of the Foreword, the Minister for Economic Development and Transport claims that the Welsh economy has undergone a transformation as measured by employment, earnings and exports that are cited as evidence of ‘dynamic businesses’ (WAVE 2004). With the benefit of hindsight we know that such claims were premature, at least using relative GVA per head as a measure of progress (WAVE 2004). One possible explanation for the overly optimistic assessment may be confusion between variations in the business cycle that did not reflect changes in the secular growth path of the Welsh economy.

In WAVE there is evidence that the Assembly believes it has the ability to foster economic change through the tenets of fiscal decentralisation arising from ‘short decision chains, close partnerships, local knowledge…’ (WAG 2004: 5). However, the guarded words used to describe the means of leverage to achieve economic change are carried forward from 2002 with the exception of an explicit commitment to invest in transport and other infrastructure. The
commitment to economic growth is restated, although perhaps tellingly, without the previous numerical targets of convergence. These targets had already become a hostage to fortune since the chosen indicator (relative GVA per head) indicated a worsening of Welsh relative economic performance (WAVE 2004).

In terms of the continuity of policy articulated in this document compared with its predecessor, there is perhaps evidence of a retreat or a softening of the position on economic inactivity as it is considered in relation to a number of mitigating circumstances (WAVE 2004: 10). Also, the previous numerical targets of convergence are omitted from Annexe C that monitors progress against AWW Targets. The document claims that GDP and GVA are both flawed measures of the quality of life and that they omit possible differences in the cost of living when comparing regions (I discuss these problems in chapter 5). As an aside it is worth noting that WAGs rejection of the use of GVA per head as a measure of progress is risky as this measure is used to determine eligibility of Objective One awards. In preference to the use of GVA or GDP, WAVE argues that assessing progress towards targets is best achieved by focussing on those measures that directly affect the quality of life such as Welsh employment and average earnings (WAVE: 9). Earnings represent a much narrower measure of earned income, but their use and interpretation also requires care because of the problem of adjusting for differences in the cost of living between regions.
One theme that is highly visible in WAVE is the importance of partnership, a word that appears 26 times in the WAVE document compared with eleven times in the previous AWW document. The use of the word ‘partnership’ in WAVE is used most often to refer to working with other organisations in the public, private and voluntary sectors. It is perhaps an indication that WAG is beginning to realise that its goals may be more difficult to achieve, working by itself, than was first envisaged and raises the possible interpretation that WAG is seeking a degree of ‘hollowing out’ itself. The WAG aspirations for Welsh development are presented with a clarity that diminishes when turning to the means to achieve them. Analysis of the language of strategy reveals an absence of the appraisal of targets that render it difficult to determine when a commitment to ‘help’ or ‘support’ is achieved.

Seven years into Devolution the Assembly election in 2007 resulted in a governing coalition of the Labour Party and Plaid Cymru and the subsequent publication of The One Wales Coalition Agreement (OWCA). A political coalition requires compromise to achieve a consensus to enable stable governance and policy formulation. This may in part explain the differences in policy that are apparent when comparing policy in OWCA with that of WAVE. In the OWCA the policy emphases are on the quality of life, the needs of disadvantaged members of Welsh society and social justice. These concerns are evidenced by the first policy chapter being devoted to health issues and the NHS. Nevertheless the importance of the economy is acknowledged in the next
Chapter 4: Economic Policy for a Semi-Autonomous Wales

chapter, where discussion revolves around the issues of job creation, enhancing skills and encouraging enterprise. This document, like its forerunners, is guarded as to how improvements are to be achieved and again it is difficult to determine how the monitoring of targets against outturns is to be undertaken. The ambitious targets using macroeconomic indicators previously discussed are not mentioned, perhaps signalling a change in focus from economic performance to social well-being.

In July 2010 some ten years after devolution, the WAG published *Economic Renewal: A New Direction (ERAND)* (WAG 2010a). The opening paragraphs seem designed to emphasise how the Welsh economy is vulnerable to both the global economy and downturns in the UK economy. Further articulation of the limits of government intervention is unambiguous, for example, ‘the Government … cannot create jobs and prosperity’ (ERAND: 2) and ‘This is not a task that can simply be delegated to an arms-length agency’ (ERAND: 2). Policy is now presented as the outcome of consultation with stakeholders and the emphasis is again on partnership, a word that appears 21 times throughout the document. Perhaps unsurprisingly, owing to the reduction in Welsh GVA per head as a percentage of that of the UK from 77.3% in 1999 to 74.3% (provisional estimate) in 2009, the convergence targets that were introduced in WAVE are not mentioned explicitly. They are alluded to as forecasts (ERAND: 49) and the ability to forecast accurately is now brought into doubt. There is a suggestion that the economic development programme should
be viewed as a long-term project as the policy stance is now ‘to long term, strategic and structural investments’ (ERAND: 49).

The levers of policy have not changed much over the decade: infrastructure, skills and innovation together with the ill-defined objective of ‘making Wales a more attractive place to do business’ (ERAND: 14) are the means for economic renewal. A new policy instrument is introduced providing business support targeted towards six sectors, chosen because they are regarded as growing markets (ERAND: 14). These sectors are: information and communications technology; energy and the environment; advanced materials and manufacturing; creative industries; life sciences; and financial and professional services. This suggests that the Assembly is taking a more disaggregated approach to economic policy intervention by attempting to anticipate economic sectors that may provide the greatest opportunity for growth of income and employment (ERAND: 37).

This discussion identifies that significant changes have taken place during the evolution of Welsh economic policy. Since Devolution the disparate elements of policy before 1999 evolved into ambitious macroeconomic targets, but after a decade of devolved government there has been a retreat from macroeconomic policy measured by macroeconomic indicators to a more targeted approach. GVA per head fell out of favour as a measure of relative economic performance and the use of alternative measure such as average incomes before tax does achieve a small improvement when making
comparisons between Wales and the UK. For example, in 2007-08 the ratio of
Welsh average total income to that of the UK was about 81% though this
represents a fall in relation to 2000 when it was about 83%.

4.5 WAG Spending as a Manifestation of Economic Policy
Two of the key differences between the Welsh Office and WAG are WAGs
control over the allocation of the budget and its ability to enact secondary
legislation. WAGs spending choices can be used as an indicator of the relative
importance it attaches to different policy objectives by considering the amounts
committed to them in their budget. Of the factors cited previously, investment
in human capital appears to be the most important for WAG for the purpose of
promoting development. For example, Pickernell (2011) has estimated that
66.38% of the WAG budget during the period 2008-2011 is committed to
supporting the development of skills and qualifications as a means of
improving the quality of human capital. The next most important category in
the WAG budget is transport infrastructure that accounts for 23.23%. Grants to
enhance targeted sectors of the Welsh economy amounted to 5.94% of the
budget, and the promotion of innovation and technology account for the
remaining 4.45%.

Pickernell (2011: 10) uses Boddy’s (2006) analysis as a comparator for
WAG spending. Boddy (2006) estimated the differences in productivity
between Wales and London and suggests that the variations in productivity
between Wales and London cannot be explained by WAG spending and are more likely to be explained by the ‘effectiveness of Welsh productivity and competitiveness policy’. The composition of the estimated productivity deficit between Wales and London is instructive as it suggests targets for policy interventions. It is alleged that the three most important sources of business productivity issues for Wales are the capital stock and its structure (accounting for 35% of the total productivity deficit) and skills and qualifications that account for a further 15%. A comparison of these figures with the resources committed by WAG to spending on associated policies from the 2008-11 budget reveals a mismatch between the sources of the productivity deficit and WAG spending on economic development. Boddy (2006) argues that WAG has allocated only about 6% of resources for productivity-related structural issues and over 66% of resources have been allocated to productivity-related skills and qualifications. The large difference in emphasis between the resources devoted to physical capital and human capital invites further analysis. Boddy’s use of London as the reference region in his analysis may have been because London appears to be the best performing region as measured by GVA per head. However, it could be argued that the use of any region for this purpose should be undertaken only if it is possible for its performance to be emulated in other regions. There are other relatively successful UK regions and small countries that could be used as comparators and each may provide a different benchmark for comparing WAG policy spending. (Pickernell 2011; Boddy 2006).
Commentators have also criticized the focus of WAG policy on the attraction of FDI. Autonomous domestic investment may be more firmly anchored within a domestic economy than investment that is attracted from abroad by financial inducements (Cato 2004; Pickernell 2011). Once a foreign firm is established, its continuity and growth as an employer is determined by decisions taken in company HQs in other countries, where decisions reflect the interests of the company in the donor country. By contrast, the propensity for company start-ups by domestic companies is likely to be related to entrepreneurial engagement reinforcing the importance of entrepreneurship for regional development (Brooksbank et al 2001).

Table 4.1 above suggests that WAG may be open to the criticism that it pays greater attention to issues of employment and social deprivation than to promoting income growth. The policy response to social issues targets the symptoms of under-development rather than the causes and it is preferable that policy should be more focussed on promoting greater business activity and higher levels of productivity (Adams et al 2003). Any bias in the WAG policy focus towards social concerns that influence its use of development funds may also be explained by the desire to attract and conform to the conditions for the use of EU funds. Ideally, inflows of FDI together with domestic innovation and entrepreneurial activity should be complementary and synergistic, but it has been argued that they are in fact generally mutually exclusive (Brooksbank and Pickernell 2001). A significant impact of Devolution in terms of economic
development policy was the waning in support for the policy of fostering FDI (see for example, WAVE, where there are few references to inward investment).

Devolution is expected to provide benefits to a region through fiscal decentralization, but a greater role for government may not be unambiguously beneficial. It is argued that Government does not have the ‘animal spirits’ in the sense of the aggressive entrepreneurial behaviour of the private sector (Cooke 2003). The need to account publicly for its use of funds and to curry political support for WAG policies may result in spending decisions biased towards public rather than private innovation activity (Cooke 2003).

It was noted in chapter 2 that Wales has more public sector employment than other UK regions, and this may have implications for the propensity to foster entrepreneurship and innovation that are key elements of WAG policy (Cooke 2003). A reliance on the public sector for employment can be argued both to result from and contribute towards a scarcity of entrepreneurial resources (Morgan 1997; Cato 2004). Perhaps counter-intuitively, high public sector employment may be associated with relatively lower wage levels and qualifying for regional aid that both contribute to attracting FDI (Hill and Munday 1992). Poor entrepreneurial activity has also been accompanied by an under-performance of indigenous innovation activity, but FDI may have had a positive effect on Welsh innovation (Driffield and Taylor 2000; Cooke et al 2003). However, the benefits of FDI for productivity are not supported by more recent research undertaken among OECD countries (Rodriguez et al 2007). For
the UK, evidence of productivity spillovers in manufacturing industries resulting from FDI was investigated by Girma et al (2008). Using firm-level panel data for the period 1992-9 the authors investigate the existence of such spillovers, distinguishing between horizontal spillovers (beneficial effects for domestic firms in manufacturing) and vertical spillovers (productivity benefits for domestic suppliers and buyers). Two interesting results of this research from the perspective of WAG policy are that horizontal productivity spillovers are more likely to occur for ‘export-oriented multinationals’ (Girma et al 2008: 336); and that ‘only domestic-market-oriented MNEs [multinational enterprises] generate positive spillovers through backward linkages for both domestic exporters and non-exporters’ (Girma et al 2008: 336). However, Welsh autonomy cannot escape the vagaries of international economic developments and a recent study (Evans et al 2008) cast some doubt on the employment-creating potential of FDI. For example, it is reported that: about ’70% of new FDI projects resulted more in safeguarding existing jobs than the creation of new ones’ (Evans et al 2008: 111). Consequently, Welsh employment may be vulnerable to competitive pressures in the UK and international labour markets, over which WAG has little control. Evidence of this weakness is reported for the decade to 2008 when Wales lost a significant number of jobs to other countries whose labour costs were more competitive (Evans et al 2008: 9).

Perhaps the Welsh government does not fully exploit its potential autonomy as its economic policy emphasises employment creation and the
reduction of economic inactivity. Such policy relies upon attracting potentially ‘footloose’ foreign firms attracted by financial inducements instead of encouraging indigenous structural change through enhancing business productivity (Adams and Robinson 2002). This discussion suggests that perhaps the most important counterfactual argument questioning the autonomy of WAG policy-making is its continuing reliance upon inward investment.

Human capital is of equal importance as physical capital in the theories of economic growth that were discussed in chapter 3 and the quality of human capital is also frequently associated with the propensity for innovation and entrepreneurship (Parhi et al 2011; Wong et al 2005). Education is sometimes cited as the means of increasing entrepreneurial engagement and innovation (Pittaway and Hannon 2008). Consequently, a number of the WAG publications concerned with economic development that were discussed earlier suggest that the problems of the Welsh economy are attributable to a deficit of entrepreneurship and innovation that can be remedied through education policy.

Education policy is important for researching economic growth because it is a prominent component of the theoretical production function explaining the growth process, and is increasingly regarded as a precursor of economic growth (Bok 2003). It is explicitly acknowledged in the empirical analysis that I undertake in Part II where I use measures of educational attainment as proxies
for the quality of human capital. In chapter 3 I discussed the importance of entrepreneurship as a driver of economic development (Audretsch et al 2006). The propensity for entrepreneurship in the working population is thought to be associated with the creation of new businesses and the generation and exploitation of new knowledge, or innovation (Acs et al 2007; Wennekers and Thurik 1999). Education is also considered to have a relationship with entrepreneurship (Pittaway and Hannon 2008; Kuratko 2005) and there is empirical evidence supporting a link between entrepreneurship with higher education (Arenius and De Clereq 2005; Gorman et al 1997). The incidence of entrepreneurial skills is considered important for regional economic development (Parhi et al 2011; Wong et al 2005); it is often regarded as an accelerant of indigenous business creation and development (Acs et al 2005).

The importance of entrepreneurial activity for Welsh economic development was acknowledged before Devolution with the publication of the Entrepreneurship Action Plan (EAP) (Entrepreneurship Action Plan 2000) and is associated with the Welsh Office strategy document Pathway to Prosperity (Welsh Office 1998). The intent of the EAP can be summarized as facilitating the development of an entrepreneurship culture in Wales that was to be achieved by increasing awareness of the benefits of private enterprise and nurturing the growth of businesses (Jones-Evans 2007). The EAP also displays evidence of an expected relationship between education and entrepreneurship that I discussed above when considering education policy. Evidence suggests that Welsh
entrepreneurial activity as measured by new business starts has increased since Devolution and now compares favourably with that of average UK performance. Although a comparison with UK regions indicates that Welsh performance lags behind two of its regional neighbours in terms of the Global Entrepreneurship Monitor construct of total entrepreneurial activity; the West Midlands and the South West (GEM 2007: 4). Although a full understanding of the relationship between the propensity for entrepreneurial activity and higher education requires further research, early indications suggest that the relationship varies by level of education and by ethnic group (Thompson et al 2010). Indeed, research provides evidence of a higher incidence of innovative entrepreneurs in Wales than in the rest of the UK (Thompson et al 2008: Table 1). Entrepreneurship is also of significance because, of the theoretical explanations of growth, it is arguably the one over which government may exert most control through education policy. However, while it may be possible to teach business skills (the science of entrepreneurship) the ability to teach the other characteristics required for successful entrepreneurial activity is disputed (see for example, Rae 2010; Taatila 2010; Jack et al 1999).

In the twenty years before Devolution there had been concern about Welsh education standards compared with those of England, even though Welsh education policy was largely driven by that of England (Reynolds 1989). The Education Reform Bill (1988) introduced the concept of the National Curriculum and the beginnings of a distinctive Welsh education policy (Jones
1994) emerged with the creation of ‘The National Curriculum of Wales’ (CCW 1993). In this respect Rees (2007) reminds us that it is important to distinguish between administrative devolution and parliamentary devolution as Welsh education policy was diverging from that of Westminster before 1999. Before 1999 policy was formulated as a composite England and Wales ‘brand’ but there was a process of policy mediation that permitted a degree of Welsh distinctiveness (Raffe et al 1999). This partial decoupling was used as an opportunity to improve education standards in Wales and to make Welsh education more distinctive because the Welsh Office accepted that the Welsh language and literature should be compulsory subjects in Welsh schools. The first evidence of this policy is to be found in the publication, *The Learning Country* (National Assembly of Wales 2001). However, this depiction of Welsh education policy should not be interpreted just as a desire for distinctiveness for its own sake, but should also be regarded as part of the means to achieve the goal of increasing Welsh prosperity. This is asserted very early in *The Learning Country* where an explicit causal link is asserted between learning and prosperity (National Assembly for Wales 2001: 8-9). Furthermore, education is seen as part of the wider policy agenda for developing entrepreneurship skills (National Assembly for Wales 2001: 33) that was reinforced through the Entrepreneurship Action Plan (2000). This belief in the synergy between education and economic progress is reiterated in *AWW* (Welsh Assembly Government 2002), where education is linked with furthering innovation and
entrepreneurship. AWW assesses improvements at the extremes of the range of educational achievement by measuring the reduction in the proportion of adults of working age with no qualifications and an increase in the proportion of those with level 4 qualifications. I have followed this practise in my own analysis by incorporating a variation of these measures in my modelling of Welsh relative economic growth and which is explained in greater detail below.

The Assembly’s belief in the potential of education policy to drive economic change is restated in the document Wales: A Better Country (Welsh Assembly Government 2003). For example, it links poverty with low levels of educational and vocational attainment (Wales: A Better Country 2003: 11) and stresses the importance of education for building the economy (Wales: A Better Country 2003: 12). The significance attached to Higher Education is made explicit by acknowledging the importance of linkages between Welsh University research and ‘modern industries’ (Wales: A Better Country 2003: 13).

In the WAG publications there is little discussion about the specific linkages between education and the economy (although established in the literature, see for example, Benhabib and Spiegel 1994, and Kitson et al 2009). However, a broad view of Welsh economic policy suggests that its importance is implicit and related to promoting the development of human capital. For policy outcomes this can be interpreted as the development of a skilled Welsh labour force with high productivity which will serve as an attraction to UK and foreign companies to establish operating plant in Wales (Schmuecker et al 2012).
WAG treats higher education with equal importance compared with primary and secondary education, but with a different emphasis, as evidenced by *Reaching Higher* (Welsh Assembly Government 2002). This different treatment originates in the belief that higher education makes a unique contribution to the development of special skills in the areas of health, and the physical and social sciences. Furthermore, it is asserted that the research output of Higher Education Institutions (HEIs) can contribute to technological change and innovation and is associated with the creation of clusters of specialised economic activity with high value-added output (*Reaching Higher* 2002: 6). In *Reaching Higher* the development and dissemination of knowledge is identified as a means for promoting the creation of new businesses and improving public services such as health and social care. The means to achieve this are considered to be by facilitating the development of a workforce with higher educational qualifications. It is the importance that WAG attaches to these policy goals that provide the justification for my inclusion of distinct variables in the empirical modelling reported below that are designed to evaluate the significance of higher education achievement in Wales.

There is evidence that WAG would like its education policy to be perceived as distinctive from Westminster education policy as an example of policy divergence between Wales and the UK. For example, In a speech delivered to the National Institute for Public Policy Research in December 2002 (Osmond 2004) the then First Minister, Rhodri Morgan, explicitly used Welsh
educational policy as a means of demonstrating policy differences between Cardiff Bay and Westminster. The quest and claims for distinctiveness seems to be a recurring theme in the education policy literature (Egan and James 2003; Phillips 2003; Rees 2002). However, distinctiveness is not desirable for its own sake but to address any shortcomings in education that contribute to Welsh economic underperformance and the attendant problems of unemployment, poverty and social need. The emerging character of education policy in Wales can be seen across the different levels of educational provision. For example, the 14-19 Learning Pathways Action Plan (Welsh Assembly Government 2006b) attempts to integrate academic learning and vocational skills and to broaden it through the Welsh Baccalaureate.

Welsh economic policy incorporates direct financial inducements to encourage increased participation in education. In further education (FE) and higher education (HE), part-time and full time Welsh students may be eligible to receive a means-tested Assembly Learning Grant. The recommendations of the Rees Review (2001) extended assistance for personal funding to those identified as being in hardship. A second Rees Review (2005) recommended that full-time students in Welsh HEIs should pay flexible top-up fees from 2007-08 and that Welsh students studying at Welsh HEIs should receive a (non means-tested) grant equivalent to any difference between existing fees and new fee levels. These changes were implemented and while WAGs ability to continue the future provision of such financial support is uncertain the present
policy does indicate a commitment to widening participation in higher education.

4.6 Conclusion: The Hollow Crown?
This chapter presents evidence that WAG policy-making like that of Westminster can be understood in terms of the idea of the ‘hollowing out’ of the state (Jessop 2002). Policy setting in devolved Wales is constrained by the UK devolution settlement and by the supra-national influence of the EU. The devolution arrangements, UK regional policy and EU regional policy provide policy continuity irrespective of whether Wales has been administered from Westminster or Cardiff Bay. However, policy continuity does not necessarily imply unchanged policy when making comparisons between its execution before and after Devolution. The concept of ‘filling in’ provides the rationale for expecting that the structure and exercise of local policy-making in Cardiff has the potential to produce improved results for Welsh economic development policy. This presents a paradox and a tension between the processes of ‘hollowing out’ as it is applied to WAG and the benefits of ‘filling in’ as the devolution programme continues to evolve. Nevertheless, independent Welsh economic policy may not exist in a real sense and may be more properly described as WAG administration of an inherited economic policy. As most of the influences on the Welsh economy are outside of the WAGs total control, policy-making in Wales can also be described as constrained optimization, where the constraints over-shadow the policy instruments. This insight perhaps
influenced the Holtham proposals that involve financing devolved government with a combination of a needs-based block grant and tax revenue levied by the WAG (ICFFW 2009). The adoption of the Holtham proposals would enhance the policy instruments available to the WAG to exert influence over economic development. However the task of implementing such radical reforms is considerable.

Examination of the literature suggests evidence of linkages between the quality of human capital and its achievement through education. Educational standards are also believed to be associated with the likelihood of successful entrepreneurship and innovation. Collectively, these precursors of development could be referred to as the basis for the knowledge economy (DTI 2003) and higher education is regarded as of particular importance in promoting the knowledge economy (Huggins and Izushi 2007; Olssen et al 2005). Education policy is one instrument over which WAG has complete control, but WAG education spending is also constrained by the overall limits to funding. In any case the value of a highly educated labour force may not be realized if economic development does not create employment opportunities that encourage skilled workers to remain in Wales.

It could be argued that, in spite of the formal process of devolution of power, we have seen more emphasis on the ‘hollowing out’ of Welsh policy-making than on the ‘filling in’. The recent expression of WAG economic policy in ERAND suggests that WAG is less confident in its ability to
bring about economic development through its own devices and is relying more upon partnership with the private sector and the targeting of scarce resources on a number of key sectors (ERAND 2010: chapter 7 and chapter 8).

In this chapter I have discussed the significance of economic policy for Welsh economic development, before and after Devolution. I have analysed the conduct of economic policy for the purpose of resolving the apparent paradox presented by the continuity of policy across Devolution, on the one hand and the expectation that WAG can have a more benign influence on the Welsh economy on the other. The conclusions of this analysis were that this apparent paradox can be reconciled by the organising concepts of ‘hollowing out’ and ‘filling in’. Specifically, that the partial transfer of power from Westminster to Cardiff Bay could be interpreted as the passing of the same policy tools to a different group of policy administrators. Elected representatives drawn from the constituency of Wales are expected to have greater local knowledge and engagement with Welsh issues. Consequently, decentralization by Devolution replaces decision-making and resource allocation of the sovereign state with sub-national governance and is expressed through the concept of ‘filling in’. In the next chapter the discussions of theory and policy that have been developed over the past three chapters are used to inform the methodology that will be used to undertake an empirical investigation of Welsh economic development.
Chapter 5

The Methodological Approach

5.1. Introduction

In earlier chapters I discussed theories of fiscal decentralization, economic growth and convergence and the manner in which they have influenced the formulation of economic policy in Wales. In this chapter I explain how the work I carried out in Part I informed the choice of methods for the empirical analysis I undertake in Part II of this thesis.

I begin in section 5.2 by discussing the role of empiricism within the economics discipline, and continue in section 5.3 by introducing the methods of analysis used to investigate growth and convergence. Section 5.4 explains how I apply these methods of analysis in this research. Section 5.5 discusses panel data methods of estimation and their use when augmented to take account of spatial effects. Section 5.6 establishes the econometric specification that is used in Part II. The data available for UK regional economic analysis and in particular that of sub-regional GVA introduces issues which affect the interpretation of the analysis and these are discussed in section 5.7. Section 5.8 concludes by drawing together the discussions of this chapter as a platform for the analysis that I perform in subsequent chapters.
5.2. Empiricism in Economics

The approach that I follow in my research is one of logical positivism. I regard social and economic phenomena as observable, quantifiable and understandable using value-free methods of analysis, and I assume that the analytical results of this analysis are suitable for the application of deductive and inductive logic (Boumans and Davis 2010). The claim that economics or the methods used in its investigation can be value-free is controversial. Economics as an academic discipline is sometimes described as positive economics (as opposed to normative economics) conveying the status of a scientific discipline. However, the demarcation between objectivity and prescription is blurred by the assumptions that individuals and companies behave to maximise utility and profit; and that economic growth is a desirable goal of government. In the analysis that follows in Part II I investigate the hypothesis that Welsh economic performance has been influenced by devolution as a question of positive economics.

The methodology employed in this thesis is a combination of inductivism and deductivism, for as was discussed in chapter 2, there is no theory that unambiguously leads us to expect a particular result for economic development as a consequence of a change in political governance. The methodology is inductive as it involves the interrogation of data using a number of statistical methods, seeking the idea for a hypothesis (Dow 2002). It may also be described as deductive because the theoretical underpinnings of this analysis suggest a number of hypotheses concerning the consequences of fiscal decentralization and growth
convergence associated with growth paradigms. Dow (2002) describes deductivism as an approach that requires the researcher to start instead with axioms which were taken to be true, apply deductive logic, and only then (but not necessarily) consult the data in relation to the propositions which emerge to see if they were consistent. Dow concedes that a strict delineation of inductivism and deductivism may be difficult to achieve, not least because it is questionable whether axioms that are not contestable and are self-evidently true, can be claimed at all for the social sciences. She escapes this bind by softening the required conditions for deductivism and invoking the hypothetico-deductive method that implies that the hypotheses from which theories are deduced are contestable and subject to periodic revision (Popper 2002). This is the methodological posture adopted in this thesis, as it was demonstrated in chapter 2 that the association between devolution of how budgets are allocated and economic growth is uncertain and ambiguous.

Inductivism represents the practise of making generalizations based upon observations or experiments (Boumans and Davis 2010). Within the economics discipline econometric research is often undertaken to investigate evidence of a statistical association between a phenomenon (such as economic growth) and factors that are thought to be important in encouraging or suppressing it. Success in econometrics is sometimes measured by the extent to which an estimated model corresponds with the hypothesis it was designed to test and is also supported by diagnostic testing. However, it is important to exercise caution when developing
conclusions and recommendations from regression results. The statistical data used for estimation in this research can be described as a single sample and it is possible that the data will be subsequently revised or that the use of data that will become available at a future date will not replicate the results reported in later chapters. For this reason, policy conclusions will be avoided in favour of objective statistical reporting and the implications of the research limited to conjectures concerning the association between Welsh economic performance and the independent variables that are thought to explain its behaviour.

Enquiry is often undertaken in economics using statistical analysis of secondary data employing econometric analysis and this is probably the most popular tool of empirical investigation. However scepticism concerning its use and abuse extends back to the late 1930s and its use is not uncontroversial (Garrone and Marchionatta 2004). It is claimed that Keynes doubted the legitimacy of inductive methods, in the form of correlation analysis applied to economic matters, because he believed economic systems to be unstable over the long term (Garrone and Marchionatta 2004). This scepticism concerning the use of inductive analysis in economics survives to the present day for other reasons. For example Leamer (1983: 36) argues that;

‘Economists have inherited from the physical sciences the myth that scientific inference is objective, and free of personal prejudice. This is utter nonsense. All knowledge is human belief; more accurately, human opinion’.
He concludes that, ‘the false idol of objectivity has done great damage to economic science’, and recommends practitioners to recognise when it is necessary ‘to make whimsical assumptions’ and ‘study the fragility of inferences’ (Leamer 1983: 43). Twenty five years after this paper was published, the suspicion around the use of econometrics remains for other reasons. Zelder (2008) has developed a game–theoretic analysis involving the interactions between authors of economic publications, economic journals and the economics profession, demonstrating that there are career incentives associated with reporting results that are biased towards those that are statically significant. Hendry’s (2000) contribution recalls Keynes’ aphorism that econometrics is statistical alchemy and acknowledges that economics, as for all social sciences, is denied objective experimental investigation. Hendry places faith in the idea that the three golden rules of econometrics are test, test and test (Hendry 2000). Nevertheless there is recognition that model-building can be difficult, and that one modelling strategy is for the model-builder to be pragmatic and ‘to obtain the most useful set of options for the decision-maker rather than the single ‘best’ model (Granger 2009). Certainly, a strict testing regime can be expected to improve the rigour of results, but this rigour can be no greater than the quality of the data as representative of the sample under investigation. For economic data and, more significantly, regional economic data, this is a major concern that I discuss in detail below.

5.3 Introduction to the Empirical Approach
Contemporary economic growth theory from the 1980s is more concerned with employing empirical investigation than was the case in previous years (Barro and Sala-i-Martin 1995). Empirical analyses are employed to test the predictions of growth theory that I explained in chapter 3; this involves testing the neoclassical growth predictions of unconditional and conditional convergence and those of endogenous growth theory that assign a role to government policy and, human capital in explaining economic growth.

The empirical methods adopted in Part II are consistent with the methods used within the economics discipline. The β-regression analysis that was developed by Baumol (1986), Barro and Sala-i-Martin (1992) and Mankiw et al (1992) has been adapted to regress average GVA per head on the initial level of GVA per head to estimate and test the hypothesis of unconditional convergence between Wales and the UK. This investigation is also augmented by adding other explanatory variables that enable the testing of conditional convergence. As this study is concerned with Welsh economic performance in relation to that of the other UK regions it is important to consider the possible influence of other regions on Welsh performance. This is accomplished by employing regional data over time to undertake spatial econometric analysis as has been undertaken for US states by Barro and Sala-i-Martin (1992) and Rey and Montouri (1999); the Canadian provinces by Coulombe and Lee (1995); the Columbian departments by Cardenas and Ponton (1995); and Mexican states by Mallick and Carayannis (1994).
Similar analysis of the regional economic performance in the UK has been undertaken by Chatterji and Dewhurst (1996) and Henley (2005). This present study uses the methods employed by the researchers cited above and extends the analysis undertaken for the UK by using data extended to 2008 and by scrutinising the data for evidence that the Welsh economy has benefited from Devolution.

5.4. Researching Growth and Convergence

Chapter 6 reports results that provide a high level analysis of the economic performance of Wales and the UK regions for evidence of economic change after Devolution. Analysing and comparing the distributions of income per head of Wales, Scotland and England is consistent with the expectation that Welsh economic performance continues to be influenced by its long period of integration in the UK economy. I examine the possibility that continuing inter-regional trade links that have evolved between Wales and other UK regions may still be instrumental in determining how the Welsh economy fares through the UK business cycle. The method to accomplish this analysis involves investigating changes in the distribution of countries’ GVA per head and by estimating beta convergence for descriptive evidence of convergence. This is complemented by investigating evidence of spatial correlation using Moran’s $I$ statistic.

The method employed in chapter 7 is an econometric investigation to determine if there is evidence of a change in Welsh economic performance after Devolution. This method is consistent with the idea of investigating an
endogenous growth model using independent variables that capture the Welsh Assembly Governments’ policy influence that was discussed in chapter 4. These powers enable the Welsh Assembly to exert influence through spending on economic development and improving human capital and are investigated in the econometric modelling.

Chapter 8 augments the estimation of absolute beta convergence undertaken in chapter 6 and the estimation of the endogenous specification of chapter 7 by including spatial effects that were also discussed in chapters 2 and 4. I continue below by discussing these methods in greater detail.

Researchers typically pursue the investigation of convergence using economic data of samples of countries and samples of regions within countries. However, the regions of a country often do not experience the same restrictions upon the mobility of labour, capital and technology as is often the case between countries and I conjecture that this suggests a hypothesis that economic development and convergence within countries will tend to be faster when compared across countries that are heterogeneous. Evidence of the mobility of labour in the UK is provided by analysis of intra-UK migration flows over the period 1975-2006. This suggests that total migration between the nations of the UK is growing on average by 600 per annum and that over this period Wales had the highest growth rate of migration (Biswas et al 2008). Nevertheless, while inter-regional mobility may be greater than cross-country mobility, inter-regional impediments may still exist. The inter-regional mobility of the factors of
production may be impeded by the problems imposed by different regional housing markets that result in large differences in the prices of similar houses in different regions (Cameron et al. 2006). Furthermore, growing cultural diversity and the polarisation of national identity that is associated with attempts to promote the greater use of the Welsh language and Gaelic in Scotland may reduce labour mobility. For example, in Wales the use of the Welsh language by public bodies is promoted by the Welsh Language Act 1993. The Welsh Language (Wales) Measure 2011 was approved by the National Assembly of Wales in February 2011 to modernise the legal framework of the 1993 Act. Nevertheless, in spite of these potential impediments to inter-regional mobility, evidence suggests that changing jobs between different regional labour markets is considered to be the most important reason explaining inter-regional migration (Dixon 2003).

Islam (1995) notes that within the Solow (1956) model, steady-state growth is determined by the exogenous rate of technological progress, and that consequently, provided that technology is a public good to be equally shared, all countries will eventually attain the same steady-state growth rate. Furthermore, the initial economic conditions and structural parameters of economies, representing such characteristics as: their degree of openness; the extent of democratic governance and the rule of law; the extent of compulsory education; the economic policy followed and the extent of fiscal decentralization and devolution are more likely to correspond across the regions of a single state. Nevertheless, the regions of a country are unlikely to be identical in all respects.
and these differences may introduce spatial frictions that impede factor mobility. For Wales, as explained above, prominent impediments between sub-regions may be represented by some sectors or employers’ use of the Welsh language, and differences in house prices and deficiencies in the transport infrastructure.

Convergence is not a discrete concept and consequently its empirical investigation is complex. Constantini and Lupi (2005) observe that, ‘most of the papers in this field [concerning the empirical investigation of convergence] tend to interpret the presence (absence) of convergence as a confirmation (falsification) of the validity of neoclassical economic growth theory’. These authors dispute the validity of the above conclusions, objecting that, theoretical models are often too vaguely defined to be tested, so that theory falsification is often impossible in practise. I would add to this the conjecture that the endogenous nature of economic growth means that econometric specifications will always be subject to omitted variable bias owing to the difficulty of identifying and measuring all the transactions that take place in an economy that may impact on growth prospects.

The empirical investigation of growth and convergence can be undertaken by examining data that is sampled as time-series, cross-section or panel data. Time-series analysis represents the investigation of single variables over time and benefits from focussing upon the dynamics of the convergence process of a single economy at the expense of cross-sectional information. It is not suitable for explaining a region’s growth performance relative to other regions. It is appropriate for investigating evidence that an economy is converging to a steady
state and comparing this with other regions’ convergence behaviour for evidence of club or pseudo-club convergence. The distinction between club and pseudo-club convergence is that for a number of economies (sovereign states or regions of a single economy) their apparent convergence to a common steady-state need not necessarily reflect club convergence; it may be a chance correspondence of their growth trajectories as opposed to one reflecting similar economic characteristics (Galor 1996).

Cross-section analysis compares different jurisdictions at the same point in time and consequently ignores the dynamics of the growth process. This is a fatal omission for convergence analysis as growth can only be investigated as changes over time. Additionally, restricting analysis to cross-section data severely limits the number of observations available to the researcher, for example, the cross-section analysis of UK regions limits the number of observations to twelve NUTS 1 non-English territories and Government Office Regions. The number of observations may be increased by further disaggregating regions into 37 NUTS 2 areas composed largely of a combination of counties, council areas and unitary authorities, and further disaggregation is possible into 133 NUTS 3 sub-regions. Disaggregation increases the number of observations available for statistical modelling but the results may be sensitive to the level of disaggregation chosen. Breaking up geographical areas according to administrative units may produce a spatial redistribution of the location of economic activity that generates different results for different levels of disaggregation.
Panel data analysis compares different jurisdictions over a changing time span and has the virtue of potentially capturing the differences in economic growth over space as well as the dynamics of growth over time (Hsiao 1985; Asteriou and Hall 2007). By creating a larger and richer dataset that straddles time and space, panel data is expected to benefit econometric analysis through facilitating, identification and discrimination between competing hypotheses (Hsiao 1985). For example, in this research it facilitates identifying the differences in the regions’ relative regional economic performance compared with regions’ spending on economic development and differences in the educational attainment of the regions’ working populations. Another benefit claimed for panel data analysis is its ability to reduce the effects of estimating relationships with omitted variables that may lead to biased coefficients. The practise of transforming observations by differencing or the inclusion of fixed effects may also contribute to the estimation of consistent values of the coefficients assuming that any omitted variables are constant over time. The inclusion of fixed effects results in a loss of degrees of freedom but avoids the loss of an entire cross-section observation that is the consequence of differencing (Hsiao 1985). However, the benefits of using panel data must not be exaggerated, as the efficacy of econometric modelling depends upon the validity of the assumptions implicit in the model, given that the real world is much more complicated than a model can allow for (Hsiao 1985).

The suitability of panel data analysis to analyse growth and convergence is demonstrated by Islam (1995) who investigates cross-country economic growth
conditional-convergence by analyzing differences in countries’ production functions as an explanation of convergence behaviour. For these reasons it was judged that panel data was suitable for the analysis that is undertaken in this thesis as it investigates the behaviour of Welsh economic performance over time in relation to other regions of UK.

Panel data, for this study, represents observations of the UK regional economies at several points in time and the analysis benefits from an increase in the number of observations (Durlauf et al 2005), a reduction in the likelihood of collinearity and may lead to more accurate parameter estimates (Hsiao 2010). This is particularly important for this research as (in terms of economic development) little time has passed since Devolution, and restricting the data to comparisons between England as a single state and Wales would involve undertaking analysis with inadequate degrees of freedom. Disaggregating England into regions creates a richer data-set that captures regional differences in population and economic clusters.

The econometric specification that is derived for empirical estimation is designed to be consistent with the theoretical specification. For example, the hypothesis of conditional convergence represents a weak form of convergence inasmuch as it does not predict convergence between regions to a common growth path and may be appropriate as an explanation for UK regions’ past economic performance. Since the industrial revolution UK regions have exhibited regional specialization (for example, coal and steel production flourished in South Wales
and the North; shipbuilding was a major employer in Glasgow and Tyneside) that persisted into the middle of the 20th century and the structural change of regional economies may have proceeded at different rates (see Robson 2011, for an empirical analysis of the effects of employment specialisation on regional labour market performance). This suggests that there is limited expectation of systematic lagged effects, a fortiori, given that I am investigating relative effects specified as Welsh economic performance in relation to the other UK regions. Also the integrated nature of the UK economy suggests that regional-specific effects should not lead to significant differences between regions’ performance arising from variations in variables such as labour, capital or technological change. However, in chapter 3 it was found that endogenous growth theory does suggest the possibility of regional variations in policy variables such as education and local public spending that may give rise to regional differences in performance, and these will be investigated in Part II of this research.

5.5 The Estimation of Panel Data Models
The long period of time over which the Welsh economy was integrated with the UK economy suggests that the analysis of the Welsh economy should be undertaken along with the other UK regional economies to test for interregional effects. This may be accommodated in the empirical analysis using the panel data method that combines cross-section and time-series analysis.
The conventional approach to testing for convergence in the 1980s and 1990s was to estimate econometric specifications of cross-country models using regression analysis (Durlauf et al. 2005). A statistical regression was performed using the growth in income per head for a set of countries as the dependent variable and a single country’s per capita income at some initial time as the independent variable. This specification was often estimated as a double logarithmic transformation and if the coefficient on the independent variable was negative and statistically significant it was interpreted as the rate of convergence. This is the specification that I use to estimate beta convergence for the UK regions in chapter 6.

Following Notarstefano and Scuderi (2006) this can be written as:

\[
\frac{1}{T} \left( \log(Y_{i,t}) - \log(Y_{i,t+T}) \right) = \alpha - \frac{1}{T} (\beta \log(Y_{i,t}) + \Psi X_{i,t} + \epsilon_{i,t+T})
\]  

(5.1)

Where \( y \) is income per head, \( X \) represents a vector of conditioning variables thought to be associated with economic growth and \( \epsilon \) is a random error term. Without the variable \( X \) this expression represents the neoclassical hypothesis of exogenous growth and absolute convergence (Baumol 1986). The addition of \( X \) is consistent with the notion of endogenous growth and conditional convergence as it permits the addition of variables, such as education and training, through which government and the private sector may influence economic activity and growth (Barro and Sala-I-Martin 1992; Mankiw et al. 1992).
In chapter 2 I presented superficial evidence suggesting that the Welsh economy has not converged towards the average of the UK in terms of GVA per head or growth rates over the last century. It was also noted that for at least the last 100 years, the Welsh economy has been integrated into the economy of Great Britain and that it is difficult to argue that the determinants of growth in Wales are different from those in other territories of the UK.

As noted in chapter 3 and following Durlauf et al (2005: 28) the basic (Solow-Swan) growth model implies:

\[
\log Y_{i,t}^E = (1 - e^{-\lambda_i}) \log Y_{i,\infty}^E + e^{-\lambda_i} \log Y_{i,0}^E
\]

(5.2)

where \( Y_{i,\infty}^E \) is the steady-state value of \( Y_{i,t}^E \) and \( \lim_{t \to \infty} Y_{i,t}^E = Y_{i,\infty}^E \); \( \lambda_i \) measures the rate of convergence of \( Y_{i,t}^E \) to its steady-state value.

The equation can be interpreted as showing that for any given economy the steady state value of output per unit of labour, adjusted for technology and in the long run in the limit \( \lim_{t \to \infty} Y_{i,t}^E = Y_{i,\infty}^E \) will approach its steady state value according to \( \lambda_i > 0 \), and will depend upon the model parameters: the efficiency of labour and technological process. The implicit assumption in this expression is that the unit of analysis, an economy, is unique and independent. Durlauf et al (2005) proceed to show how this expression can be used to derive, the basis for describing the dynamics of growth, namely:
Chapter 5: Methodology

\[ \gamma_i = g_i + \beta_i (\log Y_{i,0} - \log Y_{i,\infty} - \log A_{i,0}) \]  
(5.3)

Where

\[ \beta_i = -t^\lambda (1 - e^{-\lambda t}) \]  
(5.4)

Equation (5.3) decomposes growth \( \gamma_i \) into, \( g_i \), growth due to technological progress, and a second expression in which growth is derived from labour output per head approaching its steady state value in which \( A_{i,0} \) represents the efficiency level of each worker (Durlauf et al 2005). The same authors then invoke the restrictive assumptions that ‘the rates of technological progress and the \( \lambda_i \) parameters are constant across countries, i.e. \( g_i = g \), and \( \lambda_i = \lambda \forall i \) enabling (5.3) to be rewritten as

\[ \gamma_i = g - \beta \log Y_{i,\infty} - \beta \log A_{i,0} + \beta \log Y_{i,0} \]  
(5.5)

Equation (5.5) is a standard cross-country growth regression that is the foundation of the empirical growth literature (Durlauf et al 2005) and is estimated with a random error term \( v_i \)

\[ \gamma_i = g - \beta \log Y_{i,\infty} - \beta \log A_{i,0} + \beta \log Y_{i,0} + v_i \]  
(5.6)

This expression cannot be estimated and tested in its current form as \( \log Y_{i,\infty} \) and \( \log A_{i,0} \) are unobservable.
Mankiw et al (1992) explain growth by employing a Cobb-Douglas production function of the form

\[ Y_{it} = K_{it}^\alpha H_{it}^j (A_{it} L_{it})^{1-\alpha-j} \]  

(5.7)

In which physical capital \((K)\) and human capital \((H)\) accumulate according to

\[ \dot{K}_{it} = s_{K,i} Y_{it} - \delta K_{it} \]  

(5.8)

and

\[ \dot{H}_{it} = s_{H,i} Y_{it} - \delta H_{it} \]  

(5.9)

Where the dots denote time derivatives, \(s_{K,i}\) represents the saving rate for physical capital and \(s_{H,i}\) the saving rate for human capital and \(\delta\) denotes the contextual depreciation rate. This is a mechanistic interpretation of capital replacement and accumulation that implicitly assumes a stable relationship between savings behaviour and the depreciation of capital. Using this result it can then be shown that (Durlauf et al 2005)

\[ \gamma_i = g - \beta \log A + \beta \log Y_{i,0} + \]  

\[ \beta \frac{\alpha+j}{1-\alpha-j} \log(n_i + g + \delta) - \beta \frac{\alpha}{1-\alpha-j} \log s_{K,i} - \beta \frac{j}{1-\alpha-j} \log s_{H,i} + \epsilon_i \]  

(5.10)
Where \( n \) is population, \( g \) measures growth due to technological process and \( \delta \) denotes the depreciation rate. The savings rate for physical capital can be understood by appealing to the theory of loanable funds in which savings are recycled by the financial sector at a price determined by its scarcity, and the demand for investment funds is determined by expected rates of return in relation to risk-taking. The savings rate for human capital and the resulting investment is less straightforward owing to the separation between investors (parents and/or state) and recipients. The state sector recycles compulsory savings as taxes that may not result in equal returns to capital between regions and may consequently disadvantage some households. The devolution of UK territories can be understood as a way of ameliorating this possibility.

This formulation can be used to estimate beta convergence or can be augmented by other variables to take account of country-specific influences, i.e.

\[
\gamma_i = g - \beta \log A + \beta \log Y_{i,0} + \\
\beta \frac{\alpha + j}{1 - \alpha - j} \log (n_i + g + \delta) - \beta \frac{\alpha}{1 - \alpha - j} \log s_{K,i} - \beta \frac{j}{1 - \alpha - j} \log s_{H,i} + \pi Z_i + \epsilon_i
\]

(5.11)

where \( Z \) represents conditioning variables to explain regional variations in performance.

It is worthy of note that Durlauf et al (2005) begin by referring to ‘economies’ (page 28), and then change to ‘countries’ (page 30) as though the terms are interchangeable. This assumption is non-trivial as the independence (in
methodological terms) of an economy cannot be taken granted for countries and, *a fortiori*, for regions of a country. Countries are typically not economically independent as they may import and export raw materials, semi-finished goods and finished goods exposing them to the vagaries of other countries’ prospects and international trading conditions. This inter-dependency is likely to be more pronounced for regions within national economies, which may be exposed to both international linkages and national inter-regional linkages (Allen *et al* 2004). The integrated nature of the UK economy and the associated mobility of technology and labour, suggest a lesser role for these variables in explaining relative regional differences. Furthermore, they may not be of equal importance: I conjecture that labour market and private household frictions are likely to have a more pronounced effect upon the mobility of labour as these are private household costs, than the relative immobility of capital and technology that is ameliorated by the greater resources of the corporate sector.

Chapters 2 and 4 also discussed the importance of possible spatial factors such as regional variations in the mobility of inputs in explaining regional disparities in economic performance. Regional variations in the mobility of inputs may be included in the modelling strategy through incorporating spatial effects in the model specification and this method is undertaken in chapter 8. The use of panel data methods incorporating spatial analysis represents an innovation in the study of regional economic convergence. Taking explicit account of space is justified where the geographical location of assets or activity contributes towards
an explanation of economic behaviour. For example, house prices may vary owing to their postal code independently of their age, size and condition, and house prices in turn ration the locational choice of households by wealth and income. Spatial dependence may occur on account of location at a particular point in space or the location at one point in space in relation to another point in space. For the purpose of this research, acknowledging the integration of the UK economy together with regional specialization suggests that it is appropriate if not necessary to assume economic spatial dependence. In short, the demand for factor inputs and final goods in some areas will depend upon the economic activity evolving in other areas. Consequently, the chosen modelling strategy has to take account of spatial heterogeneity since the model parameters will vary across regions depending upon their location.

Following Elhurst (2003) a general panel data specification can be written as:

$$Y_{it} = \beta_1 X_{i1t} + \beta_2 X_{i2t} + ... + \beta_k X_{ikt} + \epsilon_{it}$$

(5.12)

Where $i = 1,\ldots,N$ refers to spatial units, $t = 1,\ldots,T$ refers to the time period, the $\beta$’s are fixed but unknown parameters and $\epsilon_{it}$ are error terms assumed to have zero mean and fixed variance.

One method of incorporating spatial effects when data are sparse is to introduce a variable intercept $\mu$ representing the effect of the omitted variables that are peculiar to each spatial unit considered (Elhurst 2003) i.e.:
In this specification the estimated coefficients of the regional dummies would capture all of the heterogeneous regional behaviour that was not explained by the explicit independent variables. This thesis estimates a model with spatial effects to investigate if there is evidence that Welsh economic performance relative to that of other regions is influenced by the integrated nature of the UK economy. Integration in this sense means that there will be spatial interdependences and spillover effects manifest in changes in economic activity in one region resulting in changes in other regions. This model specification would involve using a dummy variable for each region that would capture region-specific effects. Evidence supporting this hypothesis will suggest that Welsh economic autonomy is illusory and that its development may well continue to be connected and dependent upon the economic activity and performance of other UK regions. Consequently, the economic policy of the WAG to achieve economic convergence in both levels and growth rates might well be constrained until such time that Welsh economic development achieves an integrated Welsh economic structure capable of growth independent of other UK regions. In chapter 8 I re-estimate the values of absolute beta convergence that were undertaken in chapter 6 by investigating the possibility of spatial autocorrelation. I test for the presence of spatial correlation before and after Devolution by partitioning the data into two time-series. Data for the years 1995 to 1999 and for 2000 to 2008 are used to investigate the presence of
spatial effects using a Welsh-UK contiguity matrix and also using a Wales-outer periphery contiguity matrix. The following section 5.6 expands on the specific approaches used for this and the previous analysis outlined above.

5.6 The Econometric Specification Used in this Research

My discussion in chapter 2 argued that under the present devolution arrangements the Welsh Assembly Government derives its potential influence over economic development in Wales primarily through the allocation of its budget. Furthermore, in chapter 3 I found that the theoretical framework of endogenous growth acknowledges public spending on economic development and education and training as drivers of growth. However, the relation between public spending and growth, for whole country economies, is uncertain (Folster and Henrekson 2001; Bleaney et al 2001; Moreno-Dodson 2008). For UK regional economies this uncertainty is compounded because of the separation of revenue from general taxation using the Barnett formula, and spending decisions that are taken by regional or devolved government.

Consistent with the discussion presented in chapters two and three, I estimate an econometric specification in chapter 7 to test for evidence of endogenous growth in explaining Welsh economic performance relative to other regions of the UK. The quantitative analysis is conducted using data for the regions of the UK (excluding Northern Ireland) at the NUTS 1 level of disaggregation for the period 1995 to 2008. I examine the association between the
ratio of Welsh economic performance relative to that of each other region, the ratio of Welsh public spending on economic development to that of each other region and the ratio of Welsh educational attainment of the labour force relative to that of each other region. The models that are estimated in Part II of this research represent functional specifications to test for these influences. Welsh relative economic performance is explored by developing a specification in which all variables are presented as ratios; the dependent variable is the ratio of Welsh GVA per head to that of each NUTS 1 region in the UK, and the independent variables are the corresponding ratios of public spending upon economic development and a measure of the educational attainment of the labour force.

The base model estimated is:

\[ Y_{it} = a + b_1 Y_{it-1} + b_2 PE_{it} + b_3 E_{it} + b_4 DD_{it} \]  \hspace{1cm} (5.14)

where:

- \( Y \) is the ratio of Welsh GVA per head to that of each of the English regions and Scotland

\[ \begin{pmatrix} \frac{GVA_{Wales,t}}{GVA_{Regioni,t}} \\ \frac{GVA_{Wales,t-1}}{GVA_{Regioni,t-1}} \end{pmatrix} \]

- \( a \) is the constant

- \( i \) is the region index

- \( t \) is the year index

- \( Y_{it-1} \) is a lagged dependent variable
PE is the ratio of Welsh public spending on economic development to that of each of the English regions and Scotland

$$PE = \frac{\text{Spending on Economic Development}_{Wales,t}}{\text{Spending on Economic Development}_{\text{Region}_i,t}}$$

$E$ is the ratio of Welsh educational achievement in the labour force to that of each of the English regions and Scotland

$DD$ is a dummy variable that takes the value of 0 before 1999 and takes the value 1 from 1999 and after.

The inclusion of a lagged dependent variable will introduce problems through correlation between it and the error term even if fixed effects estimation is used (Nickell 1981). One approach to address this problem is to first-difference the data and replace the lagged and first-differenced variable $\Delta y_{it-1}$ with an instrument and use an instrumental variable estimator. In practice instruments are hard to find and would result in a loss of observations; it has been suggested that an estimation technique involving a mixture of fixed coefficients and random coefficients would be suitable (Weinhold 2004). In the analysis I undertake I judge that it would be inappropriate to use random effects as this contradicts my hypothesis of a systematic relationship between regions’ economic performance and inter-regional effects. Consequently, the analysis is undertaken using panel least squares and I will also report an experiment to determine if the results would be influenced by an alternative estimation technique such as Generalized Method of Moments.
Growth performance in each year is related to previous years as economic agents have memories and accumulate experience while economic infrastructure may deteriorate or be augmented by policy intervention. Keele and Kelly (2006) indicate that while the use of a lagged dependent variable is not universally appropriate its use is advocated when the process is ‘strongly dynamic’. The inclusion of a lagged dependent variable has some interesting consequences: a one unit increase in $PE$ leads to an increase on $y$ in the current period of $b_2$; an increase of $b_2b_1$ in next period; an increase of $b_2b_1^2$ in the following period and so on. When $b_1 < 1$ the total impact of changes in $PE$ over current and future periods is the sum:

$$b_2 \left(1 + b_1 + b_1^2 + b_1^3 + \ldots \right) = \frac{b_2}{1 - b_1} \quad (5.15)$$

This is the sum of an infinite geometric series that can be generalised as:

$$b_2 \left(1 + b_1 + \ldots + b_1^k \right) = \frac{b_2 (1 - b_1^{k+1})}{1 - b_1} \quad (5.16)$$

This means that at time $k$, the percentage of the public spending (or education) effect upon $y$ will be:

$$100(1 - b_1^{k+1}) \%$$

and the time required for 95% of the impact of public spending to be realised will be

$$K = \frac{(1 - 0.95)}{(b_1)} - 1 \quad (5.17)$$
If we were estimating a cross-country regression we would incorporate other determinants of growth (for example, the ratio of private sector investment to GVA). These data are not available at the regional level and are potentially misleading explanatory variables because decisions to invest regionally are not necessarily made in the region in which the investment is undertaken. Also excluded from this regional analysis is the practice in cross-country analysis of including initial conditioning variables that take account of differences in the starting conditions between countries at the start of the estimation period. The treatment of initial conditions in the literature is questionable because it is ill-defined and sometimes used synonymously for initial income (see for example Durlauf et al (2005), who begin their exposition using the term ‘initial conditions’ and then use the qualifier for a number of parameters without discussion). The data used for estimation in this analysis are discussed in detail in chapter 7.

The variable $DD$ is the devolution time dummy that is designed to identify the effects of devolution. It can be introduced into the equation as a constant dummy and as a slope dummy to estimate the effects of devolution on each of the independent variables. It takes the value of zero before Devolution and the value of 1 after Devolution and if the estimated coefficients are statistically significant can be used to compare the estimated regression intercepts and slope before and after Devolution. However as is explained in greater detail in chapter 7, a single time dummy representing the year of Devolution is a blunt instrument to measure the effect of Devolution on economic performance. This is because the
change in Welsh governance has provided opportunities for policy intervention by
the Welsh Assembly. To test for the possibility of subsequent policy influences
additional dummy variables are used.

There is a problem with this specification insofar as while economic growth
may be influenced by educational qualifications and public spending, there are
likely to be other factors affecting both the dependent variable and the
independent variables. Furthermore, the direction of causation between the
hypothesized dependent and independent variables is ambiguous. Economic
growth is likely to influence and be influenced by the uptake of education and by
the funds available for spending on economic development. This means that the
OLS assumption of parameter independence may be violated and if so there will
be bias in the regression. Diagnostic testing will be undertaken to detect the
presence of violations of the OLS assumptions and the appropriate corrective
response.

I introduce regional interaction into equation (5.14) by using a contiguity
weights matrix that was used to estimate absolute beta-convergence above.

Consequently, equation (5.18) is adjusted to estimate and test for a Welsh
endogenous growth relationship with spatial autocorrelation as follows:

\[
\hat{Y}_i = \hat{\alpha} + \hat{\beta}_1 Y_{i-1} + \hat{\beta}_2 PE_i + \hat{\beta}_3 E_i + \hat{\beta}_4 DD_i + \hat{\beta}_5 WY_{i-1}
\]  
(5.18)
where $W$ represents the weights matrix.

In the analysis that follows in chapters 7 and 8 the econometrics software package EVIEWS 6 was used to estimate panel data least squares specifications of equation (5.14) and (5.18). Panel data modelling can be represented using the classical regression model as

$$Y_{i,t} = \alpha + \beta x_{i,t} + \epsilon_{i,t}$$  

(5.19)

where $i = 1, \ldots, n$ and represents the cross-sectional data and $t = 1, \ldots, T$ giving each (in my case, UK region) a time dimension. The absence of subscripts attached to $\alpha$ and $\beta$ in this formulation means that referring to the constant and slope parameters they will be the same for all units and for all years (Asteriou and Hall 2007). I could choose to estimate a different value for $\alpha$ and $\beta$ for each region denoted by attaching subscript $i$ to each, suggesting the hypothesis that the constant and slope parameter should differ by region, but my hypothesis in this work is that there is a systematic and observable data generation process that can be distinguished from the background noise. Allowing the constant to vary over each cross-section datum is referred to as a fixed-effects estimator and can be performed by a data transformation involving the observations for each individual have subtracted from them the averages of all the observations for that individual (Kennedy 2003). The use of fixed effects modelling is particularly indicated when the regression analysis is limited to a precise set of individuals, firms or regions.
Chapter 5: Methodology

(Arbia and Piras 2005). Since my analysis focuses upon 12 NUTS 1 regions of the UK excluding Northern Ireland I have elected to estimate a fixed effects model.

Recalling the discussion of economic policy developed above in chapter 4, the investigation of period-specific effects is warranted as a means of testing for evidence of the various policy initiatives that have been undertaken by the WAG. This will be accomplished in two ways: firstly by estimating a specification that accounts for period-specific effects without the use of a period dummy to avoid problems of collinearity and also by estimating a cross-section fixed effects model including period dummy variables that are introduced to coincide with the timing of the policy initiatives. The use of dummy variables in the analysis takes account of the Devolution event and the changes in policy that have occurred since 2000.

An alternative approach would be to accommodate different intercepts by a random-effects model that assumes different intercepts that are randomly selected from a normal distribution (Kennedy 2003). I assume that UK regions will share a common constant term in the estimated regression on account of the integrated nature of the UK economy that has evolved historically. For researchers looking at cross-country variations in economic performance or income per head, this assumption would be questionable and I would not expect to estimate a common constant or slope coefficient.

Recalling equation (5.1) above, I can make explicit the distinction between cross-section and period-specific effects by rewriting it as:
This specification can be estimated using OLS estimation but may produce biased estimates on account of combined heteroskedasticity and serial correlation. The former refers to changes in the variance of the regressions error term and serial correlation also known as autocorrelation, exists when there is correlation in the error process over time. The presence of either problem undermines the integrity of the classical linear regression model by producing biased regression estimates. The assumed interdependence of UK regions suggests the level of and changes in economic activity in some areas affects and is affected by activity in other sectors. This has implications for econometric testing by challenging the classical assumptions that the explanatory variables are independent and that the disturbances should have a constant and equal variance. This problem is ameliorated by specifying and estimating the growth relationship in ratios as was explained above. Additionally, it is relevant to investigate variations in Welsh economic performance relative to other regions over time using a one-way fixed effects model, by allowing the estimated intercepts to differ over time but not over cross-sections. The results of this analysis are also reported in chapter 7.

5.7 Data Limitations
I described in chapter 3 how the WAG began by framing policy in terms of targeting relative GVA per head and how subsequently there has been a loss of
confidence in using that measure of relative regional economic performance. The production of UK regional GVA estimates is a complex undertaking that has implications for its use as regional economic data for the purposes of understanding and modelling the economic performance of UK regions (Office for National Statistics (ONS) 2009). That such data is often the basis for formulating policy and evaluating its consequences makes it politically sensitive. Estimates of GVA, for example, are used by the EU to determine the eligibility of EU regions receiving EU Structural Funds and to measure the economic convergence of member states. Furthermore research that undertakes the modelling of regional economic performance will be sensitive to the methods of data collection and its treatment. As this present research is primarily an empirical exercise it is important that a full explanation is given of the variables used and the data used. The results that are reported in Part II depend upon the appropriate selection of variables and data and also upon the limitations of that data. It is the purpose of this section to explain the data used in the empirical analysis and to permit the results reported and discussed to be qualified by knowledge of their shortcomings.

Workplace based GVA is a macroeconomic indicator of the economic output of an administrative area in which commuters work. It represents the value added to the inputs used to produce goods and services by organisations of an area before depreciation or capital consumption. It is equal to GDP plus subsidies and less taxes, and within the UK, comparisons between the economic
performance of regions is undertaken using GVA per head to enable consistency with the European System of Accounts (ESA) that is used by EU members (ESA 1995). The UK regional GVA figures are based upon the income measure that represents the income of those employed plus income from self-employment (together referred to as compensation of employees COE), the gross operating surplus of corporation (GOS) and taxes on production (ONS 2008). The estimates are constructed from ten different data sources: five are used to estimate employees’ incomes, six are used to estimate GOS and four are used to estimate taxes (ONS 2009). The large number of data sources, mostly using survey methods, introduces numerous possibilities for erroneous statistics. The ONS admit that it expects errors to be inherent in the production of the estimates and employs a five period moving average smoothing process to reduce the year by year volatility (ONS 2009). Without specific knowledge of the distribution of errors between surveys and over time it is difficult to determine the effect of the ONS data smoothing on the analysis which follows. The consequences of the smoothing will depend upon the unknown nature of the errors over time and between regions, and is effectively unknown; it means that the analysis undertaken later must be regarded as subject to qualification on account of the limitations of the data used. The smoothing process employed by ONS will have the effect of narrowing the range of the estimates over time and make it more difficult for the regression process used later to detect changes comparing one year with another. It will dampen the range of nearby annual estimates and may
conceal errors that introduce uncertainty into the diagnostic procedures and of the validity of the estimates. An indication of the magnitude of the problem is provided by perusal of the extent of past data revisions to regional GVA between 2004 and 2006 that the ONS have estimated was between -1.5% and 2.8%.

Another source of concern is that GVA is derived from estimates of GDP that are suspected of being inaccurate on account of the non-reporting of economic trading to evade direct and indirect taxes (Parker 1990). Estimates of the regional distribution of such tax evasion are not available but if the regional distribution of evasion was proportionate to income it might have little effect upon regional relativities. However, the incentives to evade the payment of taxes may be different through the distribution of income. Low income households have an incentive to conceal earned income if receiving social benefits and to avoid payment of direct and indirect taxes. High income households have an incentive to avoid or evade tax payments resulting from high marginal rates of income tax. However incentives exist to limit tax payments across the entire range of income and across all regions and it is not possible to speculate on the regional distribution of tax avoidance or evasion. Wales is in the lower end of the range of regional income per head and if tax evasion is relatively higher, the official figures of Welsh GVA per head are biased downwards and will exaggerate the apparent under-performance. Other reasons for the underestimating of income and output are well recognised, in theoretical terms, and relate to activities that are (legally) undertaken outside the non-traded sector of the economy. Within this category
can be included voluntary work, work undertaken by households on their own account, and informal barter arrangements.

For the purpose of assigning economic activity amongst the regions the UK is divided into a number of administrative categories that are defined in terms of population and administrative regions using the EU NUTS classification system. NUTS areas are created at three geographic levels: NUTS 1 is composed of the devolved regions, each of the nine Government Offices of England and offshore activities that are assigned as extra-regional; the onshore regions are further divided into 37 NUTS 2 areas that represent groups of unitary authorities and counties. NUTS 2 areas are also broken down into individual counties and groups of unitary districts that are known as NUTS 3 sub-regions (ONS 2009).

Spatial economic analysis can be undertaken at any of these geographical levels. Econometric analysis benefits from a greater number of observations offered by NUTS 3 data, however, the ‘cascading’ apportionment of GVA estimates from NUTS 1 through to NUTS 2 and 3 using survey data at each level raises the possibility of errors accumulating at each stage of the process resulting in larger errors at NUTS 3 than at NUTS 1. There is no empirical data to verify or quantify this possibility but it must be recognised as a further potential data problem when considering the results of the empirical analysis.

A further problem that exists is that the creation of regional geography using administrative units provides no guarantee that there will be a correspondence between the boundary of an area of economic activity and a
Chapter 5: Methodology

NUTS boundary. The importance of this distinction has led to the use of the term *functional economic areas* to be used to refer to the areas where economic activity takes place (Coombes et al 1986; Casado-Diaz 2000; Anderson 2002). This means that there may be an arbitrary allocation of capital and the working population between adjoining NUTS regions. Economic activity may be attributed to the domicile population or the working population. ONS explicitly assume that there is significant commuting in the ‘home counties’ but it must also be noted that the potential for a discrepancy between GVA based on the domicile population and GVA based on the working population increases as the level of geography becomes smaller. An additional source of inaccuracy arises from the (arbitrary) apportionment of economic activity that takes place outside of the national boundaries or extra-regio and is then allocated to NUTS 1 regions. These include offshore oil and gas activities, UK embassies and HM forces overseas (ONS 2009).

Another issue concerning the use of regional and sub-regional GVA data relates to adjusting the data for local price variations. Economic theory suggests that differences between regions in the pace of economic activity will result in regional variations in the demand for factors of production and their prices. There is evidence that these differences are significant: information from the Land Registry reports that in August 2010 the average value of houses in Surrey was more than twice as high as the average house price in Northumberland. The ONS estimated consumer prices for English Government Office Regions in 2004. The application of these regional price indices to GVA per head in 2004 suggests that
real GVA was highest in London and exceeded the real GVA per head of the North East by 62.7% compared with a difference of 89.4% in nominal terms (Wingfield et al 2005). Variations in inflationary pressure between regions will distort the interpretation of relative economic performance. Regions or sub-regions with higher inflation will appear to have higher growth than regions with lower price inflation. This may result in exaggerating the differences in growth when comparing Welsh economic growth with that of more successful regions. In the UK there are no official regional price deflators but a private company (Croner Reward 2006) publishes cost-of living indices for the UK standard regions that have been used to rebase the official NUTS 3 GVA per head estimates to a 1995 base and is used in this analysis. There are shortcomings with this approach: the indices for each region are constructed by surveying a sample of goods in a sample of shops in a sample of towns in each region. The number of towns sampled in each region differs and can be as low as four or as high as twenty three, while the number of towns sampled in some regions has changed over time. Additionally, the price indices for Wales are calculated by sampling in four towns in South Wales and do not reflect prices in the North or East of the country.

The analysis undertaken in Part II also incorporates the use of statistics of educational achievement as a proxy for changing human capital. The data does not distinguish between the subject areas of degrees or the awarding institution and therefore assumes that all awards are homogenous as investments in human capital. Additionally, a breakdown of the working population in Wales by
industrial sector may reveal a bias in the distribution of the educationally qualified in favour of working in the public sector, as employment in the Welsh public sector is disproportionately high when compared with other regions. In short, a general index of academic achievement may be too coarse to explain the evidence of persistent deterioration of the Welsh economy and this analysis would benefit from using disaggregated measures of education in the workforce together with the disaggregation of industrial sectors. It should also be noted that the definition of the educational data used by the UK Office for National Statistics (ONS) changes during the period of this study. Prior to 2001, higher education qualifications were defined to be qualifications above GCE A level or equivalent, and from 2001 the data is ordered into seven strata of qualifications of the National Qualifications Framework (NQF); namely, no qualifications, below level 2, level 2, level 2+, level 3, levels 4-6, and level 4+. The data from 2001 reflects the category of those qualified to NQF level 4 (which includes NVQs at level 4, Key Skills level 4 and Certificates of Education) and above and does not correspond exactly with the data of the previous period.

The data used in the empirical analysis also makes use of regional expenditure on economic development. Differences in the funding of the UK regions can be associated with their administrative structure as some rural English regions are based upon two tiers of administration comprising county councils and district councils; outside of areas designated as rural, local governance is based upon single-tier authorities (Adam et al 2007). This means that in my
analysis English regions are not strictly homogeneous and this may have implications for the allocation of expenditure within the two groups. The existing structure for local administration in England was introduced during 1996-1998 in response to the 1992 Local Government Act. Local government in England was reorganized again in 2009 and therefore comparisons of local authority behaviour before and after these dates may give rise to some inconsistency. However, the major difficulty originates from the constraints imposed upon English regions’ spending as some 30% is ring-fenced for use in specific services that exclude economic development (Department for Communities and Local Government 2010). The public spending data that is used in the analysis that follows was created from various editions of Public Expenditure Statistical Analysis prepared by HM Treasury and published by National Statistics. For this analysis, the spending per head of each region was calculated as the sum of current and capital spending on enterprise and economic development; science and technology; employment policies; agriculture, fisheries and forestry; transport and education and training. The choice of categories was made in recognition of the direct relation between these categories and economic activity; in contrast, other expenditures, such as those on public order and safety and social protection were omitted since their impact on economic activity is judged to be indirect (Irmen and Kuehnel 2008).

The justification for summing current and capital expenditure is to take account of the total resources expended in pursuit of economic development. An
accounting separation of current and capital expenditure is unnecessary as an estimate of the true opportunity cost of public spending choices. For example, current expenditure may be likened to spending on variable factors of production while capital expenditure represents the accumulation of fixed assets. Together they represent joint inputs within the notional production function that must be used together, such as schools and teaching staff. The summing of current and capital expenditure may introduce problems in comparing regional incomes over time if there is a significant difference between regions’ investment in capital. Regions that invest more in capital may have to wait longer to experience the benefits of their investment, so in terms of an econometric specification, different regions may display different lag structures relating income per head to spending on economic development. There is no theoretical expectation as to how this may influence the lag structure and I have employed a data-driven method to assist the choice of the lag structure to be estimated.

The expenditure classifications excluded from the public spending variable were general public services; international services; public order and safety; environmental protection; housing and community amenities; health, recreation, culture and religion; and social protection. The justification for their exclusion is that it is hypothesised that decisions regarding the budget allocations of these items is not undertaken with the direct intention of stimulating economic activity. Nevertheless, it is recognised that spending on health may affect the quality and availability of human capital but that it would be very difficult to identify these

243
effects within the total spending on health care (for a discussion of the significance of health for economic activity in the EU see Suhrcke 2005).

5.8. Conclusion

In this chapter I discussed the methodological approach of my thesis and the methods that I use to undertake the empirical analysis of my research questions. Economics is a social science that has always aspired to be as objective as the physical sciences, and adopt a positive stance towards the nature of truth. However, the difficulty of applying experimental methods within the social sciences and the reliance upon secondary data have coloured economic empiricism with scepticism. Nevertheless the primary method of choice is econometrics that is used to build and estimate economic models to test economic hypotheses.

There is a rich literature reporting the use of econometric methods to investigate economic growth and convergence between different countries. However there is little empirical work exploring growth and convergence between the regions of a sovereign territory such as the UK or the impact of devolution on regional growth and convergence. This research addresses this lacuna and I use panel data to investigate the effect of devolution on Welsh regional economic growth. I developed econometric model specifications that I use to test for evidence of economic convergence as a consequence of devolution. The data used in the analysis that follows is consistent with theory and I have made explicit the
limitations of the data which permit a balanced interpretation of the empirical results. In the next chapter I commence the empirical investigation by analysing summary statistics for evidence of convergence as a prelude to estimating the econometric specifications described above.
Part II. Devolution and Economic Growth
Convergence – An Empirical Investigation.
Chapter 6

Descriptive Statistics of Welsh Economic Performance

6.1 Introduction

In Part I of my thesis I discussed the significance of political devolution for economic growth and convergence and developed an econometric specification to undertake an empirical investigation of the influence of devolution upon Welsh economic performance. In Part II of this thesis I continue to answer my research questions by undertaking this analysis. I conduct my empirical research using a number of approaches of increasing rigour to achieve a triangulation of methods and robust results.

In this chapter I undertake a descriptive analysis of the economic performance and convergence of Wales and the UK regions. In sections 6.2 and 6.3 I present summary statistics and investigate changes in the distribution of regional GVA for evidence of convergence. In section 6.4 this analysis is extended to analyse the behaviour of the variance of GVA. Section 6.5 tests for spatial interactions between the regions using Moran’s I statistic. In the penultimate section, section 6.6, I estimate beta convergence within England, Wales and Scotland, before and since Devolution using regression analysis, and section 6.7 concludes.
6.2 Summary Statistics of UK Regional Economic Convergence

In chapter 3 I discussed theories of economic growth and convergence. I established that convergence is not a single straightforward concept and that in general the two measures used for the purpose of analysis are beta-convergence and sigma-convergence. When comparing the economic development of regions, beta-convergence can be understood as occurring when poorer regions grow faster than, and consequently catch up with, richer regions. This idea of beta-convergence is associated with neo-classical growth theory (Solow 1956). In the context of this analysis sigma-convergence measures the change in the cross-section dispersion of income among regions (Barro and Sala-i-Martin 2004). Sigma convergence can be measured by the cross-section variance of income per head across regions. Following Durlauf and Johnson (2005) sigma convergence is occurring across regions between time $t$ and time $t+T$ if

$$\sigma^2_{log,y,t} - \sigma^2_{log,y,t+T} > 0$$

where $\sigma^2_{log,y,t}$ is the variance of income per head at time $t$.

I begin by undertaking a disaggregated analysis of the economic performance of the sub-national governments of the UK (excluding Northern Ireland) for evidence of convergence at higher levels of aggregation. In chapter 5 I noted the limitations of using real GVA per head for such analysis but I follow Henley (2005) and use these data. I use statistics of real GVA per head between the years 1995 and 2008 and investigate the data for evidence of convergence by
analysing the coefficient of variation of each country as an indicator of sigma convergence between these countries.

This examination of the high-level aggregated data is augmented by an analysis of the distribution of real GVA per head. I calculate the skew and kurtosis for each country over the period as further evidence of changes that may influence regions’ convergence paths. I continue this exploration of UK regional convergence by inspecting a visual plot of UK sub-regions GVA per capita in natural logarithms. The shape of a plot of the 1995 data against that of 2008 may reveal superficial background information of regions’ relative economic performance.

I also undertake a summary spatial analysis using Moran’s I statistic to investigate sub-regional growth convergence. The analysis of spatial variations in economic behaviour is undertaken to account for the possibility of evidence of regional inter-connectedness. Furthermore, such evidence may be associated with regional specialization and the formation of labour-market and output clusters that provide some regions with a comparative advantage.

Finally, I employ cross-section regression analysis to test more rigorously for evidence that regions with lower incomes per head are growing faster than regions with higher incomes per head. This is undertaken by estimating Barro regressions (Barro and Sala-i-Martin 2004) before and after Devolution. These regressions estimate and test for unconditional beta convergence within Wales,
England, and Scotland and other groupings of regions for evidence of a negative relationship between the growth rate of income per head and the initial level of income.

I begin the empirical analysis by considering top-down measures of economic performance and changes in its distribution; the analysis includes descriptive statistics comprising the mean, standard deviation and coefficient of variation. This data is presented below as Table 6.1 and was constructed from the GVA per head of the NUTS 3 sub-regions for the UK. In the absence of official sub-regional price indices, these data were deflated by cost of living indices for UK standard regions published by a private company (Croner Reward 2009). The limitations and merits of such an approach are discussed in chapter 5.

<table>
<thead>
<tr>
<th>Year</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Coefficient of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>10493</td>
<td>4252</td>
<td>0.41</td>
</tr>
<tr>
<td>1996</td>
<td>10645</td>
<td>4485</td>
<td>0.42</td>
</tr>
<tr>
<td>1997</td>
<td>10903</td>
<td>4719</td>
<td>0.43</td>
</tr>
<tr>
<td>1998</td>
<td>11086</td>
<td>4966</td>
<td>0.45</td>
</tr>
<tr>
<td>1999</td>
<td>11065</td>
<td>5036</td>
<td>0.46</td>
</tr>
<tr>
<td>2000</td>
<td>11310</td>
<td>5022</td>
<td>0.44</td>
</tr>
<tr>
<td>2001</td>
<td>11640</td>
<td>5158</td>
<td>0.44</td>
</tr>
<tr>
<td>2002</td>
<td>12141</td>
<td>5520</td>
<td>0.45</td>
</tr>
<tr>
<td>2003</td>
<td>12714</td>
<td>5905</td>
<td>0.46</td>
</tr>
<tr>
<td>2004</td>
<td>12909</td>
<td>5919</td>
<td>0.46</td>
</tr>
<tr>
<td>2005</td>
<td>12924</td>
<td>5928</td>
<td>0.46</td>
</tr>
<tr>
<td>2006</td>
<td>13077</td>
<td>6117</td>
<td>0.47</td>
</tr>
<tr>
<td>2007</td>
<td>13186</td>
<td>6276</td>
<td>0.48</td>
</tr>
<tr>
<td>2008</td>
<td>12165</td>
<td>6013</td>
<td>0.49</td>
</tr>
</tbody>
</table>

*Source: Table 3.2 Regional Trends No. 43, Online Edition, Office for National Statistics.*
The standard deviation is sometimes used as a measure of sigma convergence. It indicates changes in the dispersion of per capita income and shows for each year the spread of figures around the mean value. In chapter 3 it was established that neoclassical theory expects convergence to occur without the need of policy intervention. If convergence had occurred it would be evident from the inspection of these data. A figure of zero for the standard deviation of a country would indicate that the sub-regions had sigma-converged, while an increasing value of the standard deviation would suggest that they were diverging. However the standard deviation is inadequate as a single measure of sigma convergence as the meaning and interpretation of its absolute value also depends upon the behaviour and magnitude of the mean value of the income distribution.

To provide a more sophisticated analysis I also report the coefficient of variation which reflects changes in both the mean and standard deviation and is calculated as the ratio of the standard deviation to the mean. A reduction in the coefficient of variation can be interpreted as a narrowing in the dispersion of income per head and as an indicator of sigma convergence. The figures for the UK are shown above in Table 6.1 and it can be seen that the coefficient of variation has increased over the period reaching a peak value of 0.49 in 2008. This suggests that between 1995 and 2008 there was an increase in the dispersion of income per head among the countries of UK, results similar to those found by McGuinness and Sheehan (1998). In order to investigate this development in more detail I continue
Chapter 6: Descriptive Statistics

by examining this data at the country level of disaggregation and present these figures in Table 6.2 below.

Table 6.2 England, Wales and Scotland - Summary Statistics of Real GVA per head 1995-2008 at 1995 prices (£ and ratios) calculated from NUTS 3 data.

<table>
<thead>
<tr>
<th>Year</th>
<th>England</th>
<th>Wales</th>
<th>Scotland</th>
<th>England</th>
<th>Wales</th>
<th>Scotland</th>
<th>England</th>
<th>Wales</th>
<th>Scotland</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>10817</td>
<td>8951</td>
<td>9984</td>
<td>4726</td>
<td>1734</td>
<td>2730</td>
<td>0.44</td>
<td>0.19</td>
<td>0.27</td>
</tr>
<tr>
<td>1996</td>
<td>11011</td>
<td>8906</td>
<td>10075</td>
<td>4988</td>
<td>1751</td>
<td>2827</td>
<td>0.45</td>
<td>0.20</td>
<td>0.28</td>
</tr>
<tr>
<td>1997</td>
<td>11329</td>
<td>8996</td>
<td>10174</td>
<td>5242</td>
<td>1878</td>
<td>2927</td>
<td>0.46</td>
<td>0.21</td>
<td>0.29</td>
</tr>
<tr>
<td>1998</td>
<td>11535</td>
<td>9037</td>
<td>10340</td>
<td>5522</td>
<td>2007</td>
<td>3024</td>
<td>0.48</td>
<td>0.22</td>
<td>0.29</td>
</tr>
<tr>
<td>1999</td>
<td>11536</td>
<td>8941</td>
<td>10217</td>
<td>5598</td>
<td>2125</td>
<td>2989</td>
<td>0.49</td>
<td>0.24</td>
<td>0.29</td>
</tr>
<tr>
<td>2000</td>
<td>11834</td>
<td>9143</td>
<td>10323</td>
<td>5557</td>
<td>2204</td>
<td>3049</td>
<td>0.47</td>
<td>0.24</td>
<td>0.30</td>
</tr>
<tr>
<td>2001</td>
<td>12220</td>
<td>9596</td>
<td>10363</td>
<td>5695</td>
<td>2351</td>
<td>3121</td>
<td>0.47</td>
<td>0.25</td>
<td>0.30</td>
</tr>
<tr>
<td>2002</td>
<td>12743</td>
<td>9990</td>
<td>10830</td>
<td>6106</td>
<td>2437</td>
<td>3342</td>
<td>0.48</td>
<td>0.24</td>
<td>0.31</td>
</tr>
<tr>
<td>2003</td>
<td>13391</td>
<td>10314</td>
<td>11229</td>
<td>6540</td>
<td>2515</td>
<td>3442</td>
<td>0.49</td>
<td>0.24</td>
<td>0.31</td>
</tr>
<tr>
<td>2004</td>
<td>13558</td>
<td>10305</td>
<td>11645</td>
<td>6561</td>
<td>2435</td>
<td>3481</td>
<td>0.48</td>
<td>0.24</td>
<td>0.30</td>
</tr>
<tr>
<td>2005</td>
<td>13485</td>
<td>10400</td>
<td>11972</td>
<td>6589</td>
<td>2393</td>
<td>3564</td>
<td>0.49</td>
<td>0.23</td>
<td>0.30</td>
</tr>
<tr>
<td>2006</td>
<td>13564</td>
<td>10611</td>
<td>12395</td>
<td>6821</td>
<td>2432</td>
<td>3703</td>
<td>0.50</td>
<td>0.23</td>
<td>0.30</td>
</tr>
<tr>
<td>2007</td>
<td>13612</td>
<td>10614</td>
<td>12807</td>
<td>6997</td>
<td>2490</td>
<td>3874</td>
<td>0.51</td>
<td>0.23</td>
<td>0.30</td>
</tr>
<tr>
<td>2008</td>
<td>12552</td>
<td>9749</td>
<td>11860</td>
<td>6710</td>
<td>2328</td>
<td>3717</td>
<td>0.53</td>
<td>0.24</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Source: Table 3.2 Regional Trends No.43, Online Edition, Office for National Statistics.

Table 6.2 above presents the figures of the previous Table disaggregated to show the same statistics for England, Wales and Scotland. The figures for England include the sub-region, Inner London West, which should be regarded as an outlier on account of GVA per head in this sub-region being over three times as high as that of Inner London East which is the sub-region with the second highest GVA per head. For example, in 2008 the average income per head in Inner London West was £107,863 compared with that of Inner London East of £33,499. The presence of this sub-regional outlier introduces bias into the statistics by
increasing the estimates of the average and standard deviation of the GVA per head of England and of the UK. Consequently, I have recalculated the figures for England by excluding Inner London West and these new results are presented below as Table 6.3.

The data for England presented in Table 6.3 compared with that of the previous Table, illustrate the distorting effect of the sub-regional outlier which has the effect of increasing measures of dispersion for England. Comparing the data for all countries indicate that Wales exhibits the lowest figures for all three measures and that the coefficient of variation for each country increases over the period. The standard deviation within Scotland is consistently the highest and that of Wales is the lowest over each year. The figures indicate that Wales has consistently recorded lower GVA per head and the lowest dispersion of GVA per head of the three nations.
Table 6.3 *England (excluding Inner London West), Wales and Scotland* - Summary Statistics of Real GVA per head 1995-2008 at 1995 prices (£ and ratios) calculated from NUTS 3 data.

<table>
<thead>
<tr>
<th>Year</th>
<th>Mean England</th>
<th>Mean Wales</th>
<th>Mean Scotland</th>
<th>Standard Deviation England</th>
<th>Standard Deviation Wales</th>
<th>Standard Deviation Scotland</th>
<th>Coefficient of Variation England</th>
<th>Coefficient of Variation Wales</th>
<th>Coefficient of Variation Scotland</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>10376</td>
<td>8951</td>
<td>9984</td>
<td>2064</td>
<td>1734</td>
<td>2730</td>
<td>0.20</td>
<td>0.19</td>
<td>0.27</td>
</tr>
<tr>
<td>1996</td>
<td>10545</td>
<td>8906</td>
<td>10075</td>
<td>2177</td>
<td>1751</td>
<td>2827</td>
<td>0.21</td>
<td>0.20</td>
<td>0.28</td>
</tr>
<tr>
<td>1997</td>
<td>10843</td>
<td>8996</td>
<td>10174</td>
<td>2357</td>
<td>1878</td>
<td>2927</td>
<td>0.22</td>
<td>0.21</td>
<td>0.29</td>
</tr>
<tr>
<td>1998</td>
<td>11022</td>
<td>9037</td>
<td>10340</td>
<td>2476</td>
<td>2007</td>
<td>3024</td>
<td>0.22</td>
<td>0.22</td>
<td>0.29</td>
</tr>
<tr>
<td>1999</td>
<td>11023</td>
<td>8941</td>
<td>10217</td>
<td>2622</td>
<td>2125</td>
<td>2989</td>
<td>0.24</td>
<td>0.24</td>
<td>0.29</td>
</tr>
<tr>
<td>2000</td>
<td>11329</td>
<td>9143</td>
<td>10323</td>
<td>2702</td>
<td>2204</td>
<td>3049</td>
<td>0.24</td>
<td>0.24</td>
<td>0.30</td>
</tr>
<tr>
<td>2001</td>
<td>11706</td>
<td>9596</td>
<td>10363</td>
<td>2822</td>
<td>2351</td>
<td>3121</td>
<td>0.24</td>
<td>0.25</td>
<td>0.30</td>
</tr>
<tr>
<td>2002</td>
<td>12190</td>
<td>9990</td>
<td>10830</td>
<td>2981</td>
<td>2437</td>
<td>3342</td>
<td>0.24</td>
<td>0.24</td>
<td>0.31</td>
</tr>
<tr>
<td>2003</td>
<td>12797</td>
<td>10314</td>
<td>11229</td>
<td>3170</td>
<td>2515</td>
<td>3442</td>
<td>0.25</td>
<td>0.24</td>
<td>0.31</td>
</tr>
<tr>
<td>2004</td>
<td>12959</td>
<td>10305</td>
<td>11645</td>
<td>3129</td>
<td>2435</td>
<td>3481</td>
<td>0.24</td>
<td>0.24</td>
<td>0.30</td>
</tr>
<tr>
<td>2005</td>
<td>12882</td>
<td>10400</td>
<td>11972</td>
<td>3120</td>
<td>2393</td>
<td>3564</td>
<td>0.24</td>
<td>0.23</td>
<td>0.30</td>
</tr>
<tr>
<td>2006</td>
<td>12938</td>
<td>10611</td>
<td>12395</td>
<td>3193</td>
<td>2432</td>
<td>3703</td>
<td>0.25</td>
<td>0.23</td>
<td>0.30</td>
</tr>
<tr>
<td>2007</td>
<td>12968</td>
<td>10614</td>
<td>12807</td>
<td>3240</td>
<td>2490</td>
<td>3874</td>
<td>0.25</td>
<td>0.23</td>
<td>0.30</td>
</tr>
<tr>
<td>2008</td>
<td>11930</td>
<td>9749</td>
<td>11860</td>
<td>3015</td>
<td>2328</td>
<td>3717</td>
<td>0.25</td>
<td>0.24</td>
<td>0.31</td>
</tr>
</tbody>
</table>

*Source: Table 3.2 Regional Trends No. 43, Online Edition, Office for National Statistics.*

It is evident from the income per head figures in Table 6.3 that the gap between Wales and England and between Wales and Scotland has been increasing over this period. Inspection of the coefficient of variation of each country reveals that this statistic increases for each territory until the early years of 2000 and then levels off following the granting of devolved government to Scotland and Wales. However the same trend is evident in England which suggests that it may be a coincidence and unrelated to devolution. It is interesting to note the growing difference in
income per head between Wales and England even though there is little difference in the respective coefficient of variation. The dispersion of income per head in England appears similar to that of Wales. The combined England and Wales distribution appears to have split into two distributions centred on different mean values and with similar dispersions. This is not the case when comparing Wales and Scotland as the statistics suggest that Scottish mean income per head is increasing relative to Wales and the dispersion of income in Scotland is larger. These differences are evident around the same time as Devolution; however it occurs too soon after Devolution to ascribe to differences in the policies of the devolved territories. A possible explanation for the difference between Wales and Scotland is that Scotland has a larger population (mid-year 2009 estimates of the Scottish and Welsh populations are 5.194 million and 2.999 million respectively) and is more dispersed over a larger land area. The population that is located outside of the Scottish central belt may account for a sizable proportion of households earning lower incomes, with the exception of Aberdeen where the offshore oil industry generates higher incomes.

Over the period under examination, the UK annual growth rate of real GDP varied considerably over the business cycle. The identification of peaks and troughs is not straightforward and vary depending upon the measure used but generally peaks are evident in 1994, 2000 and 2004 and troughs occurred in 1995, 2002 and 2005 (for example, see European Commission 2010). This would likely affect the estimates by reducing the average rate of growth of GVA per head.
during periods of recession but may have had a lesser impact on the standard
deviation resulting in a temporary elevation of the coefficient of variation. The
small changes in the coefficient of variation over this period of time may reflect the
differential effects arising from changes in the business cycle. Henley (2005) also
notes the possibility that economic cycles affect convergence and that the possible
association requires further analysis.

Welsh relative economic performance can also be measured by calculating
Welsh GVA per head as a proportion of that of England and Scotland and these
data are shown in Table 6.4 below. At the start of the period Welsh income per
head was 86% of that of England and 90% of Scotland; by the end of the period
both figures were 82%. Relative to England, much of the decline over this period
occurred before 2000 and was followed by a period of stability during which little
change occurred in the relative position of Wales. Relative to Scotland, over this
period of time Welsh economic performance improved after Devolution and then
dropped noticeably as Scottish growth of GVA per head exceeded that in Wales.
Table 6.4 Wales GVA per head as a percentage of England and Scotland

<table>
<thead>
<tr>
<th>Year</th>
<th>Wales GVA per head as % of England</th>
<th>Wales GVA per head as % of Scotland</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>86</td>
<td>90</td>
</tr>
<tr>
<td>1996</td>
<td>84</td>
<td>88</td>
</tr>
<tr>
<td>1997</td>
<td>83</td>
<td>88</td>
</tr>
<tr>
<td>1998</td>
<td>82</td>
<td>87</td>
</tr>
<tr>
<td>1999</td>
<td>81</td>
<td>88</td>
</tr>
<tr>
<td>2000</td>
<td>81</td>
<td>89</td>
</tr>
<tr>
<td>2001</td>
<td>82</td>
<td>93</td>
</tr>
<tr>
<td>2002</td>
<td>82</td>
<td>92</td>
</tr>
<tr>
<td>2003</td>
<td>81</td>
<td>92</td>
</tr>
<tr>
<td>2004</td>
<td>80</td>
<td>88</td>
</tr>
<tr>
<td>2005</td>
<td>81</td>
<td>87</td>
</tr>
<tr>
<td>2006</td>
<td>82</td>
<td>86</td>
</tr>
<tr>
<td>2007</td>
<td>82</td>
<td>83</td>
</tr>
<tr>
<td>2008</td>
<td>82</td>
<td>82</td>
</tr>
</tbody>
</table>

Source: Author’s calculations based on data of real GVA per head in Table 6.3.

6.3 Exploring the Variations in More Detail

Additional information concerning changes in these countries’ relative economic positions may be provided by calculating values of skew and kurtosis. Skew measures the extent of a distribution’s departure from the symmetry displayed by a normal distribution. Skew is evident in a distribution when distortion in the distribution of the data results in one tail of the distribution extending further out than the other tail. Skew in the left-hand tail is described as negative skew and in the right-hand tail as positive skew. In terms of the data presented as Table 6.2 a single sub-region that has a very high income such as Inner London West would be evident as positive skew. In general, evidence of skew in the distribution of UK
territories’ per capita income indicates that some household incomes are distorting the distribution of income per head to high or low values. I test for the existence of skew by undertaking a two-tail hypothesis test: the null hypothesis is that the distribution is symmetrical and the alternative hypothesis is that the distribution is not symmetrical. The two-sided test is conducted by comparing the estimated values with the critical table values; if the estimated values are equal to or greater than the critical values we can reject the assumption of symmetry. There is no merit associated with a symmetrical normal distribution or indeed with any distribution; such normative judgements are best left to democratic consensus. My analysis makes use of symmetry as a convenient benchmark for revealing ordinal change and the conclusions are limited to observing relative regional distributional change.

Kurtosis is also a measure of the extent to which a distribution departs from normality in terms of both peakedness and tailedness, and is a statistic that is not affected by the variance of the distribution (DeCarlo 1997). Kurtosis ($K$) is measured as:

$$K = \frac{1}{N} \sum_{i=1}^{N} \left( \frac{y_i - \bar{y}}{\hat{\sigma}} \right)^4 - 3$$

The value of kurtosis of the normal distribution is 3 which means that an estimate of the departure from normality requires that 3 is subtracted from the result. Kurtosis is relevant for the analysis of sigma convergence as it can be used
to measure changes in the differences between the standardized income distributions of regions or countries. Positive kurtosis (a leptokurtic distribution) results in the density of the distribution being squeezed on both shoulders of the distribution from the outside resulting in greater density in the peak, while negative kurtosis (a platykurtic distribution) results in the density being squeezed along the shoulders from the inside of the distribution and more density in the tails. Figure 6.1 provides diagrams to support the explanation of the distinction between positive and negative kurtosis.

**Figure 6.1 An example of positive and negative kurtosis**

I formally test for the existence of kurtosis using critical values at 5% significance. The null hypothesis is that kurtosis is zero; the alternative hypothesis is that it is not zero and a two-tailed test is therefore required. The critical tables comprise, for each level of significance, a low and a high value. The decision rule that is followed is to reject the assumption of the absence of kurtosis in favour of the
presence of kurtosis if the estimated value is greater than or equal to the high
critical value, or is less than or equal to the low critical value; otherwise the
evidence supports its absence.

Table 6.5 below displays the statistics of skew and kurtosis for England
including and excluding the sub-region Inner London West and illustrates the
manner in which this outlier sub-region introduces bias into the figures. The
figures in Table 6.5 indicate that the estimates of skew for England including and
excluding Inner London West for each year exceed the critical value that rounds to
0.49 for both cases and consequently that we can reject the assumption of the
absence of skew. It is interesting to note that the exclusion of Inner London West
does not remove evidence of positive skewness from the English data and may
reflect the higher incomes per head of the English population located in the south
east compared with that of other regions.
Table 6.5 Skew and Kurtosis of Real GVA per head of England including and excluding Inner London West between 1995 and 2008

<table>
<thead>
<tr>
<th>Year</th>
<th>Skew including Inner London West</th>
<th>Skew excluding Inner London West</th>
<th>Kurtosis including Inner London West</th>
<th>Kurtosis excluding Inner London West</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>7.04*</td>
<td>0.61*</td>
<td>60.27*</td>
<td>0.61</td>
</tr>
<tr>
<td>1996</td>
<td>7.05*</td>
<td>0.70*</td>
<td>60.31*</td>
<td>0.74</td>
</tr>
<tr>
<td>1997</td>
<td>6.91*</td>
<td>0.78*</td>
<td>58.54*</td>
<td>0.80</td>
</tr>
<tr>
<td>1998</td>
<td>6.93*</td>
<td>0.81*</td>
<td>58.70*</td>
<td>0.80</td>
</tr>
<tr>
<td>1999</td>
<td>6.71*</td>
<td>0.91*</td>
<td>55.98*</td>
<td>0.66</td>
</tr>
<tr>
<td>2000</td>
<td>6.51*</td>
<td>0.91*</td>
<td>53.48*</td>
<td>0.53</td>
</tr>
<tr>
<td>2001</td>
<td>6.40*</td>
<td>0.95*</td>
<td>52.18*</td>
<td>0.48</td>
</tr>
<tr>
<td>2002</td>
<td>6.49*</td>
<td>0.97*</td>
<td>53.19*</td>
<td>0.46</td>
</tr>
<tr>
<td>2003</td>
<td>6.53*</td>
<td>0.97*</td>
<td>53.70*</td>
<td>0.54</td>
</tr>
<tr>
<td>2004</td>
<td>6.62*</td>
<td>0.94*</td>
<td>54.78*</td>
<td>0.53</td>
</tr>
<tr>
<td>2005</td>
<td>6.66*</td>
<td>0.94*</td>
<td>55.26*</td>
<td>0.58</td>
</tr>
<tr>
<td>2006</td>
<td>6.72*</td>
<td>0.95*</td>
<td>56.01*</td>
<td>0.65</td>
</tr>
<tr>
<td>2007</td>
<td>6.78*</td>
<td>0.94*</td>
<td>56.70*</td>
<td>0.69</td>
</tr>
<tr>
<td>2008</td>
<td>6.93*</td>
<td>0.97*</td>
<td>58.58*</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Source: Author’s calculations based on data from Table 3.2 Regional Trends No. 43, Online Edition, Office for National Statistics.

Note: * denotes 5% significance

The test for kurtosis uses the low critical value of -0.73 and the high critical value of 1.19. The figures including Inner London West exceed the high value and indicate rejection of the assumption of normality in favour of positive kurtosis.

This result suggests that the English distribution is peakier and has less density in the tails compared with a normal distribution. However, once the outlier sub-region is removed the estimated values fall within the extreme bounds of the critical values suggesting that we cannot reject the assumption of zero kurtosis.

Table 6.6 below extends this analysis by comparing skew and kurtosis for the UK nations using the figures for England that exclude the outlier sub-region.
The data indicate that the estimates of Welsh skew are all below the critical value of 1.28 and suggest that we cannot reject the assumption of symmetry: in other words there is a balance between those in the extreme tails of the distribution. However caution is warranted since there are only 12 sub-regions in Wales and this represents a small sample.

For Scotland, the estimates of skew for all years exceed the critical value of 0.95 and indicate rejection of the assumption of the absence of skew in favour of a positive skew: this suggests that the distribution is becoming increasingly distorted or asymmetric in the right-hand tail as instances of higher incomes enter the distribution of GVA per head. This result for Scotland may reflect the large differential between the GVA per head in the Central Belt and the Highlands and the impact of oil development in the North East. Evidence supporting the evidence of skew in Scottish GVA per head is provided by NUTS 3 statistics. These statistics indicate that in 2008 low incomes were evident in the sparsely populated Highlands and Islands compared with incomes exceeding the Scottish average in the more populated Eastern (Angus and Dundee City, Clackmannanshire and Fife, East Lothian and Midlothian, Scottish Borders, City of Edinburgh, Falkirk, Perth, Kinross, Stirling and West Lothian) and North East (Aberdeen and Aberdeenshire) sub-regions.
## Table 6.6 England (excluding Inner London West), Wales and Scotland - Skew and Kurtosis of Real GVA per head between 1995 and 2008

<table>
<thead>
<tr>
<th></th>
<th>England</th>
<th>Wales</th>
<th>Scotland</th>
<th>England</th>
<th>Wales</th>
<th>Scotland</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Skew</td>
<td></td>
<td></td>
<td></td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.73</td>
<td>-1.55</td>
<td>-1.18</td>
</tr>
<tr>
<td>Critical values at 5% significance</td>
<td>0.49</td>
<td>1.28</td>
<td>0.95</td>
<td>1.19</td>
<td>3.21</td>
<td>2.37</td>
</tr>
<tr>
<td>1995</td>
<td>0.61*</td>
<td>0.54</td>
<td>1.39*</td>
<td>0.61</td>
<td>0.00</td>
<td>1.64</td>
</tr>
<tr>
<td>1996</td>
<td>0.70*</td>
<td>0.58</td>
<td>1.38*</td>
<td>0.74</td>
<td>0.00</td>
<td>1.54</td>
</tr>
<tr>
<td>1997</td>
<td>0.78*</td>
<td>0.65</td>
<td>1.39*</td>
<td>0.80</td>
<td>-0.26</td>
<td>1.43</td>
</tr>
<tr>
<td>1998</td>
<td>0.81*</td>
<td>0.67</td>
<td>1.48*</td>
<td>0.80</td>
<td>-0.64</td>
<td>1.63</td>
</tr>
<tr>
<td>1999</td>
<td>0.91*</td>
<td>0.78</td>
<td>1.57*</td>
<td>0.66</td>
<td>-0.69</td>
<td>1.85</td>
</tr>
<tr>
<td>2000</td>
<td>0.91*</td>
<td>0.86</td>
<td>1.65*</td>
<td>0.53</td>
<td>-0.61</td>
<td>2.09</td>
</tr>
<tr>
<td>2001</td>
<td>0.95*</td>
<td>0.94</td>
<td>1.76*</td>
<td>0.48</td>
<td>-0.38</td>
<td>2.51*</td>
</tr>
<tr>
<td>2002</td>
<td>0.97*</td>
<td>0.94</td>
<td>1.87*</td>
<td>0.46</td>
<td>-0.29</td>
<td>3.08*</td>
</tr>
<tr>
<td>2003</td>
<td>0.97*</td>
<td>0.98</td>
<td>1.89*</td>
<td>0.54</td>
<td>-0.12</td>
<td>3.31*</td>
</tr>
<tr>
<td>2004</td>
<td>0.94*</td>
<td>1.00</td>
<td>1.83*</td>
<td>0.53</td>
<td>-0.12</td>
<td>3.10*</td>
</tr>
<tr>
<td>2005</td>
<td>0.94*</td>
<td>1.05</td>
<td>1.76*</td>
<td>0.58</td>
<td>-0.01</td>
<td>2.84*</td>
</tr>
<tr>
<td>2006</td>
<td>0.95*</td>
<td>1.10</td>
<td>1.74*</td>
<td>0.65</td>
<td>0.15</td>
<td>2.80*</td>
</tr>
<tr>
<td>2007</td>
<td>0.94*</td>
<td>1.17</td>
<td>1.78*</td>
<td>0.69</td>
<td>0.40</td>
<td>3.03*</td>
</tr>
<tr>
<td>2008</td>
<td>0.97*</td>
<td>1.22</td>
<td>1.82*</td>
<td>0.84</td>
<td>0.65</td>
<td>3.14*</td>
</tr>
</tbody>
</table>

*Source: Calculated by author from Table 3.2 Regional Trends No. 43, Online Edition, Office for National Statistics*

*Note: * denotes 5% significance

The estimated values of skew for England exceed the critical value 0.49 and suggest rejection of the null hypothesis that the distribution is symmetrical. The values are not dissimilar to those of Wales but represent a larger sample of 92 sub-regions that suggests greater statistical confidence. The positive skew of the distribution of English per capita incomes indicates that the proportion of English sub-regions with incomes above the mean value is not balanced by a similar
proportion that has incomes below the average; in other words, there are more English sub-regions below than above the mean.

To undertake the hypothesis test of kurtosis for the Welsh data the estimates are compared with the critical range of -1.55 to 3.21. For each year the estimated values lie within the extreme bounds of the critical values, which suggest that we cannot reject the assumption of the absence of kurtosis. For Scotland the same conclusion can be drawn up until 2001, after which the estimated values of kurtosis exceed the upper critical bound of 2.37. This indicates rejection of the null hypothesis in favour of evidence of positive kurtosis following Devolution. Without necessarily attributing causation, there is evidence that more Scottish sub-regions have clustered around the mean value of GVA per head following Devolution and the tails of the distribution have thinned.

To confirm these results I have also undertaken the Jarque-Bera test for normality of these data (Jarque and Bera 1987). This test calculates the probability that the absolute value of the test statistic exceeds the observed value under the null hypothesis of a normal distribution. The results are presented below as Table 6.7 and provide support for the conclusion that GVA per head in Wales, England and Scotland have not been normally distributed over this period.
Table 6.7 Jarque-Bera Test of the Normality of Real GVA per head
1995-2008 England (excluding Inner London West), Wales and Scotland

<table>
<thead>
<tr>
<th>Year</th>
<th>England</th>
<th>Wales</th>
<th>Scotland</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>27.65***</td>
<td>5.09</td>
<td>9.16**</td>
</tr>
<tr>
<td>1996</td>
<td>27.03***</td>
<td>5.17</td>
<td>9.31***</td>
</tr>
<tr>
<td>1997</td>
<td>27.75***</td>
<td>6.16**</td>
<td>9.82***</td>
</tr>
<tr>
<td>1998</td>
<td>28.52***</td>
<td>7.54**</td>
<td>10.20***</td>
</tr>
<tr>
<td>1999</td>
<td>33.79***</td>
<td>8.00**</td>
<td>10.73***</td>
</tr>
<tr>
<td>2000</td>
<td>36.05***</td>
<td>7.99**</td>
<td>11.24***</td>
</tr>
<tr>
<td>2001</td>
<td>38.09***</td>
<td>7.48**</td>
<td>12.14***</td>
</tr>
<tr>
<td>2002</td>
<td>39.09***</td>
<td>7.17**</td>
<td>13.35***</td>
</tr>
<tr>
<td>2003</td>
<td>37.83***</td>
<td>6.79**</td>
<td>13.85***</td>
</tr>
<tr>
<td>2004</td>
<td>37.04***</td>
<td>6.86**</td>
<td>12.88***</td>
</tr>
<tr>
<td>2005</td>
<td>36.09***</td>
<td>6.72**</td>
<td>11.95***</td>
</tr>
<tr>
<td>2006</td>
<td>34.97***</td>
<td>6.48**</td>
<td>11.69***</td>
</tr>
<tr>
<td>2007</td>
<td>34.17***</td>
<td>6.11**</td>
<td>12.12***</td>
</tr>
<tr>
<td>2008</td>
<td>32.35***</td>
<td>5.75**</td>
<td>12.69***</td>
</tr>
</tbody>
</table>

Source: Calculated by the author from Table 6.6
Note: ** indicates rejection of the null hypothesis of normality at 5% significance; *** indicates rejection of the null hypothesis of normality at 1% significance.

This conclusion is subject to the qualification that the calculations are based on NUTS 3 data and are consequently calculated for groups of local authorities, London boroughs and Council Districts. This means that the data for England (93 observations) are more numerous than those for Wales (12 observations) and Scotland (23 observations). The different number of observations in the different countries may have led to biased results since a larger number of sub-regions introduce a greater chance of a higher dispersion of performance.
6.4 Investigating Convergence

Sigma convergence can be also measured as the variance of the distribution of incomes per head within and across sub-regions. I have calculated these values as the variance of the log of real GVA per head following Henley (2005). A logarithmic transformation of the data is undertaken to remove any strong trend that may conceal more subtle differences. My method follows that of Henley, who reports real GDP per head by producing figures in real terms using regional deflators acquired from a commercial organization (Croner Reward 2009). The benefits and limitations of these data are discussed in chapter 5 and I decided that their use was warranted on balance. Henley’s figures and my own are compared below in Table 6.8. Taking account of the possibility of data revisions to the NUTS 3 data and to the price deflators, his estimates and those of this study appear consistent. Both sets of NUTS 3 figures display a rising trend until the year 2000. After two further years of increase they appear to stabilize until after 2005 when the figures resume an upward path and provide evidence in support of the weak conclusion of non-convergence.
Table 6.8 Variance of Natural Log of Real GVA per head 1995-2008 UK NUTS 3 Sub-Regions compared with those of Henley (2005) in parenthesis.

<table>
<thead>
<tr>
<th>Year</th>
<th>Godfrey</th>
<th>Henley</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>0.0646</td>
<td>(0.0600)</td>
</tr>
<tr>
<td>1996</td>
<td>0.0683</td>
<td>(0.0632)</td>
</tr>
<tr>
<td>1997</td>
<td>0.0730</td>
<td>(0.0693)</td>
</tr>
<tr>
<td>1998</td>
<td>0.0767</td>
<td>(0.0760)</td>
</tr>
<tr>
<td>1999</td>
<td>0.0805</td>
<td>(0.0794)</td>
</tr>
<tr>
<td>2000</td>
<td>0.0802</td>
<td>(0.0813)</td>
</tr>
<tr>
<td>2001</td>
<td>0.0808</td>
<td>(0.0817)</td>
</tr>
<tr>
<td>2002</td>
<td>0.0825</td>
<td>(NA)</td>
</tr>
<tr>
<td>2003</td>
<td>0.0848</td>
<td>(NA)</td>
</tr>
<tr>
<td>2004</td>
<td>0.0820</td>
<td>(NA)</td>
</tr>
<tr>
<td>2005</td>
<td>0.0810</td>
<td>(NA)</td>
</tr>
<tr>
<td>2006</td>
<td>0.0822</td>
<td>(NA)</td>
</tr>
<tr>
<td>2007</td>
<td>0.0840</td>
<td>(NA)</td>
</tr>
<tr>
<td>2008</td>
<td>0.0868</td>
<td>(NA)</td>
</tr>
</tbody>
</table>

Source: Regional Trends and Eurostat.

The results provide further evidence in support of Henley’s (2005) conclusion that GVA per head within the UK are diverging. This is illustrated graphically in Figure 6.2, below, which shows the UK sub-regions’ GVA per head in natural logarithms in 1995 plotted against those for 2008, for all regions. The diagonal 45 degree line aids interpretation of the change over this period.
A point on the line indicates that the GVA per head of a sub-region has not changed over this period; a point under the line would suggest that a sub-region had a lower GVA per head in 2008 than in 1995, while a point above the line indicates a higher value in 2008 than in 1995. For example, the single point in the north-east of the plot represents the outlier sub-region, Inner London West that is above the reference 45 degree line indicating that real GVA per head in 2008 was higher than in 1995. Evidence of convergence for the sub-regions would be visible over the period if sub-regions with lower income per head in 1995 had grown faster than other sub-regions. Visually this suggests that a line plot of such behaviour should be shifting towards the horizontal, indicating growth varying
inversely with income per head. Growth would then be more rapid for those sub-regions with lower levels of income per head in 1995 than at higher levels of income per head pushing the left-hand side of the plot upwards and the right-hand side downwards. Even if we ignore the (Inner London West) outlier it is apparent that there is no visual evidence in favour of income convergence. The range of the increase in income per head over this period over all sub-regions is between -12% and +50% with an average increase of 13%. Application of neoclassical convergence theory suggests that the poorer sub-regions should be able to grow faster as they have more opportunity to increase the marginal product of capital and labour (Barro 1997). However, this notion is suspect as we found in chapter 3 that there is evidence of different capital structures in the regions and of the possible correlation of economic performance with the proximity to London and the South East (Brun et al 2005).

In 2008 Welsh GVA per head at 1995 prices, was £10,168 and the second lowest of all UK regions (the lowest was the North East with a comparable figure of £10,003) and about 80% of the average for the UK, excluding Northern Ireland. After adjusting for inflation, for most of the years since 2000 Wales has been the worst performing region. However, by comparison net capital expenditure per person employed in Wales in 2003 was £5,023 and exceeded that of any other UK region and the next highest was the North East with £4,468 (Office of National Statistics 2006). If this data is accurate it can be challenged as counter-intuitive as more rapid capital planting could be interpreted as an increase in capital-labour
ratios, that may raise an expectation of higher productivity and income generation. That this result is not evident in the statistics may be due to the change in Welsh capital expenditure taking place on a low base or because the spending is taking place in low growth industries.

Within England there is some evidence of an association between economic performance and distance from London. The significance of distance between centres of economic activity for economic performance is attracting increasing attention (see for example Graham et al 2009; Redding and Venables 2002). The capital represents the region with the highest GVA per head while the North East has the lowest. In 2008, the ranking in descending order of GVA per head were London, the South East, East, South West, East Midlands, the North West, West Midlands, Yorkshire and the Humber, and the North East; as noted previously, using this measure Welsh economic performance in 2008 is lower than that of the North East.

It is also instructive to inspect the economic performance of the Welsh sub-regions. Table 6.9 below compares real GVA per head of Welsh sub-regions in 1995, 2000 and 2008 and as a proportion of the UK average. The data show that in 1995 Cardiff and the Vale of Glamorgan and Flintshire and Wrexham were the most successful sub-regions with GVA per head greater than that of the UK as a whole. Comparison with the UK indicates that these two sub-regions also exceeded the average for the UK. By 2008 Cardiff and the Vale of Glamorgan and Monmouthshire and Newport were successful in exceeding the level of GVA per
head of the UK average. With the exception of these two sub-regions and Swansea, all Welsh sub-regions exhibit a reduction of GVA per head relative to the UK comparing their performance in 2008 with that in 1995.

The statistics presented in Table 6.9 have additional significance as West Wales and the Valleys (all Welsh sub-regions with the exception of Monmouthshire and Newport, Cardiff and Vale of Glamorgan, Flintshire and Wrexham and Powys) received £1.3 billion of Objective 1 funding and an additional £700 million of public matched funding for the period 2000-2008. Over this period the total GVA of West Wales and the Valleys increased from £17.1 billion to £24.4 billion. The figures also reveal that these sub-regions exhibit a higher GVA per head in 2008 relative to the UK than in 2000. Between 2000 and 2008 GVA per head in West Wales and the Valleys at 1995 prices increased from £7941 to £8591 and relative to the UK represents a small increase from 70.2% to 70.6%. There are three other UK Objective 1 sub-regions (Merseyside, South Yorkshire and Cornwall and the Isles of Scilly). West Wales and the Valleys performed better than South Yorkshire where GVA per head declined from 98.2% to 98.0% of the UK. The others did better: Cornwall and the Isles of Scilly improved from 63.3% to 69.1% and Merseyside increased from 77.2% to 79.8%. It is also notable that over the same period, East Wales, that is not a recipient of Objective 1 funding, measured by GVA per head, declined from 107.9% to 106.0% relative to the UK. In fact Table 6.9 indicates that the sub-regions exhibiting the
largest falls relative to the UK between 2000 and 2008 were Flintshire and Wrexham in East Wales.

**Table 6.9 Real GVA per Head at 1995 prices; Welsh Sub-Regions and as Percentage of UK Average for 1995, 2000 and 2008**

<table>
<thead>
<tr>
<th>Sub-Region</th>
<th>1995</th>
<th>2000</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GVA per</td>
<td>Percent</td>
<td>GVA per</td>
</tr>
<tr>
<td></td>
<td>head</td>
<td>of UK</td>
<td>head</td>
</tr>
<tr>
<td>Isle of Anglesey</td>
<td>6205</td>
<td>59.1</td>
<td>6439</td>
</tr>
<tr>
<td>Gwynedd</td>
<td>8886</td>
<td>84.7</td>
<td>8098</td>
</tr>
<tr>
<td>Conwy and Denbighshire</td>
<td>7905</td>
<td>75.3</td>
<td>7717</td>
</tr>
<tr>
<td>South West Wales</td>
<td>8168</td>
<td>77.8</td>
<td>7434</td>
</tr>
<tr>
<td>Central Valleys</td>
<td>7534</td>
<td>71.8</td>
<td>7601</td>
</tr>
<tr>
<td>Gwent Valleys</td>
<td>7373</td>
<td>70.3</td>
<td>7522</td>
</tr>
<tr>
<td>Bridgend and Neath Port Talbot</td>
<td>9295</td>
<td>88.6</td>
<td>8539</td>
</tr>
<tr>
<td>Swansea</td>
<td>8807</td>
<td>83.9</td>
<td>9679</td>
</tr>
<tr>
<td>Monmouthshire and Newport</td>
<td>10001</td>
<td>95.3</td>
<td>12391</td>
</tr>
<tr>
<td>Cardiff and Vale of Glamorgan</td>
<td>11846</td>
<td>112.9</td>
<td>13164</td>
</tr>
<tr>
<td>Flintshire and Wrexham</td>
<td>12041</td>
<td>114.8</td>
<td>11920</td>
</tr>
<tr>
<td>Powys</td>
<td>9345</td>
<td>89.1</td>
<td>9207</td>
</tr>
</tbody>
</table>

*Source: Regional Trends No. 439*

*Note: UK average GVA per head at 1995 prices; 1995 = £10493; 2000 = £11310; 2008 = £12165.*

### 6.5 Spatial Correlation and Regional Economic Convergence in the UK

The regions of the UK are not economically independent: regions trade goods and services between themselves, firms and retail outlets may have numerous regional locations and economic agents may live and work in different regions.
Consequently regions are unlikely to be economically independent of each other and this suggests the possibility that they may exhibit spatial autocorrelation, in the sense that there may be an underlying systematic pattern in the distribution of economic performance between regions. Furthermore, groups of firms may find it beneficial to congregate close to each other in order to achieve some mutual benefit, a pattern of geographical location sometimes referred to as clustering (Cortright 2006). Industrial agglomeration is considered beneficial on account of the resulting knowledge spillovers and improvements in total factor productivity (Chang and Oxley 2009). There is an extensive literature concerned with the investigation of agglomeration effects on total factor productivity (see for example, Chang and Oxley 2009; Feldman 2000; Jaffe et al 1993). When such industry clusters straddle regional boundaries it may result in neighbouring regions that are more likely to be similar in some economic characteristic than distant regions. Such systematic patterns in economic activity can be described as examples of spatial autocorrelation, and may be detected by analysing a variable such as GVA per head for evidence that it is correlated over space. Neighbouring or nearby regions or sub-regions that are alike in terms of some economic attribute are described as examples of positive spatial autocorrelation while negative spatial autocorrelation describes neighbours that are less similar than more distant regions (Moran 1950; Cliff and Ord 1973). The absence of positive or negative spatial association is described as random spatial distribution. Regression analysis using cross-sectional or panel data often ignores the possibility of spatial
autocorrelation and assumes that samples are independent. When positive spatial
autocorrelation is present it violates this assumption and introduces bias into
diagnostic testing.

Spatial correlation is estimated to determine and test the statistical
significance of the strength of economic association between sub-regions and can
be undertaken using Moran’s $I$ statistic (Moran 1950). This statistic varies between
-1.0 and +1.0 where a zero value indicates a random spatial distribution, -1.0
indicates dispersion and +1.0 indicates clustering. The null hypothesis of the
Moran test is that there is a random spatial pattern or $H_0: E(I) = 0$ and the
alternative hypothesis is that there is positive or negative spatial autocorrelation
and $H_1: E(I) \neq 0$. Moran’s $I$ is a measure of global spatial autocorrelation or a
measure of the clustering over all the observations of a geography and in my
terms the estimated statistic summarises the spatial association over all the NUTS3
sub-regions.

To validate and extend our understanding of the convergence process in
terms of the importance of sub-regions’ location relative to other sub-regions, I
have calculated the Moran statistic for each year for the UK excluding Northern
Ireland and England. The calculation of the Moran $I$ for Wales and Scotland may
be misleading because of the small number of sub-regions in each region (12 sub-
regions in Wales and 23 in Scotland). Additionally, population and economic
activity tends to cluster around the urban areas of Cardiff, Glasgow and
Edinburgh where much of the populations of Wales and Scotland are concentrated.
In Scotland much of the economic activity is located in two regions, Eastern Scotland and South Western Scotland and some sub-regions of Scotland are islands and not contiguous with the Scottish mainland.

Acknowledging these reasons for caution, the estimated value of the Moran’s I for the sub-regions of both countries in 2008 was found to be 0.90 for Scotland and 0.85 for Wales and both estimates are significant at 1%.

The effect of the Wales and Scotland observations can also be discerned in the results shown in Table 6.10 that compare the results for the UK with the results for England. The Moran statistic tests for the association of values (in this case of real GVA per head) between nearby locations. The definition of proximity is at the discretion of the researcher and I have elected to undertake the analysis using first-order queen neighbours, representing sub-regions that are spatially contiguous because they share a border. This means that any sub-region that shares any geographical point of contact with the sub-region of interest, that may be as small as a vertex (corner), is considered to be a neighbour for the purpose of statistical analysis. This is implemented in the analysis by creating a spatial-weights matrix reflecting this choice of contiguity measure. In other words the spatial-weights matrix is populated with zeros and ones, where zero indicates that two regions do not share a common border and a value of unity indicates that the regions do share a common boundary. This means that in the spatial-weights matrix sub-regions of Wales sharing a border with the sub-regions of England will
show unity for the sub-regions of Wales-South West, Wales-West Midlands and Wales-North West, and zeros elsewhere. The results are presented in Table 6.10.

**Table 6.10** Moran’s I Statistic for England and the UK, 1995-2008.  
*(Calculated from the Log Real GVA per head of NUTS 3 Sub-Regions)*

<table>
<thead>
<tr>
<th>Year</th>
<th>England</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>0.0351</td>
<td>0.1055**</td>
</tr>
<tr>
<td>1996</td>
<td>0.0355</td>
<td>0.1210**</td>
</tr>
<tr>
<td>1997</td>
<td>0.0364</td>
<td>0.1394***</td>
</tr>
<tr>
<td>1998</td>
<td>0.0369</td>
<td>0.1605***</td>
</tr>
<tr>
<td>1999</td>
<td>0.0373</td>
<td>0.1851***</td>
</tr>
<tr>
<td>2000</td>
<td>0.0375</td>
<td>0.1846***</td>
</tr>
<tr>
<td>2001</td>
<td>0.0373</td>
<td>0.1792***</td>
</tr>
<tr>
<td>2002</td>
<td>0.0371</td>
<td>0.1826***</td>
</tr>
<tr>
<td>2003</td>
<td>0.0373</td>
<td>0.1916***</td>
</tr>
<tr>
<td>2004</td>
<td>0.0373</td>
<td>0.1875***</td>
</tr>
<tr>
<td>2005</td>
<td>0.0369</td>
<td>0.1855***</td>
</tr>
<tr>
<td>2006</td>
<td>0.0367</td>
<td>0.1856***</td>
</tr>
<tr>
<td>2007</td>
<td>0.0366</td>
<td>0.1762***</td>
</tr>
<tr>
<td>2008</td>
<td>0.0365</td>
<td>0.1756***</td>
</tr>
</tbody>
</table>

*Source*: Regional Trends No. 43  
*Notes*: ** indicates 5% significance  
*** indicates 1% significance

When the data are combined to estimate figures for UK (UK figures were used to enable direct comparison with those of Henley 2005), the dominance of English observations produces a positive *I* value over each year and *p*-values that permit rejection of the null hypothesis of no spatial autocorrelation. The advantage of UK pooled data is that it also picks up the significance of the regions in Wales, England and Scotland that are contiguous. The estimated *I* statistic for the pooled UK data is positive and the *p*-values support rejection of the null hypothesis of no
spatial autocorrelation. This is consistent with findings by Henley (2005: 1252, Table 4.) who found evidence of spatial autocorrelation (as measured by Moran’s $I$ statistic), although his data extends over the earlier period between 1977 and 1998. Furthermore his data is composed of both counties-level data and NUTS 3 data that are limited to the period between 1995 and 2001.

The estimated $I$ coefficients for the UK are consistently positive and statistically significant over the period, indicating rejection of the null hypothesis of a random distribution. It can be interpreted as suggesting that on average neighbouring sub-regions tend to be similar in terms of real income per head. The estimated $I$ coefficients for England however are much smaller and are not statistically significant and suggest that the economic performance of English sub-regions are independent of one another. The implication is that the results for the UK are influenced by those of Wales and Scotland where clustering is evident because of the closeness of income per head among their contiguous sub-regions. Comparing the results for the English sub-regions with results for the UK sub-regions suggest that we can reject the null hypothesis that there is random spatial autocorrelation between the Scottish sub-regions and between Welsh sub-regions.

Further information for spatial analysis is available by calculating Moran scatterplots that are shown below for the years 1995, 2000 and 2008. This provides a measure of spatial autocorrelation using NUTS 3 UK sub-regions log of real GVA per head for the years 1995, 2000 and 2008. The vertical axis measures the sub-regional spatial lag using the spatial weights described above. The four
quadrants enable an indication of how the GVA per head of sub-regions are related to their neighbours. For example, points in the upper right quadrant represent sub-regions with above average GVA per head with neighbours with above average GVA per head. Sub-regions in the lower right quadrant represent sub-regions with higher than average GVA per head with neighbours who have below average GVA per head. The upper left quadrant contains sub-regions with high values and low-value neighbours and the lower left quadrant represent locations with low values and lower than average neighbours. The diagonal line in each scatterplot is the estimated regression line and runs from the south-west quadrant upwards to the north-east quadrant. Sub-regions on this line are adjacent and have similar GVA per head. Those above the line of best fit are sub-regions with higher GVA per head neighbours and those below the line are sub-regions with lower GVA per head neighbours.

The estimated value of the Moran’s I for the UK between 1995 and 2008 does not exceed 18.5% and for each of these 3 years was significant at the 5% level. For the years shown there is evidence of positive spatial autocorrelation within the UK estimated using data for NUTS 3 sub-regions, but the evidence suggests that this may be explained by the lower incomes in Wales and Scotland.
Figure 6.3 Spatial Autocorrelation in log real GVA per capita, UK sub-regions 1995 Moran’s scatterplot
(Moran’s I = 0.1055)

Figure 6.4 Spatial Autocorrelation in log real GVA per capita, UK sub-regions 2000 Moran’s scatterplot
(Moran’s I = 0.1846)
6.6 Estimates of Beta Convergence between UK Sub-Regions

A more rigorous method to investigate the possibility of convergence can be undertaken by estimating beta convergence. This measures whether poorer sub-regions are growing faster than richer sub-regions by estimating the relationship over time, between the growth of per capita income over the period and the level at the start of the period. Beta convergence is a measure of the speed of convergence and for this study the extent to which Wales is catching up with the rest of the UK.

UK regions share some characteristics and differ in others, as many citizens of different regions celebrate their social and cultural distinctiveness and each region has a unique economic history and frequently a distinctive industrial infrastructure. This makes it difficult to judge whether the regions can be
considered to be homogeneous for the purpose of estimating evidence of regional convergence. Homogeneity would suggest the possibility of absolute economic convergence and is more likely to occur between Wales and England than between Wales and Scotland, owing to the long period of English and Welsh political and economic integration and the shorter distance between their capital cities. Consequently I report below in Table 6.11 the results of tests for absolute beta convergence for England, Wales, Scotland and also for the sub-regions grouped together as the core, inner periphery and outer periphery regions, groupings that are conventionally used for regional analysis of the UK. I have also investigated evidence of beta convergence for Wales together with its adjacent regions to determine if they can be regarded as an emerging club owing to increasing economic interdependence that can be regarded as spatial autocorrelation.

Beta convergence is estimated for these regions for the period 1995 to 1999 and for the years 2000 to 2008 to estimate evidence of convergence before and after Devolution in Wales and Scotland. Convergence is estimated by regressing the difference in the logarithm of real GVA per head of the chosen sub-regions at the end of the chosen period from that at the start of the chosen period against the logarithm of their initial income in that period. Recalling equation (3.18) the estimated equation was:

\[
\frac{1}{T} \log \left( \frac{y_{i,T}}{y_{i,0}} \right) = a - \left( \log(y_{i,0}) \cdot (1 - e^{-\beta yT}) \right) + \omega_{i0,T} \tag{6.1}
\]
where $y_i$ is per capita income of each of the selected regions; $\omega_i$ is an error term, the subscript $t$ indicates the start of a time interval; $\tau$ is the end of the time interval and $\frac{1}{\tau}$ is scaling term for the length of the period.

This model specification is equivalent to assuming that technological progress and any other hypothesised drivers of convergence are the same for all regions (i.e. unconditional convergence). A significant negative coefficient ($\beta < 0$) would suggest rejection of the null hypothesis of no absolute beta convergence. However, it is difficult to defend the implicit assumption of common steady-state growth rates for all regions noting the heterogeneity of regional industrial structure (ONS 2010a). For example, clusters of high technology enterprise around Cambridge may reflect the advantage of proximity to its prestigious University and is characterized by cutting-edge technology, while the Welsh industrial structure and the distribution of employment still reflect its heritage of reliance upon coal extraction and heavy industry. In this respect the ability of the Welsh economy to adapt can be seen as limited by path dependency (Page 2006). It may be that history matters, not only in the limitations imposed on economic growth by the stock of physical and human capital, but also by issues of work-ethic and cultural attitudes to entrepreneurial engagement. Additionally, it is unlikely that the steady-state growth of (say) London and the North East or Wales could be equivalent as the significance of the financial sector in the former enables higher increasing returns to scale than the smaller financial sectors in other regions. Estimates of beta convergence are shown below in Table 6.11.
Table 6.11 *Estimates of Beta Convergence for England, Wales, Wales and Adjacent Regions, Scotland, Core Regions, Inner Periphery (IP) Regions and Outer Periphery (OP) Regions calculated using NUTS 3 data between 1995 and 2008 using OLS.*

<table>
<thead>
<tr>
<th>Sample Period</th>
<th>Area</th>
<th>Constant</th>
<th>Beta coefficient</th>
<th>Adjusted R-squared</th>
<th>Prob(F-statistic)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995-1999</td>
<td>England</td>
<td>-0.1719***</td>
<td>0.0201***</td>
<td>0.0786</td>
<td>0.0038</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>(0.0624)</td>
<td>(0.0067)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-2008</td>
<td>England</td>
<td>-0.1279*</td>
<td>0.0599**</td>
<td>0.0314</td>
<td>0.0489</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>(0.0672)</td>
<td>(0.0300)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995-1999</td>
<td>Wales</td>
<td>-0.2746</td>
<td>0.0300</td>
<td>-0.0097</td>
<td>0.3668</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>(0.2883)</td>
<td>(0.0317)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-2008</td>
<td>Wales</td>
<td>0.0986</td>
<td>-0.0099</td>
<td>-0.0151</td>
<td>0.3820</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>(0.0989)</td>
<td>(0.0109)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995-1999</td>
<td>Wales and adjacent regions</td>
<td>-0.2669**</td>
<td>0.0299**</td>
<td>0.0992</td>
<td>0.0157</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>(0.1095)</td>
<td>(0.0119)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-2008</td>
<td>Wales and adjacent regions</td>
<td>0.0636</td>
<td>-0.0062</td>
<td>0.0071</td>
<td>0.2522</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>(0.0495)</td>
<td>(0.0054)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995-1999</td>
<td>Scotland</td>
<td>-0.0218</td>
<td>0.0029</td>
<td>-0.0449</td>
<td>0.8185</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>(0.1153)</td>
<td>(0.0126)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-2008</td>
<td>Scotland</td>
<td>0.0312</td>
<td>-0.0016</td>
<td>-0.0462</td>
<td>0.8672</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>(0.0846)</td>
<td>(0.0092)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995-1999</td>
<td>Core</td>
<td>-0.1135</td>
<td>0.0143</td>
<td>0.0403</td>
<td>0.1156</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>(0.0825)</td>
<td>(0.0089)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-2008</td>
<td>Core</td>
<td>-0.0515</td>
<td>0.0063</td>
<td>0.0341</td>
<td>0.1345</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>(0.0389)</td>
<td>(0.0041)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995-1999</td>
<td>IP</td>
<td>-0.2679**</td>
<td>0.0304**</td>
<td>0.1121</td>
<td>0.0299</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>(0.1233)</td>
<td>(0.0134)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-2008</td>
<td>IP</td>
<td>0.1059*</td>
<td>-0.0109</td>
<td>0.0527</td>
<td>0.1020</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>(0.0603)</td>
<td>(0.0065)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995-1999</td>
<td>OP</td>
<td>-0.0677</td>
<td>0.0078</td>
<td>-0.0086</td>
<td>0.4664</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>(0.0967)</td>
<td>(0.0106)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-2008</td>
<td>OP</td>
<td>-0.0207</td>
<td>0.0035</td>
<td>-0.0134</td>
<td>0.2848</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>(0.0594)</td>
<td>(0.0065)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Dependent variable: log real GVA per head at end of period – log real GVA per head at start of period/Length of time period.
Figures in brackets are standard errors. *** denotes coefficient significant at 1%; ** denotes coefficient significant at 5%; * denotes coefficient significant at 10%.
Core regions include London, the South East, East Midlands and the East of England.
Inner periphery (IP) regions include the West Midlands, the South West, and Yorkshire Humberside.
Outer periphery (OP) regions include the North West, the North East, Wales and Scotland.
Regions adjacent to Wales include the North West, the West Midlands and the South West.

The results presented in Table 6.11 do not indicate any evidence of convergence within Wales. Wales together with the adjacent English regions are of interest because of the hypothesis of spatial interaction on account of the regions'
proximity to each other. The results for Wales and the adjacent regions indicate evidence of beta divergence between 1995 and 1999. For England, the positive coefficient that is significant in both periods suggests beta divergence. The core group of regions do not display evidence of convergence or divergence over either period of time. Within the IP there is evidence of beta divergence between 1995 and 1999 and no evidence of beta convergence or beta divergence for the latter period. There is no evidence of beta convergence or beta divergence in the OP during either period of time. The behaviour of the Scottish results is of particular interest owing to the granting of Scottish Devolution in 1999. The results for Scotland over both periods of time are similar to those of Wales in that there is no evidence of either beta convergence or beta divergence. Drawing together the results over all geographies indicates evidence of beta divergence in England over both periods of time; beta divergence in Wales and adjacent regions in the earlier period and beta divergence in the IP in the earlier period. These results are not dissimilar to those estimated by Roberts (2004) who undertook a similar analysis based upon UK counties for the period 1977-1993 and the conclusion reported by Henley (2005) that ‘Britain appears to be an economy of growing spatial inequality’.

6.7 Conclusion

This chapter has presented a preliminary investigation of the evolution of economic growth in Wales relative to the other regions of UK for the period 1995
to 2008 that straddles the granting of political devolution to Wales. I have presented evidence using summary descriptive statistics that indicate the absence of evidence of sigma convergence between or within Wales and other regions over this period. The investigation of sigma values was augmented with calculations of changes in the logarithm of GVA per head for UK, which produced evidence that did not contradict the conclusion of the absence of sigma convergence.

I continued by considering the possibility that the analysis undertaken so far was misleading on account of concealed spatial interactions. Consequently, I calculated the Moran I statistic for each country and evidence that I could not reject the possibility of spatial autocorrelation in Scotland occurring by chance. There is no evidence of convergence within Wales and the evidence of the absence of contiguous similarity within Wales supports the previous conclusion of no evidence of sigma convergence.

I also performed estimation of beta convergence of the nations’ sub-regions and of the groupings of regions that are conventionally used for regional comparison and analysis. This analysis did not find evidence of beta convergence within Wales in the period following Devolution or within the outer periphery of the worst performing regions. The one result of note was evidence of growth divergence between 1995 and 1999, and no evidence to suggest growth convergence between 2000 and 2008 within the UK’s inner periphery group of regions. In general, these findings are not dissimilar to those of Roberts (2004)
whose analysis of UK regions between 1977 and 1993 found no evidence of beta convergence and but did provide evidence of sigma divergence.

The conclusions from this analysis are tentative, however, as they are limited to the superficial evidence provided by summary descriptive statistics and the estimation of beta convergence under the restrictive implied assumptions of the neoclassical paradigm. I continue my empirical analysis in chapter 7 by constructing and estimating a model specification that relaxes the restrictive neoclassical assumptions and entertains the possibility of endogenous growth.
Chapter 7: Endogenous Growth

Chapter 7

Endogenous Growth in Wales

7.1 Introduction

In chapter 6 I commenced answering my research questions using empirical analysis. Exploratory data analysis was conducted and summary statistics were calculated for the purpose of seeking indications of economic growth convergence. I was not able to find evidence in support of the hypothesis of convergence in chapter 6. This analysis did not attempt to consider factors that might explain differentials in regional growth even though, as I discussed in chapter 3, endogenous growth theory acknowledges that government policy and education are expected to influence economies’ long-run growth rates.

Previous chapters (2, 3 and 4) have discussed the significance of devolved governance for economic policy and economic development. My analysis of economic growth and economic policy demonstrated that investment in physical capital and investment in education and training, often described as investment in human capital, have been recurring themes of government interventions to enhance productivity growth and encourage the growth of Welsh incomes. These policies suggest a hypothesis linking a change in governance to an expectation of improved economic performance arising from more effective spending on economic development and higher levels of educational attainment.
Chapter 7: Endogenous Growth

The purpose of this chapter is to continue to answer the research questions posed in chapter 1; specifically, I investigate whether there is evidence of a change in Welsh economic prospects following Devolution. I report the development and estimation of a testable hypothesis based upon the econometric specification that was discussed in chapter 5. In this chapter I explore this hypothesis by developing an econometric model specification that is estimated using panel data. This can be considered as a contribution to our understanding of the connection between changes in governance through devolution and economic growth convergence.

Using regression analysis, I investigate whether WAG economic policy as it is manifest in spending on economic development and enhancing educational qualifications, has improved Welsh economic performance relative to other UK regions. This approach acknowledges the limited nature of the Welsh devolution settlement and the use of the Barnett funding mechanism (discussed previously in chapters 2 and 4) that excludes tax-raising powers. The policies pursued by the WAG since Devolution represent choices taken under a funding method that is effectively out of its control and based upon an inflexible formula that uses population proportions to calculate the changes in funding. This means that the decisions made by the WAG represent an exercise in constrained optimization, an inefficient allocative mechanism since it involves the separation of those who raise the funds from those who spend the budget.

This chapter is organised as follows: in section 7.2 I explain the use of public spending and education in the econometric specification. Section 7.3
discusses the modelling strategy and the choice of data, and in the following section I develop the theoretical specification. Section 7.5 presents the modelling results along with the diagnostic tests undertaken to analyse the model’s robustness and suitability and section 7.6 draws some preliminary conclusions prior to undertaking spatial analysis in chapter 8.

7.2 Government Spending, Education and Economic Development

The analysis in this chapter addresses the research aim discussed in chapter 1 of investigating the impact of WAG economic policy on Welsh economic development. The analysis is designed to explain the behaviour of Welsh economic performance relative to other UK regions using NUTS 1 data (the issues of geography and the use of NUTS data was discussed in chapter 5) comprising Wales, Scotland and the nine English Government Office Regions. In this chapter I undertake analysis that focuses upon factors within the regional economies which may be expected to have a palpable effect upon relative economic performance. This model is extended in chapter 8 to capture the effects of cross-regional economic interactions as an explanation of economic performance.

Following Easterly and Rebelo (1993) and Bleaney et al (2001) I investigate the premise of the endogenous growth school that government policy may influence an economy’s long-run growth path. However, there is a distinction between analysing the effect of UK fiscal policy upon the UK economy and the use of fiscal policy by WAG to effect an improvement in the performance of the Welsh
The Welsh devolution settlement does not yet permit WAG to vary taxes although it was found in chapter 4 that the Holtham Review (2009) has discussed this possibility. Currently, the latitude of WAG fiscal policy is limited to varying the distribution of the block grant between competing uses. Furthermore, it was argued in chapter 4 that WAGs influence on policy is constrained by the Barnett arrangements and the interplay of development funds received from the EU. Additionally, the economies of Wales and the other regions of the UK will be affected by the economic policy of Westminster through fiscal and monetary policy that does not discriminate by regional economic need. Consequently, the conclusions of this investigation cannot be attributed solely to WAG policy as a manifestation of its spending on economic development.

A theoretical explanation of the relationship between government expenditure and economic growth is incomplete (Irmen and Kuehnel 2008). In particular, there is a problem of discriminating causation in developed economies: namely, that government expenditure may be employed to influence economic growth, but the reverse may also hold if the demand for the services of public infrastructure grows in response to economic growth. Furthermore there may be a qualitative difference between the growth consequences of different categories of public expenditure. This distinction is recognised by Irmen and Kuehnel (2008), who focus exclusively on what they term ‘productive government expenditure’, which includes public expenditure on infrastructure such as roads, ports, or communication systems, public sector research spending and the provision of
basic education and medical services. Such a distinction is controversial since the category ‘productive government expenditure’ excludes spending on social welfare, defence and law and order, that all contribute directly and indirectly to the continuity of a stable society and economy. Also, the expenditures chosen and represented as a homogeneous group are also questionable as they represent investments that are diverse in their expected influence upon economic performance. For example, spending on infrastructure is likely to have an immediate but less direct influence than spending on research and education that may have a lagged effect but ultimately a greater influence on economic development.

It was established in chapters 2 and 3 that the quality of human capital is regarded as a *sine qua non* for economic development. A large body of literature suggests that there is a relationship between the quality of human capital and structured teaching and learning (see for example, Becker 1964; Nelson and Phelps 1966; Mincer 1974; Jorgenson and Fraumeni 1989; Benhabib and Spiegel 1994; Krueger and Lindahl 2001; Kneller and Stevens 2002; Harmon *et al* 2003; Hanushek and WoBmann 2007). Consequently, education and training are considered important for relative regional economic performance as they are expected to enhance the quality of human capital and labour productivity. However, there are many ways of representing educational achievement in empirical analysis. Barro and Sala-i-Martin (2004) incorporate the effect of education by estimating cross-country growth regressions using the variable...
‘upper-level schooling’ (secondary education in the UK). They also estimate governments’ impact upon growth using a measure of government consumption by subtracting the estimated ratio to inflation-adjusted GDP of inflation-adjusted spending on non-capital expenditures on education (Barro and Sala-i-Martin 2004). However, these variables are estimated along with other explanatory variables that are suitable for cross-country estimation but less so for cross-regional analysis, as they include measurement of ethnicity and the democratic nature of the political system. Such variables are assumed to be effectively homogeneous for comparisons of UK regions, are consequently unsuitable for explaining variations across regional economic performance and are omitted from this analysis. An explanation and discussion of the data used for estimation is given in the following section.

7.3 The Econometric Specification and the Data Used

The econometric specification that is estimated explores the relationship between Welsh economic performance relative to other regions, educational attainment and Welsh relative spending on economic development. This choice of variables is consistent with the hypothesis that Devolution can make a difference to the Welsh secular economic growth path through the transfer of power from Westminster to Cardiff Bay that have enabled the economic policy interventions discussed in chapter 4. The choice of data regarding regional aggregation, economic performance, public spending on economic development and education is
explained below. I begin by discussing the data that represents the different arrangements for financing the devolved territories and the English local authorities. Furthermore, an analysis of Welsh economic performance compared with that of the English regions and Scotland must take explicit account of their financing arrangements as variations in regions’ funding impose constraints on the spending choices available to the different jurisdictions.

Differences in the funding of the UK regions can be associated with their administrative structure as some rural English regions are based upon two tiers of administration comprising county councils and district councils; outside of areas designated as rural, local governance is based upon single-tier authorities (Adam et al. 2007). This means that in my analysis English regions are not strictly homogeneous and this may have implications for the allocation of expenditure within the two groups. The existing structure for local administration in England was introduced during 1996-1998 in response to the 1992 Local Government Act. Local government in England was reorganized again in 2009 and therefore comparisons of local authority behaviour before and after these dates may give rise to some inconsistency. However, the major difficulty originates from the constraints imposed upon English regions’ spending as some 30% is ring-fenced for use in specific services that exclude economic development (Department for Communities and Local Government 2010).

Census data (see Table 7.1 below) suggest that there is significant inter-regional commuting. However, the analysis of economic convergence may not
recognise this and implicitly assume that there is a correspondence between where
people work and live. Often this may not be the case, but if so it introduces a
disparity between regions’ income and output. GVA per head is calculated as the
difference between the value of output and intermediate consumption. Regions
that have net inward commuting, experience an increase in their output, while the
income generated is repatriated to the region of origin and this introduces
variations between income and output in these regions. Table 7.1 below
reproduces the data from the 2001 Census showing the extent of commuting
between all of the regions in England and Wales, and in particular the level of
commuting between Wales and other regions.

Table 7.1 represents a snapshot of inter-regional commuting in 1999 based
upon the 2001 census and is the latest available data until publication of the 2011
census. The first column identifies the regions of the origins of the commuters and
the columns show their associated destinations. The figures reinforce the
significance of proximity to Wales in explaining commuting behaviour between it
and other regions. The largest commuting populations from Wales travelled to the
regions adjacent to Wales: the North West, West Midlands and the South West
and these regions were also the origins of the largest commuting groups into
Wales. However, the data suggests that in 1999 more residents of Wales derived
income from working in English regions than residents of English regions
benefited from working in Wales. For example, the net outflow of commuters to
the North West region was 9,700, and to the West Midlands and the South West it
was 3,300 and 6,200 respectively. The net outflow of commuters may be explained by better job opportunities and higher incomes that can be earned by Welsh residents in England compared to those in Wales that enable them to experience a net benefit from commuting after allowing for increased travel costs and travel-to-work times. However, the net pair-wise numbers cannot be used to deduce the net effect on income and output as further information is required concerning the employment and income of the commuters, since, there may be significant differences in the level of pay of these two groups. Nevertheless, it highlights evidence of the extent to which the income of Wales, in 1999 at least, was dependent upon labour markets outside Wales. Such issues also highlight the problems associated with spatial economic analysis; the level of geography chosen affects the measurement of economic activity and varies with the mobility of labour (see for example Fox and Kumar 2005).

Table 7.1 Intra-Regional and Inter-Regional Commuting of Employees and the Self-Employed within England and Wales in 1999. (Thousands rounded to one decimal place)

<table>
<thead>
<tr>
<th>Origins</th>
<th>North East</th>
<th>North West</th>
<th>Yorkshire</th>
<th>East Midlands</th>
<th>West Midlands</th>
<th>Eastern</th>
<th>London</th>
<th>South East</th>
<th>South West</th>
<th>Wales</th>
</tr>
</thead>
<tbody>
<tr>
<td>North East</td>
<td>989.8</td>
<td>4.3</td>
<td>12.8</td>
<td>1.9</td>
<td>1.7</td>
<td>2.0</td>
<td>3.1</td>
<td>3.7</td>
<td>1.5</td>
<td>0.4</td>
</tr>
<tr>
<td>North West</td>
<td>2.3</td>
<td>2797.7</td>
<td>17.8</td>
<td>8.3</td>
<td>18.5</td>
<td>4.6</td>
<td>8.8</td>
<td>8.1</td>
<td>3.6</td>
<td>16.9</td>
</tr>
<tr>
<td>Yorkshire</td>
<td>13.6</td>
<td>22.0</td>
<td>2085.0</td>
<td>27.7</td>
<td>4.8</td>
<td>4.6</td>
<td>6.5</td>
<td>6.1</td>
<td>2.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Humberside</td>
<td>1.2</td>
<td>19.1</td>
<td>43.2</td>
<td>1721.4</td>
<td>46.5</td>
<td>34.0</td>
<td>13.7</td>
<td>29.3</td>
<td>22.9</td>
<td>0.8</td>
</tr>
<tr>
<td>East</td>
<td>0.7</td>
<td>21.4</td>
<td>3.2</td>
<td>35.3</td>
<td>2213.9</td>
<td>5.1</td>
<td>10.4</td>
<td>13.7</td>
<td>17.1</td>
<td>7.3</td>
</tr>
<tr>
<td>Midlands</td>
<td>0.6</td>
<td>2.9</td>
<td>2.5</td>
<td>14.1</td>
<td>4.1</td>
<td>2213.9</td>
<td>283.6</td>
<td>44.8</td>
<td>3.1</td>
<td>0.6</td>
</tr>
<tr>
<td>Western</td>
<td>0.7</td>
<td>2.9</td>
<td>1.8</td>
<td>3.2</td>
<td>3.5</td>
<td>73.2</td>
<td>104.2</td>
<td>132.1</td>
<td>3.9</td>
<td>0.9</td>
</tr>
<tr>
<td>London</td>
<td>0.7</td>
<td>3.4</td>
<td>2.3</td>
<td>10.4</td>
<td>8.2</td>
<td>40.0</td>
<td>374.9</td>
<td>3402.5</td>
<td>29.6</td>
<td>1.2</td>
</tr>
<tr>
<td>South</td>
<td>0.7</td>
<td>3.4</td>
<td>2.3</td>
<td>10.4</td>
<td>8.2</td>
<td>40.0</td>
<td>374.9</td>
<td>3402.5</td>
<td>29.6</td>
<td>1.2</td>
</tr>
<tr>
<td>East</td>
<td>0.4</td>
<td>2.3</td>
<td>1.4</td>
<td>1.9</td>
<td>11.7</td>
<td>4.1</td>
<td>16.1</td>
<td>51.2</td>
<td>2179.8</td>
<td>6.3</td>
</tr>
<tr>
<td>Wales</td>
<td>0.4</td>
<td>26.6</td>
<td>1.4</td>
<td>1.3</td>
<td>10.6</td>
<td>2.1</td>
<td>3.8</td>
<td>5.2</td>
<td>12.5</td>
<td>1117.5</td>
</tr>
</tbody>
</table>

Source: 2001 Census: Special Workplace Statistics (Level 1).
7.3.1 The Education Data

The income data and public spending data that are used in the analysis and its limitations are discussed in chapter 5 and are not repeated here. Chapter 3 established that economic growth is considered to be enabled by and to create a demand for human capital. As a broad concept, human capital incorporates the characteristics of human performance in economic activity that influences the quantity or quality of output or the speed with which output is produced given the physical capital in use. The significance of human capital for economic performance is that it permits productivity growth to take place without increasing the quantity or changing the vintage of the capital stock or increasing the amount of labour employed; for example, the quality of human capital can explain productivity growth arising from experiential learning (Arrow 1962; Sheshinski 1967; Beaudry 2010). Experience, or learning by doing, and its effect on productivity is not easily observable and cannot be used to produce data for quantitative analysis and it is assumed that educational qualifications can be used as a proxy for the accumulation of human capital. This is not ideal as it is reasonable to assume that there are members of the workforce without formal qualifications whose output benefits from experience just as there may be those with formal qualifications whose output does not. The extent of educational qualifications in the working population can affect economic activity; a shortage of educated labour may increase the price of labour and firms’ variable costs. Consequential cost increases may affect firms’ competitiveness, profitability and
sales growth with implications for further employment creation. In the extreme
the cost and productivity of labour may influence firms’ locational decisions when
expanding the capacity of existing enterprise or setting up new businesses; in this
way the incidence of education may have a direct effect on employment and
income generation and its regional distribution.

There are different ways of representing data of educational attainment to
model its impact on economic performance: Barro and Lee (2010) use the
proportion of adults that have completed different levels of education; Aghion et
al (2009) estimate a model using education expenditure on different grades of
education; Appiah and McMahon (2002) use the ratio of education expenditure to
GDP and Barro (1997) uses education enrolment ratios. It is important to
distinguish between the inputs into the production of human capital through
education and additions to the stock of human capital (Solow 2003). It is the effect
of the latter that is likely to affect economic performance and this analysis uses a
variant of that used by Barro and Lee (2010) by measuring the proportion of the
working population that has attained a certain level of education. It was
established in chapter 4 that WAG attach importance to the development of
human capital to promote economic development. This measure has also been
used by WAG in its measurement of policy targets that was discussed in chapter 4
(A Winning Wales 2002).

I investigate the educational achievement of the working age population
as a proxy for differences in the quality of human capital in different regions and
Chapter 7: Endogenous Growth

its impact on the growth process. Using a proxy such as this is not an ideal method of capturing the change in skills of those achieving or not undertaking educational qualifications, but it has the merit of maintaining consistency with the WAG who use similar measures of educational attainment in their policy documents (see for example WAG 2002).

Three methods of measuring relative educational achievement between regions are investigated: firstly, by comparing higher educational achievement; secondly, by measuring the absence of basic education, and finally by creating a ratio of both measures (see for example Hanushek and Woessmann 2007 for evidence of the importance of the extremes of educational attainment). In the first case regions with more workers with higher qualifications are assumed to have a work force with higher quality human capital and are expected to be more productive and innovative; regions with more workers who are not educated to a minimum level are expected to be less productive and the third measure has the merit of capturing the impact of both measures. The relative shortage or abundance of educational achievement in the working population can be measured from data of the academic achievement of each regional workforce provided by the ONS. These data are published in Regional Trends where it is described as the population of working age by highest qualification. This data was used to create three variables representing the extremes of educational attainment in order to highlight any differences of the effect of qualifications upon economic performance:
a) the percentage of the working population with higher education, and;

b) the percentage of the working population with no qualifications; and

c) using the data from a) and b) to calculate the ratio of the working population with higher education to the working population with no qualifications.

The working population includes males between the ages of 16 and 64 and females aged 16 to 59. Higher education qualifications include degrees or equivalent vocational awards, including NVQ level 4 and above, BTEC/SCOTVEC, HNC/HND, RSA Higher Diploma, and nursing and teaching qualifications.

The econometric estimation may be affected by correlation between regions’ expenditure on education and training and the qualifications of the workforce. The analysis of policy previously undertaken in chapter 4 confirmed the importance that WAG attaches to education as an accelerant of growth. Success of WAG education policy can be associated with changes in the incidence of educational attainment. In other words, this introduces the possibility of collinearity between the public spending and education independent variables of the specification. This is likely under the restrictive assumptions that the regional populations of those who are unqualified and those who are highly qualified reside and work in the regions where they were trained or remained untrained. In the econometric estimation I undertake in later chapters I test for this possibility by using a diagnostic test for multicollinearity.
7.4. The Theoretical Specification

In chapter 6 I estimated the rate of convergence of per capita incomes across UK sub-regions following Sala-i-Martin (1996) and Barro and Sala-i-Martin (2004).

This was estimated using equation (6.1) that is reproduced below:

\[
\frac{1}{T} \log \left( \frac{y_{it}}{y_{i,T}} \right) = a - \left( \log \left( y_{i,T} \right) \left( 1 - e^{-\beta T} \right) \frac{1}{T} \right) + \omega_{i,T}
\]  

(7.1)

Where, \( y \) is real per capita income

- \( i \) = denotes a region
- \( t \) = terminal date
- \( T \) = length of period and \( \frac{1}{T} \) is the scaling term.
- \( \omega \) = the error term

The parameter \( \beta \) estimates annual convergence between low and high income regions; if convergence is taking place it is expected that regions with a lower level of income per head would grow faster than regions with a higher level of income per head. In an endogenous model specification it is hypothesised that the effectiveness of devolution for economic development is captured by improvements in the various types of capital described above after the devolution date. Hence the above equation is augmented with variables to capture the effect of public capital (spending on infrastructure) and human capital (education and training).
Following Lall and Yamiz (2000) the above equation can be written as:

\[ \log(y_{it}) = a - b \log(y_{it-1}) + c \log K_{jt-1} + d_i R_i + fS \]  

(7.2)

\( K \) is a vector of \( j \) regional characteristics capturing changes in the use of capital and human capital. It is assumed that there are no autonomous changes in private productive capital resulting from devolution, as periods of political change are often associated with increasing uncertainty and may inhibit private investment. However, if devolution does increase growth in future periods, this could result in multiplier-accelerator positive feedback effects that will encourage investment in private capital.

\( R \) is a vector of regional dummies included to illuminate specific regional effects and \( S \) is a time dummy to distinguish between the years before and after Devolution. For the moment I ignore the possibility of spatial effects which will be developed in chapter 8 by the inclusion of regional dummies in further models.

The focus of this study is Welsh economic performance relative to the rest of the UK and one of the innovations introduced by this analysis is to model the above equation in terms of the change in Welsh income per head as a ratio of each of the UK regions. This dependent variable is estimated as a function of spending on Welsh economic development in relation to that of each of the regions to represent a proxy for a physical capital effect. The human capital effect is captured by the estimation of another variable representing Welsh educational achievement in the workforce in relation to that of each of the regions. The underlying theory of
the specification to be estimated is that there is a relationship between Welsh economic performance relative to other regions that is explained by the ratio of public spending on economic development together with the relative educational attainment of the workforce. Implicitly this assumes that Wales and other regions are always in steady-state equilibrium and to capture a long-run solution will require the use of lag structures to model the changing regional relativities of the physical and human capital stock.

The application of economic theory does not suggest the appropriate lag length to employ in the model specification. Economic behaviour and performance within a region or a state in one time period are unlikely to be independent of that of previous periods because of inter-temporal saving and investment behaviour and the slow turnover of the stock of physical and human capital. The likelihood of uncertain lagged economic effects in relation to the data available for econometric estimation may explain why some researchers make simplifying assumptions concerning the lag length used in econometric specifications. For example, a recent paper (Mohl and Hagen 2011) estimates a panel data model investigating the relationship between EU Structural Funds and regional employment incorporating a one-period lag without explaining the choice of lag length. The absence of a theoretical foundation for lag selection has led to the use of data driven methods (see for example, Pakes and Griliches 1982; Khim and Liew 2004). Modelling a dynamic relationship to investigate the significance of devolution for Welsh economic performance would be overly restrictive by
assuming that the association between the independent variables and GVA per head was restricted to the current year. Consequently, equation 7.3 below is to be interpreted as a generalised form of a long-run dynamic relationship to be used to estimate the long-run equilibrium solution. The influence of public expenditure and academic achievement may not be immediate and their consequences may not be apparent within one year and may or may not include both short- and long-run effects. Hence, I shall allow for these possibilities by estimating equation 7.3 with a one-period lag because it is consistent with the use of public sector annual budgeting. Additionally I verified the use of a one-period lag by investigating the relationship between the dependent variable and the lagged values of each independent variable up to five year. For all variables it was found that after the first period lag the estimated coefficient decayed rapidly and was not significant at 10%.

Six versions of the following model were estimated using natural logs:

\[
\begin{align*}
\log(y_{it}) &= A + b_1 \log(y_{it-m}) + b_2 \log(PE_{it-m}) + b_3 \log(Q_{it-m}) + b_4 D + b_5 D^* \log(PE_{it-m}) \\
&+ b_6 D^* \log(Q_{it-m}) + e_{it}
\end{align*}
\]

(7.3)

As this is a complex specification on account of the variables indicating relative behaviour I set out the equation below explicitly
Chapter 7: Endogenous Growth

\[
\log\left(\frac{Y_{Wales,t}}{Y_{t,t}}\right) = \alpha_0 + \beta_1 \log\left(\frac{Y_{Wales,t-1}}{Y_{t,t-1}}\right) + \beta_2 \log\left(\frac{p_{Wales,t-m}}{p_{E,t-m}}\right) + \beta_3 \log\left(\frac{q_{Wales,t-m}}{q_{t,t-m}}\right) +
\beta_4 D + \beta_5 D \cdot \log\left(\frac{p_{Wales,t-m}}{p_{E,t-m}}\right) + \beta_6 D \cdot \log\left(\frac{q_{Wales,t-m}}{q_{t,t-m}}\right) + e_{it} \tag{7.4}
\]

The different versions correspond with the use of time dummies to investigate the research question concerning changes in the effectiveness of WAG economic policy over time. In the first version \(D\) is a time (constant) dummy that takes the value 0 before the year 2000 and the value 1 after. The two variables following \(D\) are slope dummies and \(e\) is an error term, assumed to have zero mean and non-zero variance; \(e_{it} \sim N(0, \sigma^2_e)\). The purpose of the dummies is to test for the existence and to quantify the effect of devolution upon the relationship postulated by the estimating equation. Devolution in Wales occurred in 1999 and I have assumed that it is unlikely that this would have any measurable effect upon economic performance until the following year at the earliest. This means that the dummy has five years of data before Devolution (1995–1999) and nine years of data following Devolution (2000–2008). This panel data uses UK regional data at the NUTS 1 level of disaggregation and therefore represents 50 observations before Devolution and 90 observations since Devolution. However, a dummy for a single year that captures the before and after effects of Devolution is a crude instrument that ignores the policy initiatives of the Welsh Assembly in subsequent years that were discussed previously in chapter 4. To capture the effects of subsequent policy intervention I have estimated this specification individually with each of five additional dummy variables: the subsequent years’ dummies are identified as ...
Chapter 7: Endogenous Growth

$D1$ that takes the value of unity from 2001; $D2$ takes the value of unity from 2002 and so on up until $D5$ that takes the value of unity from 2005. It was decided to discontinue the use of dummy variables in this year as the data available terminates at 2008.

The variables used for estimation are:

$y_{it}$ is GVA per head in Wales as a proportion of the income per head in each of the English regions and Scotland at 1995 prices for each year of the analysis; the use of this dependent variable and the attendant data issues are discussed at length in chapter 5.

$Y_{it-m}$ is a lagged dependent variable. The accumulation of private productive capital, in a mixed economy, is partly explained by the expectation of profit and the achievement of a return on capital commensurate with the expected risk of enterprise. Economic theory posits that there is a relationship between the accumulation of private productive capital and economic growth (Acemoglu 2009), in the absence of regional and sub-regional data this effect is captured by the use of a lagged dependent variable. Additionally, my discussion of economic growth theory in chapter 3 identified many candidate variables that can be associated with an economy’s notional production function, including for example, culture, religion and political institutions (Barro and Sala-i-Martin 2004). Data, where available, are unlikely to exhibit sufficient variation within the UK across regions and over time. A lagged dependent variable is used as a partial adjustment mechanism to limit the problems associated with missing variables.
Chapter 7: Endogenous Growth

PE represents Welsh public expenditure per head on economic development relative to that of the other regions at 1995 prices. This independent variable is intended to capture changes in public spending behaviour on various non-social components of public spending before and after Devolution. For each region for each year it represents the sum of current and capital spending on enterprise and economic development, science and technology, employment policies, agriculture, fisheries and forestry, transport, and education and training. The independent variable is calculated as the ratio of Welsh spending on the sum of these items in each year in relation to each English region and Scotland. I predict that the estimated coefficient will be positive as such expenditures are hypothesized to be undertaken with the purpose of stimulating economic activity.

Q is a measure of educational attainment. Three formulations of this variable are investigated in separate regressions: the proportion of the working population who are qualified to level 4 or above of the National Qualifications Framework; the proportion of the working population who have no qualifications, and the ratio of these two proportions, i.e. the numerator is the proportion of the working population who are qualified to level 4 or above of the National Qualifications Framework and the denominator is the proportion of the working population who have no qualifications. This ratio for each region was then used to calculate the Welsh ratio as a proportion of that of each of the other regions. I assume that higher education is associated with higher labour productivity and will have a positive effect upon income growth and that the opposite effect will
operate for the absence of qualifications. Consequently, I expect that an increase in the ratio will improve Welsh relative economic performance.

It should be noted that the definition of this data used by the UK Office for National Statistics (ONS) changed during the period of study. Prior to 2001, higher education qualifications were defined to be qualifications above GCE A level or equivalent, and from 2001 the data is ordered into seven strata of qualifications of the National Qualifications Framework (NQF); namely, no qualifications, below level 2, level 2, level 2+, level 3, levels 4-6, and level 4+. The data from 2001 reflects the category of those qualified to NQF level 4 and above, that is judged to be most consistent with data from previous years.

The use of the variable $Q$ representing the extremes of educational attainment in the workforce minimises the loss of degrees of freedom that would occur if both variables were used individually. Additionally, there is evidence from inspection of the correlation matrix that to use both variables individually introduces multicollinearity (-0.58) that is removed by using the ratio $Q$ (the correlation between $Q$ and $PE$ is 0.08). On the other hand, the use of $Q$ ignores the possible importance of other educational attainment such as GCSE, GCE A levels and a category of education that is classified as ‘other qualifications’ of a vocational nature. If these categories of educational attainment are important in explaining variations in economic performance they will contribute to omitted variable bias in the estimated regression residuals. However they are indirectly
taken into account by the variable measuring an absence of formal qualifications
that will exclude awards described by the category of ‘other qualifications’.

The assumption that each region grows along its own unique steady-state
growth path could be interpreted, in economic terms, as a fixed-effects model. The
use of panel data involves multiple observations of each region or sub-region and
avoids omitted variable bias. I have tested this assumption using a redundant
fixed effects test for each of the three combinations of independent variables used
and the results are shown below in Table 7.2.

Table 7.2 Test for Redundant Cross-Section Fixed Effects

<table>
<thead>
<tr>
<th>Effects Test</th>
<th>Statistic</th>
<th>d.f.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variables (IVs) – PE, ER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross-section F</td>
<td>243.4</td>
<td>(9,128)</td>
<td>0.0000</td>
</tr>
<tr>
<td>Cross-section Chi-square</td>
<td>405.5</td>
<td>9</td>
<td>0.0000</td>
</tr>
<tr>
<td>(IVs) – PE, NQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross-section F</td>
<td>345.3</td>
<td>(9,128)</td>
<td>0.0000</td>
</tr>
<tr>
<td>Cross-section Chi-square</td>
<td>452.2</td>
<td>9</td>
<td>0.0000</td>
</tr>
<tr>
<td>IVs – PE, HE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross-section F</td>
<td>172.1</td>
<td>(9,128)</td>
<td>0.0000</td>
</tr>
<tr>
<td>Cross-section Chi-square</td>
<td>360.2</td>
<td>9</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Note: PE is ratio of Welsh expenditure on economic development to that of each other region; NQ is the ratio of the proportion of the workforce in Wales with no educational qualifications to that of each other region; HE is the ratio of the proportion of the workforce in Wales with higher education qualifications to that of each other region; ER is the ratio of HE to NQ.

This tests the joint significance of the fixed effects estimates by estimating an
unrestricted specification with fixed effects for comparison with a restricted
specification. Two tests are reported, the F-test (using sums-of-squares) and the
Chi-square test. The test statistics and the associated p-values strongly reject the
null that the effects are redundant, implying that the regions are not
homogeneous. This result is consistent with the theoretical expectation that the
regions of a previously integrated economy can be expected to have developed in a broadly similar fashion after taking account of regional specialization. It is also consistent with the expectation that inter-regional trade within a single economy will lead to some correlation of regional growth paths.

7.5 Model Estimation and Diagnostic Tests

Panel data regressions may result in spurious estimates of the coefficients when the data is non-stationary (Engle and Granger 1987). The data may exhibit trending over time and observations that are not independent from each other may result in a violation of the assumptions of the classical linear regression model. Consequently, it is necessary to test data for stationarity by using panel unit-root tests and, if required, transform the data to achieve an order of integration of zero prior to estimating the regression. The model is estimated with log-transformed variables and the unit root tests are also conducted in this way.

Panel unit-root tests may be conducted assuming a common unit-root process across all cross-sections using the Levin, Lin and Chu (LLC) test (2002), or the Breitung test (2000). Alternatively, assuming individual unit-root processes over cross-sections, the possible tests are those of Im, Pesaran and Shin (IPS) (2003), or the Fisher-ADF and Fisher-PP tests as proposed by Maddala and Wu (1999) and Choi (2001) respectively.

Based on the variants of the Augmented Dickey-Fuller (ADF) specification (Dickey and Fuller 1979):
\[ \Delta y_t = \alpha y_{t-1} + \sum_{j=1}^{p} \beta_{ij} \Delta y_{it-j} + x_{it} \delta + \varepsilon_{it} \] (7.4)

tests with a common unit root process, the LLC and Breitung tests, assume a null hypothesis and the alternative hypothesis:

\[ H_0: \alpha = 0 \]
\[ H_1: \alpha < 0 \] (7.5)

where \( \alpha = \rho - 1 \) and the lag on the difference term \( \rho_i \) can vary over cross-sections. LLC estimate two auxiliary regressions and obtain proxy estimates of \( \Delta y_{it} \) and \( y_{it} \) from which \( \alpha \) can be derived from the pooled proxy equation. The Breitung test differs in the construction of the proxies and also involves a transformation of the proxies to remove the trend.

The IPS test investigates for individual unit root processes that allow \( \rho_i \) to vary over cross-sections. A separate ADF regression is estimated for each section and the average of the \( t \)-statistics for \( \alpha_i \) is used to form a test statistic. An alternative approach to individual unit root tests is taken by the Fisher-ADF and the Fisher-PP procedures. The \( p \)-values of each cross-section are used to form a \( X^2 \) and an \( F \)-statistic to test the same null as that used for the IPS test.

The IPS test assumes that the dependent variable is heterogeneous over cross-sections and implies that for this analysis, UK regions are dissimilar. However it was earlier argued that the growth performance of regions within a
single economy such as the UK can be assumed to be more homogeneous than when comparing the economic performance of sovereign nation-states. In fact, the statistics of the UK regions economic performance suggest a three-way-classification of regions that are usually referred to as the core, inner periphery and outer periphery (Brand 2003). This can be interpreted as evidence of the regional clustering of growth paths that indicates club behaviour and not variations between individual region’s behaviour, regional heterogeneity that was also suggested by the result of the fixed effects test. Over time these clubs do not appear to converge and this suggests heterogeneous club behaviour as opposed to heterogeneous regional behaviour. To allow for this range of possibilities a number of tests are conducted that are reported below.

The analysis commences by performing unit root tests for the dependent variable, GVA per head and the public spending variable. The null hypothesis of these tests is that a series is non-stationary (i.e. that there is a unit root) and the probability values are shown below in Table 7.3 for intercept and intercept and trend.
### Table 7.3 Level Panel Unit-Root Tests 1995-2008

<table>
<thead>
<tr>
<th>Series</th>
<th>Intercept Income</th>
<th>Intercept Public Spending</th>
<th>Intercept and Trend Income</th>
<th>Intercept and Trend Public Spending</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPS statistic</td>
<td>-2.0293</td>
<td>-5.7586</td>
<td>-0.7807</td>
<td>-3.8705</td>
</tr>
<tr>
<td>Prob.</td>
<td>(0.0212)</td>
<td>(0.0000)</td>
<td>(0.2175)</td>
<td>(0.0001)</td>
</tr>
<tr>
<td>No. of observations</td>
<td>125</td>
<td>124</td>
<td>126</td>
<td>123</td>
</tr>
<tr>
<td>LLC statistic</td>
<td>-2.8419</td>
<td>-8.7841</td>
<td>-5.5751</td>
<td>-9.8849</td>
</tr>
<tr>
<td>Prob.</td>
<td>(0.0022)</td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>No. of observations</td>
<td>125</td>
<td>124</td>
<td>126</td>
<td>123</td>
</tr>
<tr>
<td>Breit. statistic</td>
<td>NA</td>
<td>0.5676</td>
<td>-2.5165</td>
<td></td>
</tr>
<tr>
<td>Prob.</td>
<td>NA</td>
<td>(0.7149)</td>
<td>(0.0059)</td>
<td></td>
</tr>
<tr>
<td>No. of observations</td>
<td>NA</td>
<td>NA</td>
<td>116</td>
<td>113</td>
</tr>
<tr>
<td>ADF statistic</td>
<td>36.0621</td>
<td>69.2618</td>
<td>29.6826</td>
<td>51.9139</td>
</tr>
<tr>
<td>Prob.</td>
<td>(0.0151)</td>
<td>(0.0000)</td>
<td>(0.0752)</td>
<td>(0.0001)</td>
</tr>
<tr>
<td>No. of observations</td>
<td>125</td>
<td>124</td>
<td>126</td>
<td>123</td>
</tr>
<tr>
<td>PP statistic</td>
<td>51.5626</td>
<td>26.9054</td>
<td>24.3875</td>
<td>8.7023</td>
</tr>
<tr>
<td>Prob.</td>
<td>(0.0001)</td>
<td>(0.1379)</td>
<td>(0.2259)</td>
<td>(0.9861)</td>
</tr>
<tr>
<td>No. of observations</td>
<td>130</td>
<td>130</td>
<td>130</td>
<td>130</td>
</tr>
</tbody>
</table>

**Notes:**
- IPS = the Im, Pesaran and Shin test
- LLC = the Levin, Lin and Chu test
- Breit = the Breitung test
- ADF = the augmented Dickey-Fuller test
- PP = the Phillips-Perron test
- LLC and Breitung null assume a common unit process, i.e. that the AR process is identical across cross sections.
- IPS, ADF and PP null assume individual unit root processes across cross sections.
- The Breitung statistic is not calculated for the intercept alone as its formula requires exogenous regressors.
- Estimated using EViews 6 software set for automatic selection of maximum lag.
I also conducted panel unit root tests on the education variables that are shown below as Table 7.4.

### Table 7.4 Level Panel Unit-Root Tests 1995-2008 Education variables

<table>
<thead>
<tr>
<th>Series</th>
<th>Intercept</th>
<th>Intercept and Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Education</td>
<td>Education</td>
</tr>
<tr>
<td></td>
<td>No Quals</td>
<td>High Quals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Method</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LLC statistic</strong></td>
<td>-2.9638</td>
<td>-2.7203</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Breit. statistic</strong></td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ADF statistic</strong></td>
<td>38.3851</td>
<td>76.9861</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PP statistic</strong></td>
<td>53.7329</td>
<td>92.2708</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- IPS = the Im, Pesaran and Shin test
- LLC = the Levin, Lin and Chu test
- Breit = the Breitung test using
- ADF = the augmented Dickey-Fuller test
- PP = the Phillips-Perron test
- LLC and Breitung null assume a common unit process, i.e. that the AR process is identical across cross sections.
- IPS, ADF and PP null assume individual unit root processes across cross sections.
- The Breitung statistic is not calculated when for the intercept alone as its formula requires exogenous regressors.
- Estimated using EVIEWS 6 software set for automatic selection of maximum lag.
The balance of evidence provided by the panel unit root tests indicate that first-differencing of the data is not required and the model was estimated over the period 1995-2008 using the natural logarithms of the original data in levels using panel least squares and cross-section fixed effects. Three specifications were estimated that each used a different education variable along with each dummy variable and the results are reported below in Tables 7.5 – 7.7.

Comparing the base estimation using each of the education variables common characteristics can be discerned. The lagged dependent variable is less than one reflecting indications of a convergence to zero change relative to other UK regions that is weakening over time. Relative public spending does not appear to have a sizeable influence on Welsh income per head or to be significant suggesting that Welsh investment in economic development does not appear to have an appreciable impact on economic performance. Comparison of the statistical significance of the three education variables that have been explored suggests that the ratio measure of education reported in Table 7.5 is the best explanation of the importance of human capital on income growth. Over each specification the impact dummy variables are consistently negative and the slope dummies are mainly insignificant.
### Table 7.5 Fixed Effects Regression Estimates: UK NUTS1 Regions, 1995-2008; education variable: HE qualifications as ratio of no qualifications.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.0411***</td>
<td>-0.0566***</td>
<td>-0.0919***</td>
<td>-0.0910***</td>
<td>-0.0945***</td>
<td>-0.0905***</td>
</tr>
<tr>
<td>Lagged dep. var.</td>
<td>0.8262***</td>
<td>0.7797***</td>
<td>0.6019***</td>
<td>0.6075***</td>
<td>0.6073***</td>
<td>0.6535***</td>
</tr>
<tr>
<td>Public spending</td>
<td>0.0492</td>
<td>0.0586*</td>
<td>0.0792***</td>
<td>0.0708***</td>
<td>0.0950***</td>
<td>0.0971***</td>
</tr>
<tr>
<td>Public spending(-1)</td>
<td>-0.0455</td>
<td>-0.0347</td>
<td>-0.0493**</td>
<td>-0.0422*</td>
<td>-0.0624***</td>
<td>-0.0631***</td>
</tr>
<tr>
<td>Education</td>
<td>0.0271</td>
<td>0.0233</td>
<td>-0.0157</td>
<td>-0.0192</td>
<td>-0.0245</td>
<td>-0.0327**</td>
</tr>
<tr>
<td>Education(-1)</td>
<td>-0.0176</td>
<td>-0.0196</td>
<td>0.0153</td>
<td>0.0190</td>
<td>0.0189</td>
<td>0.0140</td>
</tr>
<tr>
<td>Dummy (D)</td>
<td>-0.0029</td>
<td>-0.0013</td>
<td>-0.0118***</td>
<td>-0.0109**</td>
<td>-0.0103**</td>
<td>-0.0018</td>
</tr>
<tr>
<td>D*public spending</td>
<td>0.1050**</td>
<td>0.1119**</td>
<td>0.0260</td>
<td>0.1561***</td>
<td>0.1288*</td>
<td>0.0447</td>
</tr>
<tr>
<td>D*public spending(-1)</td>
<td>-0.0649</td>
<td>-0.0567</td>
<td>0.1167***</td>
<td>-0.0645</td>
<td>-0.0261</td>
<td>0.0490</td>
</tr>
<tr>
<td>D*education</td>
<td>0.0285</td>
<td>-0.0740***</td>
<td>0.0354</td>
<td>0.0654**</td>
<td>0.0407</td>
<td>0.0311</td>
</tr>
<tr>
<td>D*education(-1)</td>
<td>-0.0725**</td>
<td>0.0876***</td>
<td>-0.0032</td>
<td>-0.0369</td>
<td>-0.0111</td>
<td>0.0005</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.9932</td>
<td>0.9936</td>
<td>0.9941</td>
<td>0.9941</td>
<td>0.9940</td>
<td>0.9940</td>
</tr>
<tr>
<td>F-statistic</td>
<td>997.0</td>
<td>1052.7</td>
<td>1147.8</td>
<td>1146.4</td>
<td>1126.6</td>
<td>1121.9</td>
</tr>
<tr>
<td>Prob (F-statistic)</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Standard error of regressor</td>
<td>0.0141</td>
<td>0.0137</td>
<td>0.0132</td>
<td>0.0132</td>
<td>0.0133</td>
<td>0.0133</td>
</tr>
</tbody>
</table>

**Notes:**
- Dependent variable: log (real Gross Value Added (GVA) per capita Wales/ real GVA per capita other UK regions).
- Education variable: log (HE qualifications Wales/no qualifications other UK regions)
- Standard errors are shown in parentheses
- Total panel (balanced) observations = 130
- *** Significance at 1%, ** significance at 5%, * significance at 10%.
### Table 7.6 Fixed Effects Regression Estimates: UK NUTS1 Regions, 1995-2008; education variable: no qualifications.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.0539***</td>
<td>-0.0627**</td>
<td>-0.0893***</td>
<td>-0.0869***</td>
<td>-0.0908***</td>
<td>-0.0886***</td>
</tr>
<tr>
<td></td>
<td>(0.0187)</td>
<td>(0.0176)</td>
<td>(0.0161)</td>
<td>(0.0158)</td>
<td>(0.0157)</td>
<td>(0.0155)</td>
</tr>
<tr>
<td>Lagged dep. var.</td>
<td>0.8057***</td>
<td>0.7805***</td>
<td>0.6327***</td>
<td>0.6461***</td>
<td>0.6392***</td>
<td>0.6802***</td>
</tr>
<tr>
<td></td>
<td>(0.0649)</td>
<td>(0.0616)</td>
<td>(0.0580)</td>
<td>(0.0608)</td>
<td>(0.0613)</td>
<td>(0.0593)</td>
</tr>
<tr>
<td>Public spending</td>
<td>0.0643</td>
<td>0.0695**</td>
<td>0.0884***</td>
<td>0.0777***</td>
<td>0.0999***</td>
<td>0.1026***</td>
</tr>
<tr>
<td></td>
<td>(0.0400)</td>
<td>(0.0323)</td>
<td>(0.0275)</td>
<td>(0.0237)</td>
<td>(0.0221)</td>
<td>(0.0217)</td>
</tr>
<tr>
<td>Public spending(-1)</td>
<td>-0.0439</td>
<td>-0.0379</td>
<td>-0.0584**</td>
<td>-0.0502**</td>
<td>-0.0664**</td>
<td>-0.0646**</td>
</tr>
<tr>
<td></td>
<td>(0.0353)</td>
<td>(0.0282)</td>
<td>(0.0233)</td>
<td>(0.0220)</td>
<td>(0.0209)</td>
<td>(0.0207)</td>
</tr>
<tr>
<td>Education</td>
<td>-0.0298</td>
<td>-0.0247</td>
<td>0.0281</td>
<td>0.0356</td>
<td>0.0421*</td>
<td>0.0517**</td>
</tr>
<tr>
<td></td>
<td>(0.0328)</td>
<td>(0.0312)</td>
<td>(0.0252)</td>
<td>(0.0234)</td>
<td>(0.0222)</td>
<td>(0.02177)</td>
</tr>
<tr>
<td>Education(-1)</td>
<td>0.0459</td>
<td>0.0459</td>
<td>-0.0082</td>
<td>-0.0160</td>
<td>-0.0203</td>
<td>-0.0111</td>
</tr>
<tr>
<td></td>
<td>(0.0336)</td>
<td>(0.0293)</td>
<td>(0.0259)</td>
<td>(0.0211)</td>
<td>(0.0207)</td>
<td>(0.0200)</td>
</tr>
<tr>
<td>Dummy (D)</td>
<td>-0.0005</td>
<td>-0.0003</td>
<td>-0.0121***</td>
<td>-0.0100**</td>
<td>-0.0104**</td>
<td>-0.0019</td>
</tr>
<tr>
<td></td>
<td>(0.0055)</td>
<td>(0.0048)</td>
<td>(0.0046)</td>
<td>(0.0047)</td>
<td>(0.0047)</td>
<td>(0.0047)</td>
</tr>
<tr>
<td>D*public spending</td>
<td>0.0882*</td>
<td>0.1019**</td>
<td>0.1201***</td>
<td>0.1736***</td>
<td>0.1532**</td>
<td>0.0756</td>
</tr>
<tr>
<td></td>
<td>(0.0514)</td>
<td>(0.0445)</td>
<td>(0.0407)</td>
<td>(0.0455)</td>
<td>(0.0667)</td>
<td>(0.0736)</td>
</tr>
<tr>
<td>D*public spending(-1)</td>
<td>-0.0518</td>
<td>-0.0455</td>
<td>-0.0102</td>
<td>-0.0710</td>
<td>-0.0376</td>
<td>0.0300</td>
</tr>
<tr>
<td></td>
<td>(0.0458)</td>
<td>(0.0408)</td>
<td>(0.0383)</td>
<td>(0.0461)</td>
<td>(0.0676)</td>
<td>(0.0626)</td>
</tr>
<tr>
<td>D*education</td>
<td>0.1045**</td>
<td>0.1039***</td>
<td>-0.0294</td>
<td>-0.0925**</td>
<td>-0.0751</td>
<td>-0.0778</td>
</tr>
<tr>
<td></td>
<td>(0.0408)</td>
<td>(0.0394)</td>
<td>(0.0412)</td>
<td>(0.0467)</td>
<td>(0.05089)</td>
<td>(0.0536)</td>
</tr>
<tr>
<td>D*education(-1)</td>
<td>-0.1160***</td>
<td>-0.1295**</td>
<td>-0.0217</td>
<td>0.0502</td>
<td>0.0314</td>
<td>0.0305</td>
</tr>
<tr>
<td></td>
<td>(0.0408)</td>
<td>(0.0397)</td>
<td>(0.0411)</td>
<td>(0.0460)</td>
<td>(0.0497)</td>
<td>(0.0536)</td>
</tr>
</tbody>
</table>

| Adjusted R-squared  | 0.9932           | 0.9935     | 0.9940     | 0.9941     | 0.9940     | 0.9940     |
|                     | 0.9935           | 0.9940     | 0.9941     | 0.9940     | 0.9940     | 0.9940     |
| F-statistic         | 996.9            | 1042.9     | 1130.2     | 1134.8     | 1118.3     | 1125.0     |
|                     | 1042.9           | 1130.2     | 1134.8     | 1118.3     | 1125.0     |           |
| Prob. (F-statistic) | 0.0000           | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     |
|                     | 0.0000           | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     |
| Standard error of regression | 0.0141 | 0.0138 | 0.0133 | 0.0132 | 0.0133 | 0.0133 |

**Notes:**
- Dependent variable: log (real Gross Value Added (GVA) per capita Wales/ real GVA per capita other UK regions).
- Education variable: log (no qualifications Wales/ no qualifications other UK regions)
- Standard errors are shown in parentheses
- Total panel (balanced) observations = 130
- *** Significance at 1%, ** significance at 5%, * significance at 10%.
### Table 7.7 Fixed Effects Regression Estimates: NUTS1 Regions, 1995-2008; education variable: HE qualifications.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.1306**</td>
<td>0.1883***</td>
<td>0.1532***</td>
<td>0.1476***</td>
<td>0.1878***</td>
<td>0.1950***</td>
</tr>
<tr>
<td></td>
<td>(0.0567)</td>
<td>(0.0568)</td>
<td>(0.0565)</td>
<td>(0.0538)</td>
<td>(0.0488)</td>
<td>(0.0470)</td>
</tr>
<tr>
<td>Lagged dep. var.</td>
<td>0.7786***</td>
<td>0.6890***</td>
<td>0.6899***</td>
<td>0.6965***</td>
<td>0.6593***</td>
<td>0.6504***</td>
</tr>
<tr>
<td></td>
<td>(0.0660)</td>
<td>(0.0758)</td>
<td>(0.0752)</td>
<td>(0.0677)</td>
<td>(0.0570)</td>
<td>(0.0536)</td>
</tr>
<tr>
<td>Public spending</td>
<td>0.0436**</td>
<td>0.0491***</td>
<td>0.0228</td>
<td>0.0191</td>
<td>0.0133</td>
<td>0.0119</td>
</tr>
<tr>
<td></td>
<td>(0.0179)</td>
<td>(0.0173)</td>
<td>(0.0153)</td>
<td>(0.0141)</td>
<td>(0.0133)</td>
<td>(0.0128)</td>
</tr>
<tr>
<td>Public spending(-1)</td>
<td>-0.0315</td>
<td>-0.0384**</td>
<td>0.0002</td>
<td>0.0030</td>
<td>0.0074</td>
<td>0.0078</td>
</tr>
<tr>
<td></td>
<td>(0.0201)</td>
<td>(0.0194)</td>
<td>(0.0152)</td>
<td>(0.0148)</td>
<td>(0.0134)</td>
<td>(0.0129)</td>
</tr>
<tr>
<td>Education</td>
<td>0.0180</td>
<td>0.0479</td>
<td>0.0609</td>
<td>0.0576</td>
<td>0.0400</td>
<td>0.0394</td>
</tr>
<tr>
<td></td>
<td>(0.0389)</td>
<td>(0.0357)</td>
<td>(0.0369)</td>
<td>(0.0362)</td>
<td>(0.0342)</td>
<td>(0.0327)</td>
</tr>
<tr>
<td>Education(-1)</td>
<td>0.0126</td>
<td>0.0058</td>
<td>0.0092</td>
<td>0.0134</td>
<td>0.0232</td>
<td>0.0253</td>
</tr>
<tr>
<td></td>
<td>(0.0236)</td>
<td>(0.0221)</td>
<td>(0.0225)</td>
<td>(0.0224)</td>
<td>(0.0207)</td>
<td>(0.0200)</td>
</tr>
<tr>
<td>Dummy (D)</td>
<td>-0.0286</td>
<td>-0.0351*</td>
<td>-0.0389*</td>
<td>-0.0382*</td>
<td>-0.0314</td>
<td>-0.0281</td>
</tr>
<tr>
<td></td>
<td>(0.0202)</td>
<td>(0.0200)</td>
<td>(0.0201)</td>
<td>(0.0199)</td>
<td>(0.0194)</td>
<td>(0.0196)</td>
</tr>
<tr>
<td>D*public spending</td>
<td>-0.0508*</td>
<td>-0.0381</td>
<td>0.0236</td>
<td>0.0249</td>
<td>0.1808***</td>
<td>0.1806***</td>
</tr>
<tr>
<td></td>
<td>(0.0275)</td>
<td>(0.0290)</td>
<td>(0.0349)</td>
<td>(0.0526)</td>
<td>(0.0637)</td>
<td>(0.0664)</td>
</tr>
<tr>
<td>D*public spending(-1)</td>
<td>0.0699***</td>
<td>0.0634**</td>
<td>0.0007</td>
<td>-0.0017</td>
<td>-0.1589</td>
<td>-0.1556**</td>
</tr>
<tr>
<td></td>
<td>(0.0264)</td>
<td>(0.0280)</td>
<td>(0.0351)</td>
<td>(0.0512)</td>
<td>(0.0612)</td>
<td>(0.0644)</td>
</tr>
<tr>
<td>D*education</td>
<td>0.0448</td>
<td>-0.0255</td>
<td>-0.0356</td>
<td>-0.0320</td>
<td>-0.0047</td>
<td>-0.0089</td>
</tr>
<tr>
<td></td>
<td>(0.0403)</td>
<td>(0.0401)</td>
<td>(0.0468)</td>
<td>(0.0469)</td>
<td>(0.0471)</td>
<td>(0.0471)</td>
</tr>
<tr>
<td>D*education(-1)</td>
<td>-0.0391</td>
<td>0.0225</td>
<td>0.0434</td>
<td>0.0409</td>
<td>0.0058</td>
<td>0.0004</td>
</tr>
<tr>
<td></td>
<td>(0.0427)</td>
<td>(0.0451)</td>
<td>(0.0515)</td>
<td>(0.0514)</td>
<td>(0.0524)</td>
<td>(0.0524)</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.9922</td>
<td>0.9925</td>
<td>0.9918</td>
<td>0.9918</td>
<td>0.9926</td>
<td>0.9939</td>
</tr>
<tr>
<td>F-statistic</td>
<td>861.0</td>
<td>895.2</td>
<td>824.3</td>
<td>822.0</td>
<td>909.6</td>
<td>969.1</td>
</tr>
<tr>
<td>Prob. (F-statistic)</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Standard error of regression</td>
<td>0.0115</td>
<td>0.0113</td>
<td>0.0118</td>
<td>0.0118</td>
<td>0.0112</td>
<td>0.0109</td>
</tr>
</tbody>
</table>

Notes:
Dependent variable: log (real Gross Value Added (GVA) per capita Wales/ real GVA per capita other UK regions).
Education variable: log (HE qualifications Wales/HE qualifications other UK regions)
Standard errors are shown in parentheses
Total panel (balanced) observations = 130
*** Significance at 1%, ** significance at 5%, * significance at 10%.
The analyses were refined by simplifying each variable group to the most significant variable. This was undertaken to estimate a specification that corresponds with the research goal of investigating the effect of WAG policy on public spending and human capital before and after Devolution. The least statistically significant variables were removed and their omission was tested by undertaking omitted variables tests that are reproduced below as Table 7.8. The test is an $F$-test of the joint significance of the group of variables included in the estimation. The tests indicate that that at 5% significance levels they do not reject the null hypothesis that the excluded variables in each specification are jointly irrelevant.

### Table 7.8 Omitted Variables Tests

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PS(-1); E; E(-1); D<em>X1; D</em>X4(-1)</td>
<td>1.7560</td>
<td>1.5919</td>
<td>0.7308</td>
<td>0.5605</td>
<td>1.7563</td>
<td>1.3995</td>
</tr>
<tr>
<td>PS; PS(-1); E(-1); D2<em>E; D3</em>E(-1)</td>
<td>9.9831</td>
<td>10.8249</td>
<td>5.0811</td>
<td>3.9150</td>
<td>11.8930</td>
<td>9.5634</td>
</tr>
<tr>
<td>PS; PS(-1); D2<em>PS(-1); D3</em>E; D4*E(-1)</td>
<td>0.1279</td>
<td>0.0757</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS; PS(-1); D3<em>PS(-1); D4</em>E; D5*E(-1)</td>
<td>0.0757</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS; PS(-1); D4<em>PS(-1); D5</em>E; D6*E(-1)</td>
<td>0.1279</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS; PS(-1); D5<em>PS(-1); D6</em>E; D7*E(-1)</td>
<td>0.0757</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes: PS is public spending on economic development, E is education.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The estimates after excluding omitted variables are shown below in Table 7.9.
Table 7.9 Fixed Effects Regression Estimates: NUTS1, 1995-2008; education variable: HE qualifications as ratio of no qualifications.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.1749***</td>
<td>0.2622***</td>
<td>0.2287***</td>
<td>0.2073***</td>
<td>0.2289***</td>
<td>0.2288***</td>
</tr>
<tr>
<td></td>
<td>(0.0491)</td>
<td>(0.0498)</td>
<td>(0.0472)</td>
<td>(0.0402)</td>
<td>(0.0370)</td>
<td>(0.0351)</td>
</tr>
<tr>
<td>Lagged dep. var.</td>
<td>0.7478***</td>
<td>0.6007***</td>
<td>0.6443***</td>
<td>0.6775***</td>
<td>0.6476***</td>
<td>0.6522***</td>
</tr>
<tr>
<td></td>
<td>(0.0640)</td>
<td>(0.0673)</td>
<td>(0.0670)</td>
<td>(0.0549)</td>
<td>(0.0504)</td>
<td>(0.0474)</td>
</tr>
<tr>
<td>Public spending</td>
<td>0.0207*</td>
<td>0.0222*</td>
<td>0.0206*</td>
<td>0.0171</td>
<td>0.0171</td>
<td>0.0151</td>
</tr>
<tr>
<td></td>
<td>(0.0123)</td>
<td>(0.0114)</td>
<td>(0.0114)</td>
<td>(0.0107)</td>
<td>(0.0104)</td>
<td>(0.0101)</td>
</tr>
<tr>
<td>Public spending(-1)</td>
<td>0.03328**</td>
<td>0.0398**</td>
<td>0.0358**</td>
<td>0.0412***</td>
<td>0.0394***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0144)</td>
<td>(0.0156)</td>
<td>(0.0154)</td>
<td>(0.0146)</td>
<td>(0.0140)</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.0030</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0149)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy (D)</td>
<td>-0.0453***</td>
<td>-0.0574***</td>
<td>-0.0570***</td>
<td>-0.0539***</td>
<td>-0.0506***</td>
<td>-0.0467***</td>
</tr>
<tr>
<td></td>
<td>(0.0160)</td>
<td>(0.0179)</td>
<td>(0.0180)</td>
<td>(0.0177)</td>
<td>(0.0181)</td>
<td>(0.0184)</td>
</tr>
<tr>
<td>D*public spending</td>
<td>0.0315**</td>
<td>0.0350***</td>
<td>0.0340**</td>
<td>0.0277**</td>
<td>0.0283**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0125)</td>
<td>(0.0127)</td>
<td>(0.0130)</td>
<td>(0.0134)</td>
<td>(0.0139)</td>
<td></td>
</tr>
<tr>
<td>D*public spending(-1)</td>
<td>0.0268**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0126)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D*education</td>
<td>0.0192*</td>
<td></td>
<td></td>
<td>0.0121</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0099)</td>
<td></td>
<td></td>
<td>(0.0096)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D*education(-1)</td>
<td>0.0150</td>
<td>0.0126</td>
<td>0.0123</td>
<td>0.0044</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0104)</td>
<td>(0.0100)</td>
<td>(0.0099)</td>
<td>(0.0102)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.9921</td>
<td>0.9926</td>
<td>0.9924</td>
<td>0.9924</td>
<td>0.9927</td>
<td>0.9931</td>
</tr>
<tr>
<td>F-statistic</td>
<td>1075.4</td>
<td>1152.5</td>
<td>1125.0</td>
<td>1118.1</td>
<td>1177.8</td>
<td>1242.7</td>
</tr>
<tr>
<td>Prob. (F-statistic)</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Standard error of regression</td>
<td>0.0116</td>
<td>0.0112</td>
<td>0.0114</td>
<td>0.0114</td>
<td>0.0111</td>
<td>0.0108</td>
</tr>
</tbody>
</table>

Notes:
Dependent variable: log (Real Gross Value Added (GVA) per capita Wales/ Real GVA per capita other UK regions).
Education variable: log (HE qualifications Wales/No qualifications other UK regions)
Standard errors are shown in parentheses
Total panel (balanced) observations = 130
*** Significance at 1%, ** significance at 5%, * significance at 10%.

The sign of the coefficient on the public spending variable and academic qualifications variable are expected to be positive. Additionally, we can
distinguish between effects occurring before and after Devolution by inspecting the significance and values of the dummy coefficients. The estimated coefficients of the public spending coefficient are positive and weakly significant until 2002. For later years they are not significant and the value of the coefficient appears to be declining as the date of devolution dummy is later in the period of estimation. The observed change in the estimated coefficient of the public spending variable could be interpreted as indicating that the effect of spending on Welsh economic development was positive and weakly significant until 2002 and was then insignificant. However the public spending slope dummy is positive and highly significant suggesting that the evidence does provide support for the proposition that WAG spending on economic development is associated with an improvement in Welsh economic development. The education variable is positive and significant for all years from 2001 and the value of the education coefficient exceeds the coefficient on spending on economic development. The fact that the education slope dummy is only weakly significant in 2000 does not suggest that WAG policy has enhanced the effectiveness of education on economic development. The impact dummies for all years are significant and negative; the overall impact of Assembly intervention after 2001 may not have been immediately beneficial to Welsh economic development.

Devolution occurred in Scotland at the same time as that in Wales. The Scottish Parliament was granted greater powers of fiscal intervention and the Scottish economy has performed more successfully over the period under analysis.
(between 1995 and 2008 in current prices the Scottish economy grew by 83% while Wales grew by 65%). I have undertaken the same modelling for the Scottish economy to determine if it is possible to identify the reasons for its better performance using the same education variable as was used in Table 7.9 and the results are shown below as Table 7.10.

Table 7.10 Fixed Effects Regression Estimates (Scotland): NUTS1, 1995-2008; education variable: HE qualifications as ratio of no qualifications.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.2721***</td>
<td>0.3665***</td>
<td>0.3827***</td>
<td>0.3548***</td>
<td>0.2397***</td>
<td>0.3275***</td>
</tr>
<tr>
<td></td>
<td>(0.0596)</td>
<td>(0.0594)</td>
<td>(0.0629)</td>
<td>(0.0635)</td>
<td>(0.0582)</td>
<td>(0.0587)</td>
</tr>
<tr>
<td>Lagged dep. var.</td>
<td>0.6495***</td>
<td>0.5786***</td>
<td>0.5758***</td>
<td>0.6729***</td>
<td>0.8254***</td>
<td>0.7195***</td>
</tr>
<tr>
<td></td>
<td>(0.0594)</td>
<td>(0.0624)</td>
<td>(0.0669)</td>
<td>(0.0701)</td>
<td>(0.0594)</td>
<td>(0.0597)</td>
</tr>
<tr>
<td>Public spending</td>
<td>0.0314***</td>
<td>0.0353***</td>
<td>0.0317***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0115)</td>
<td>(0.0123)</td>
<td>(0.0138)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public spending(-1)</td>
<td></td>
<td>-0.0351***</td>
<td>-0.0681***</td>
<td>-0.0415***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0131)</td>
<td>(0.0103)</td>
<td>(0.0096)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>0.0218**</td>
<td>0.0018</td>
<td>-0.0023</td>
<td>0.0257**</td>
<td>0.0361***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0107)</td>
<td>(0.0110)</td>
<td>(0.0119)</td>
<td>(0.0118)</td>
<td>(0.0117)</td>
<td></td>
</tr>
<tr>
<td>Education(-1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0174</td>
<td>0.0126</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.0117)</td>
<td>(0.0126)</td>
</tr>
<tr>
<td>Dummy (D)</td>
<td>0.0107</td>
<td>-0.0021</td>
<td>-0.0211</td>
<td>-0.0582**</td>
<td>-0.0741***</td>
<td>-0.0659***</td>
</tr>
<tr>
<td></td>
<td>(0.0244)</td>
<td>(0.0247)</td>
<td>(0.0265)</td>
<td>(0.0260)</td>
<td>(0.0247)</td>
<td>(0.0288)</td>
</tr>
<tr>
<td>D*public spending</td>
<td>-0.0110</td>
<td>-0.0048</td>
<td>0.0144</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0152)</td>
<td>(0.0155)</td>
<td>(0.0175)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D*public spending(-1)</td>
<td></td>
<td></td>
<td></td>
<td>0.0228</td>
<td>0.0326**</td>
<td>0.0316*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.0170)</td>
<td>(0.0162)</td>
<td>(0.0188)</td>
</tr>
<tr>
<td>D*education</td>
<td>0.0213**</td>
<td></td>
<td></td>
<td></td>
<td>0.0128</td>
<td>0.0186*</td>
</tr>
<tr>
<td></td>
<td>(0.0092)</td>
<td></td>
<td></td>
<td></td>
<td>(0.0086)</td>
<td>(0.0096)</td>
</tr>
<tr>
<td>D*education(-1)</td>
<td>0.0259***</td>
<td>0.0280***</td>
<td>0.0262***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0089)</td>
<td>(0.0091)</td>
<td>(0.0097)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.9937</td>
<td>0.9934</td>
<td>0.9925</td>
<td>0.9927</td>
<td>0.9936</td>
<td>0.9924</td>
</tr>
<tr>
<td>F-statistic</td>
<td>1355.0</td>
<td>1290.5</td>
<td>1138.9</td>
<td>1167.8</td>
<td>1328.1</td>
<td>1122.1</td>
</tr>
<tr>
<td>Prob. (F-statistic)</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Standard error of regression</td>
<td>0.0142</td>
<td>0.0145</td>
<td>0.0155</td>
<td>0.0153</td>
<td>0.0143</td>
<td>0.0156</td>
</tr>
</tbody>
</table>

Notes:
Dependent variable: log (Real Gross Value Added (GVA) per capita Scotland/ Real GVA per capita other UK regions).
Education variable: log (HE qualifications Scotland/HE qualifications other UK regions)
Standard errors are shown in parentheses
Total panel (balanced) observations = 130
*** Significance at 1%, ** significance at 5%, * significance at 10%.
The public spending variable is positive and statistically significant for the dummy variables in 2000, 2001 and 2003 indicating evidence of a positive association with relative economic performance. However for each subsequent year Scottish Parliament spending on economic development appears to have a negative effect on the Scottish economy that is offset to some extent by the public spending slope dummy. It is interesting to note evidence of a lagged effect of public spending on relative income in Scotland but not in Wales. The possibility that it takes longer for the effects of spending on economic development in Scotland to have a measurable effect on income was investigated by experimenting with lag structures up to 5 years for both Scotland and Wales but did not reveal a positive effect between public spending and income. For Scotland the education variable associated with slope dummies appears to have a larger impact on relative economic performance and have greater statistical significance than is the case in Wales. The impact dummies for Scottish Devolution were found are negative for the most part and statistically significant for the last 3 dummies.

Provisional estimates of GVA per head in 2010 (published by WAG on the StatsWales website) indicate that the gap between Scotland and Wales has not diminished since 2000 and may have widened. The results reported above in Tables 7.9 and 7.10 suggest that the benefits of autonomous economic policy formulation afforded by Devolution have not yet been manifest in improved Welsh economic performance over the past decade. The evidence suggests that the overall impact of WAG policy was not positive while in Scotland there is evidence
of a positive association between spending on economic development and relative Scottish economic performance.

It is also instructive to investigate the presence of time effects that are described as period-specific effects. This involves using a dummy variable for each time period (minus one). For this analysis it is necessary to omit the period dummy variables to avoid collinearity. I estimated a regression using period fixed effects by regressing the dependent variable described above on the public spending variable and the educational ratio variable. I performed a redundant fixed effects test and the results are reported below as Table 7.11

<table>
<thead>
<tr>
<th>Test for Redundant Period Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variables (IVs) – PE, ER</td>
</tr>
<tr>
<td>Period F</td>
</tr>
<tr>
<td>Period Chi-square</td>
</tr>
</tbody>
</table>

Note: PE is ratio of Welsh expenditure on economic development to that of each other region; NQ is the ratio of the proportion of the workforce in Wales with no educational qualifications to that of each other region; HE is the ratio of the proportion of the workforce in Wales with higher education qualifications to that of each other region; ER is the ratio of HE to NQ.

The results in Table 7.11 suggest that we cannot reject the null hypothesis that period fixed effects are redundant for these variables in this sample. This can be interpreted as suggesting that no significant devolution effect is evident.

### 7.6 Conclusion

This chapter continues the process of answering the research questions that were established in chapter 1. In Part I of this thesis it was argued that Devolution has
the potential to enhance economic performance through WAGs ability to frame policy that will permit public spending to target economic development more effectively than the Welsh Office was able. Furthermore, the Welsh Assembly has the potential for framing education policy more closely to meet the needs of the Welsh economy. This chapter tests these expectations and contributes to our understanding of Welsh economic performance relative to other regions of the UK before and after Devolution by modelling its behaviour using panel data. I have investigated the significance of targeted public expenditure and the importance of the quality of human capital on economic performance supplemented by using dummy variables to capture the influence of WAGs evolving policy. Additionally, I have used Scottish data to re-estimate the preferred Welsh specification and enable a comparison of the two nations since the Scottish Parliament was established in the same year as the Welsh Assembly (1999).

Measured as GVA per head in current prices, the ranking of Wales and Scotland among UK NUTS1 regions indicates that neither country has significantly changed its position between 1995 and 2008. For example, at the beginning of the period Scotland was ranked as the third highest region and occupied this position in 2008. In 1995 Wales was the second worst performing region in the UK and in 2008 was the worst performing region. On the basis of this observation we might expect similar results from the modelling but this was not found to be the case. The evidence suggests that public spending has not consistently enhanced economic performance in Wales and Scotland and that the
influence of spending on economic regeneration is more evident in Wales than in Scotland. Furthermore, education has made a measurable impact on economic development in Wales but is more variable in Scotland. There is no evidence to suggest the reason for this apparently greater variability, but we can speculate that it may be associated with differences between the two countries in the migration of the highly educated and the proportion of those lacking education in each country. This does not necessarily indicate that Welsh or Scottish policies are more effective for inducing growth; it may be a statistical artefact that is explained by path dependence. Nevertheless the evidence suggests that as devolved governance becomes embedded that economic policy as it finds expression in public spending on economic development is beginning to become effective.

In terms of WAG policy it suggests evidence in support of policy prescriptions concerning the importance for economic development of widening and deepening educational achievement within the population. Furthermore, it suggests that education funds may be better utilized by focusing scarce resources upon both ends of the range of educational achievement.

These results pose the interesting observation that WAG spending on economic development does not appear to be effective in achieving its goal of reducing the gap between Welsh growth and average growth within the UK. Official statistics suggest that Welsh relative economic performance is static and convergence with other regions is not occurring (provisional statistics published online on StatsWales indicate that in 2010 Welsh GVA per head, without adjusting
for inflation, was little changed from that of 2008). On the other hand, the analysis I have undertaken in this chapter affirms the importance of investment in human capital. In the next chapter I explore the importance of regional interactions to investigate how spatial spillovers may be influencing Welsh economic development.

Notes.

1. The UK regional data used in this empirical analysis is disaggregated using the NUTS regional classification that was explained in chapter 5, and consequently it is not consistent with previous English county boundaries. This does not affect the data for Wales but will affect comparisons between Wales and other regions when making such comparisons before and after the introduction of NUTS. The modelling undertaken in my research is consistent in using NUTS data throughout.

2. Hayes (2005) estimated a series of regional prices for the period 1974-96 and concluded that it was not possible to reject the null hypothesis that each of the regional price indices was not significantly different from the Retail Prices Index in growth rates at the 1% level. Using 1974 as the base year, and excluding the estimates for Northern Ireland, he estimated that the highest value of the estimated index was 564.5 for East Midlands, and the lowest value was 550.7 for the North. The estimated figure for Wales was 551.5 and maintenance of this rank order in estimates over my period of analysis would result in the application of higher deflators to most other regions and a reduction of the spread of estimates of real income per head. Evidence of such an effect would show up as an unexpectedly low degree of divergence and if reliable regional deflators become available they will
be used to undertake this analysis in real terms. Nevertheless, as was
explained in chapters 5 and 6 the GVA per head data has been adjusted for
inflation using figures calculated by a commercial organisation.

3. The qualifications used to define higher education were: university degrees,
NVQ’s (National Vocational Qualification), BTEC National Diploma
(Business and Technology Education Council Diploma), SCOTVEC
(Scottish Vocational Educational Council awards), HNC (Higher National
Certificate) and HND (Higher National Diploma).

4. My attempts to locate government public expenditure data from HM
Treasury Public Expenditure Statistical Analysis publications (PESA) for
earlier years involved an informative exchange with Professor David Heald
of Aberdeen University who confirmed that time-series data of
disaggregated public expenditure were not available for years before the
time period that was used for the estimation of the results reported above.
Chapter 8
Spatial Econometric Analysis of Beta Convergence

8.1 Introduction
In chapter 7 I investigated data for evidence of a change in Welsh economic performance in relation to other UK regions after Devolution, assuming that Welsh economic fortunes are independent of those of other regions. The implicit assumption was that regions are isolated economies (Fingleton and Lopez-Bazo 2006) and that what happens in one region has no significance for any other regions. In this chapter I address the fourth research question that was discussed in chapter 1 that Welsh economic prospects may not be independent and are bound up with the performance of other UK regions. I relax the assumption of independence and investigate if there is evidence of mutual regional economic dependence, the legacy of the long period of time when the Welsh economy was integrated into the UK economy. I extend the modelling undertaken in chapters 6 and 7 by exploring the hypothesis that Welsh economic fortunes depend not only on the public expenditure choices made within Wales and its own investment in human capital, but are also affected by the choices of other UK regions. Evidence of regional inter-connection can be discerned in the labour markets from the extent of inter-regional commuting behaviour, and further evidence is implied from the estimates of regional multipliers that were discussed in chapter 3. These are the tangible signs of regional inter-dependence that require investigation to
understand the dynamics of spatial economic change, particularly to guide the potential for policy intervention. Evidence of such inter-connectedness and the tacit competition between regions’ economic development policies, weakens the effectiveness of WAG economic policy that was discussed in chapter 4 to achieve a rate of growth greater than has been achieved in the past, and weakens the case for devolution as a panacea for Welsh economic under-achievement.

I begin by explaining the model specification required to analyse evidence of absolute beta convergence taking account of spatial interactions. In the following section, section 8.3, I present the results of estimating beta-convergence augmented to investigate spatial effects. In the next section I model Welsh economic performance as an endogenous relationship with spatial weights and section 8.5 concludes.

8.2 Spatial Econometric Analysis of UK and Welsh Economic Convergence

The conventional specification of absolute beta-convergence described in chapter 6 as equation (6.1) is reproduced below as equation (8.1):

\[
\frac{1}{T} \log \left( \frac{y_{i,t}}{y_{i,t-T}} \right) = a_y - \left( \log (y_{i,t-T}) \cdot (1 - e^{\phi_y}) \cdot \frac{1}{T} \right) + \epsilon_{i,t}
\]  

This specification assumes that regions’ economic activity and performance are independent of one another and that each region’s error term is also independent of all others, or following Fischer and Wang (2011):
The essential concepts of spatial analysis are derived from the idea in Geography that ‘near things are more related than distant things’ (Tobler 1970: 236). The association of economic phenomena over space, or spatial association, can be estimated as spatial correlation statistics. Regional economic connectivity can be made explicit in spatial models in two ways, spatial lag and spatial error models (Anselin 1988: Fischer and Wang 2011). The first of these, spatial lag models, explain spatial dependence in spatial autoregressive models through the addition of an exogenous explanatory variable that explains spatial correlation in the dependent variables. In my analysis in chapter 7, for example, I hypothesize that regional variations can be explained by differences in the regions’ spending on economic development and by differences in the educational attainment. Evidence in support of this hypothesis may result in an association between observations of the dependent variable in neighbouring areas. Formally, the spatial lag model takes the form:

\[
y_i = \rho \sum_{j=1}^{n} W_{ij} y_j + \sum_{q=1}^{Q} X_{iq} \beta_q + \epsilon_i
\]  

(8.3)

where \(W_{ij}\) is the row-standardized spatial weights matrix that sum to the value 1 in each row for columns that are neighbours of area \(j\) and the value 0 elsewhere. For example, I investigate Welsh economic performance in relation to its
bordering regional neighbours, the North West, West Midlands and the South West. To do this I use a binary weights matrix that has element values of 1 for Wales and each of these regions which is then standardized by dividing each weight by 3. The parameter $\rho$ is estimated and represents the strength of the relation between a region and its neighbours. Spatial lag models have the merit of an underpinning theoretical justification for the econometric specification. In this present study the theoretical justification is that disparities in regional economic performance are associated with regional spending on economic development and education as a proxy indicator of the quality of human capital.

An alternative method of investigating spatial interaction is to assume that it occurs in the error processes owing to the effect of unobservable variables or because of spatial covariance between the errors from different areas. This may be the result of a lack of correspondence in the data between the spatial distribution of economic activity and regional administrative boundaries; such models are called spatial error models. Formally, spatial error models (see for example, Glass 2012) may be given by:

$$y_i = \sum_{q=1}^{Q} X_{iq} \beta_q + \varepsilon_i$$

where

$$\varepsilon_i = \lambda \sum_{j=1}^{n} W_{ij} \varepsilon_j + \mu_i$$

(8.4)

$\lambda$ is the autoregressive parameter and $\mu_i$ a random error term. The spatial error specification implies that interactions occur between regions through exogenous shocks as opposed to a systematic and continuous process that
is implied by the hypothesis of regional interdependence. In my analysis of relative Welsh economic growth, use of this model would suggest that Welsh performance was affected by other regions through the error process because the model is under-specified. Such a modelling strategy is unsatisfactory as our aim is to explicitly understand economic performance, and furthermore, the evidence available from regional input-output analysis in chapter 3 supports the hypothesis of spatial dependence between the nations of the UK. Nevertheless, I continue by estimating both a spatial lag model and a spatial error model to derive further evidence in support of spatial dependence.

Following the approach of Lim (2003) I have innovated on this formulation by utilizing the conditional convergence specification that was discussed and estimated in chapter 7. The spatial autoregressive approach involves estimating a spatial autoregressive parameter, $\rho$ by adding a spatial weight matrix $W$ to equation (8.1):

$$
\frac{1}{T} \log \left( \frac{y_{i,t}}{y_{i,t-T}} \right) = a_y - \log \left( y_{i,t} \right) \left( 1 - e^{\rho \omega} \right) + \rho W \log \left( \frac{y_{j,t}}{y_{j,t-T}} \right) + \omega_{i,t} \quad (8.5)
$$

Equation (8.5) explains the average growth in one region as being influenced by growth in another region in a manner specified by the weights matrix $W$ that reflects which regions are believed to be related to others and indicates the strength of each pair-wise association. There are in principle many ways of
populating such a matrix $W$ using for example, bilateral trade flows, relative population size and the relative importance of industrial sectors. This present work tests for spatial association between Wales and other regions by testing for regional dependence between Wales and the regions with which it shares borders, namely the North West, the West Midlands and the South West, on the assumption that close proximity is more likely to encourage more trade between adjoining regions than between regions that are further apart. If the estimated value of the coefficient $\rho = 0$ the model reverts to a standard non-spatial regression while significant non-zero values of $\rho$ capture evidence of spatial interaction. This approach has the merit of simplicity but does not consider the possibility of influence between regions that are not contiguous.

Accordingly, I populate the weights matrix to investigate the significance of regional contiguity between Wales and its neighbours by creating a square spatial weights unit matrix $W$ in which rows and columns denote UK sub-regions. An element of the standardised matrix has a 1 divided by the number of adjacent sub-regions in England that are adjacent to sub-regions in Wales and 0 elsewhere. Formally, $w_{ij} = 0$ where $i=$Welsh sub-region and $j=$ an English sub-region and $ij$ are not adjacent; $w_{ij} = 1$ when a Welsh sub-region and an English sub-region are adjacent. As in the previous chapter, the data used in the analysis are GVA per head at 1995 prices for the years 1995 to 2008 for the 128 NUTS 3 sub-regions.
8.3 Estimates of Welsh Absolute Beta Convergence and Spatial Autocorrelation

I begin by re-estimating the values of absolute beta convergence that were undertaken in chapter 6. I now report estimates of absolute beta convergence with controls for spatial autocorrelation, before and after Devolution, by partitioning the data into two time-series representing the years 1995 to 1999 and 2000 to 2008 below as Tables 8.1 to 8.4.

Table 8.1 reports estimates of unconditional convergence for real GVA per head within the UK between 1995 and 1999 and between 2000 and 2008. Table 8.2 repeats this analysis by investigating evidence of convergence between Wales and England and Scotland. However, it may be that limiting the analysis to strict contiguity may exclude non-contiguous sub-regional association. I investigate this possibility in Table 8.3 and extend this analysis by estimating conditional convergence by including regional dummy variables that estimate evidence of convergence between Wales and each other region. For each estimated model the annual convergence speed (β) is reported and the estimates of the model for conditional convergence report the spatial version of the Breusch-Pagan (B-P) test for heteroskedasticity with the null that the disturbances are homoskedastic (Breusch and Pagan 1979). I also report for the model of conditional convergence Lagrange multiplier tests of spatial dependence (Anselin 1988b).

Table 8.1 presents estimates of beta convergence for the UK between 1995 and 1999 and between 2000 and 2008 using a spatial lag and a spatial error model. In the earlier period the estimated coefficient on the base year income per
head is significantly different from zero and positive for both models suggesting evidence of economic growth divergence of between 1.1 % p.a. and 1.3% p.a. The estimates of β divergence for 1995-1999 reported here can be compared with those reported by Henley (2005) for the years 1995-2001 of between 1% p.a. and 1.18% p.a. There is a small difference that may be explained by the difference in sample time periods and by the possibility of data revisions. Both the spatial lag and the spatial error parameter are highly significant suggesting evidence in favour of spatial interaction in GVA per head. The log-likelihood values indicate that the spatial lag model is preferred but the difference between the values is very small.

The estimates for 2000-2008 in Table 8.1 indicate a reduction in the estimated coefficients of base year income per head and a consequent fall in the estimated speed of divergence to less than 0.2% per annum; however the estimated coefficients are not statistically significant. The estimated spatial lag parameter is not statistically significant while that of the spatial error parameter is, suggesting that for the later period the spatial error model is preferred. The log-likelihood estimates also indicate that the spatial error model is preferred by a small margin.

Table 8.2 reports the results of modelling beta convergence between Wales and England and Scotland combined for the same two periods of time. Between 1995 and 1999 the estimates suggest that the growth of Welsh GVA per head was static in relation to the two other countries, although this estimate is based upon coefficients that are not statistically significant. Nevertheless both the spatial lag
parameter and the spatial error parameter are highly significant supporting
evidence in favour of spatial correlation. The estimates of log-likelihood are too
close to indicate that one model is preferred over the other.

For the post-Devolution period between 2000 and 2008 the estimated
coefficients are negative indicating convergence of about 0.03% per annum, and
both coefficients are statistically significant. The spatial lag and spatial error
parameter estimates are both significant and the value of both coefficients is lower
than in the earlier period. The evidence favouring support for a spatial lag process
in this period is supported by the higher value of the estimated log-likelihood,
albeit by a small margin.

Table 8.1 Unconditional beta convergence estimates UK NUTS 3 areas.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spatial lag</td>
<td>Spatial error</td>
<td>Spatial lag</td>
<td>Spatial error</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.4547***</td>
<td>-0.3811*</td>
<td>-0.0589</td>
<td>-0.0749</td>
</tr>
<tr>
<td></td>
<td>(0.0190)</td>
<td>(0.1978)</td>
<td>(0.2253)</td>
<td>(0.2314)</td>
</tr>
<tr>
<td>Base year income per head</td>
<td>0.0524**</td>
<td>0.0464**</td>
<td>0.0124</td>
<td>0.0152</td>
</tr>
<tr>
<td></td>
<td>(0.0206)</td>
<td>(0.0215)</td>
<td>(0.0243)</td>
<td>(0.0249)</td>
</tr>
<tr>
<td>Spatial lag parameter; spatial error parameter</td>
<td>0.4276***</td>
<td>0.4144***</td>
<td>0.1450</td>
<td>0.2211**</td>
</tr>
<tr>
<td></td>
<td>(0.0915)</td>
<td>(0.0946)</td>
<td>(0.1088)</td>
<td>(0.1073)</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>181.1</td>
<td>179.4</td>
<td>148.2</td>
<td>149.2</td>
</tr>
<tr>
<td>β</td>
<td>-0.0128</td>
<td>-0.0113</td>
<td>-0.0015</td>
<td>-0.0019</td>
</tr>
</tbody>
</table>

Notes: Dependent variable: log real Gross Value Added (GVA) per capita end year – log real GVA per capita base year
Standard errors in parenthesis.
Significance at *10%, **5% and ***1%.
β is the estimated annual speed of convergence
Number of observations = 128
Table 8.2 Unconditional beta convergence estimates – Wales convergence with England and Scotland

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spatial Lag</td>
<td>Spatial Error</td>
<td>Spatial Lag</td>
<td>Spatial Error</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.0002</td>
<td>0.0000</td>
<td>0.0210***</td>
<td>0.0268***</td>
</tr>
<tr>
<td></td>
<td>(0.0022)</td>
<td>(0.0036)</td>
<td>(0.0057)</td>
<td>(0.0067)</td>
</tr>
<tr>
<td>Base year income per head</td>
<td>-0.0000</td>
<td>-0.0002</td>
<td>-0.0022***</td>
<td>-0.0027***</td>
</tr>
<tr>
<td></td>
<td>(0.0005)</td>
<td>(0.0007)</td>
<td>(0.0006)</td>
<td>(0.0008)</td>
</tr>
<tr>
<td>Spatial lag</td>
<td>0.4118***</td>
<td>0.4152***</td>
<td>0.3191***</td>
<td>0.2931***</td>
</tr>
<tr>
<td>parameter; spatial error parameter</td>
<td>(0.0948)</td>
<td>(0.0945)</td>
<td>(0.0992)</td>
<td>(0.1032)</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>319.6</td>
<td>319.7</td>
<td>326.0</td>
<td>325.4</td>
</tr>
<tr>
<td>β</td>
<td>0.0000</td>
<td>0.0001</td>
<td>0.0003</td>
<td>0.0003</td>
</tr>
</tbody>
</table>

Notes: Dependent variable: log real Gross Value Added (GVA) per capita end year Wales – log real GVA per capita base year Wales.
Standard errors in parenthesis.
Significance at *10, **5 and ***1%.
β is the estimated annual speed of convergence
Number of observations = 128

Table 8.3 reports the estimates of a model of Welsh convergence using regional dummies before and after Devolution. The regional dummies are constructed by assigning a value of unity to each sub-region that belongs within the corresponding NUTS 1 region. The model cannot be run using all of the regions as dummy variables owing to the dummy variable trap and accordingly Wales was selected as the reference region as the research questions concern Welsh performance. This model is less coarse than the previous specification as it provides a higher resolution of spatial interaction by making visible the extent to which the sub-regions of each NUTS 1 region are converging to higher or lower steady states relative to Wales. The results before Devolution estimate a positive and significant coefficient for the base year showing that all UK sub-regions are diverging at less than 1% per annum. The interpretation of this result for Wales depends upon the behaviour of Welsh sub-regions, for some may be above and
some below this rate, and different Welsh sub-regions may have different weights
with the Welsh economy due to their different populations. The spatial lag and
spatial error models indicate that only the South East (SE) is statistically significant
as a regional dummy in the earlier period, indicating that it is growing at a faster
rate in both cases. This result does not necessarily suggest a regional linkage
between Wales and the South East as it could reflect the importance of the South
East as a driver of UK economic growth in general. Both the spatial lag and the
spatial error parameters are statistically significant while the estimate of log-
likelihood narrowly favours the spatial lag model. The test for heteroskedasticity
reports low probabilities that indicate non-acceptance of the null of
homoskedasticity. The spatial lag and spatial error dependence tests do not
provide evidence in favour of unaccounted for spatial dependence.

In the latter period after Devolution the estimates of beta divergence
decline to about 0.27% p.a. although these are calculated using base year
coefficients that are not statistically significant. The coefficient on the West
Midlands regional dummy, a region sharing a border with Wales, is significant
and negative. This represents a perverse result in relation to the hypothesis of
positive spatial association between Wales and its regional neighbours. Another
result of note for the estimates over 2000-2008 is the significant and positive
coefficient on the Scotland regional dummy. That Devolution was
contemporaneous in Wales and Scotland invites a comparison of the economic
effects for their respective territories. The estimation of a significant and positive

regional dummy does not suggest that the economic linkages between Wales and Scotland should be any more developed than the linkages between Wales and any other region, especially in view of the distance between them. It has to be assumed that this is a chance occurrence that may weaken as both countries develop their own economic policies and economic development strategies.

Of the two specifications both the spatial lag and the spatial error parameter are significant only in the earlier period suggesting evidence of a spatial lag before Devolution but not after Devolution. The Breusch-Pagan test for heteroskedasticity reports probability values in the latter period suggesting that we cannot reject the null of homoskedasticity for both models. However this is not the case from 2000 and the results may reflect heteroskedasticity, resulting in estimates of the coefficients that are not efficient and biased standard errors of the coefficients (Baltagi 2008). This has the potential effect of producing unreliable hypothesis testing where the t-scores may be biased upwards making it more likely that the null hypothesis, \( H_0: \beta \leq 0 \) will be rejected. The Lagrange multiplier test for spatial dependence is not significant for both models over either period of time suggesting that there is no evidence of spatial dependence.

Table 8.4 reports the results of estimating a specification for both periods of time that limits the use of regional dummies to the regions adjoining Wales; the North West, West Midlands and the South West. This is equivalent to assuming that only the regions adjacent to Wales are responsible for spatial interactions between Wales and the rest of the UK. In the earlier period beta divergence of
about 0.12% per annum is evident, although calculated from coefficients that are not statistically significant. The estimates of the regional dummies are negative and are not statistically significant although the spatial lag and spatial error coefficients are significant indicating the presence of spatial interaction. Evidence of spatial interaction is also provided by the spatial lag and spatial error dependency tests that are both significant. The log-likelihood estimates for both models are identical but the test for heteroskedasticity indicates evidence to reject the null of homoskedasticity.

The estimated coefficients for the years 2000-2008 suggest convergence of about 0.15% per annum which is calculated from a spatial lag coefficient that is statistically significant at the 10% level of confidence. All of the regional dummy variables are negative and lack statistical significance that does not provide evidence of spatial interaction between Wales and its adjacent regions. Nevertheless, the spatial lag and spatial error parameters are significant as are the tests for spatial dependence although the Breusch-Pagan test suggests that we can reject the null of homoskedasticity.
Table 8.3 Conditional beta convergence estimates – Wales; using NUTS 3 data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.3417* (0.1989)</td>
<td>-0.3045 (0.1965)</td>
<td>-0.1364 (0.2238)</td>
<td>-0.1413 (0.2243)</td>
</tr>
<tr>
<td>Base year income per head</td>
<td>0.0391* (0.0219)</td>
<td>0.0359* (0.0216)</td>
<td>0.0220 (0.0245)</td>
<td>0.0222 (0.0245)</td>
</tr>
<tr>
<td>North East</td>
<td>-0.0131 (0.0265)</td>
<td>-0.0140 (0.0353)</td>
<td>-0.0448 (0.0245)</td>
<td>-0.0440 (0.0245)</td>
</tr>
<tr>
<td>North West</td>
<td>0.0035 (0.0218)</td>
<td>0.0055 (0.0296)</td>
<td>0.0027 (0.0263)</td>
<td>0.0008 (0.0264)</td>
</tr>
<tr>
<td>Yorkshire/Humberside</td>
<td>0.0225 (0.0238)</td>
<td>0.0345 (0.0316)</td>
<td>-0.0274 (0.0286)</td>
<td>-0.0279 (0.0287)</td>
</tr>
<tr>
<td>East Midlands</td>
<td>0.0172 (0.0239)</td>
<td>0.0218 (0.0313)</td>
<td>-0.0038 (0.0286)</td>
<td>0.0073 (0.0287)</td>
</tr>
<tr>
<td>West Midlands</td>
<td>0.0004 (0.0242)</td>
<td>0.0037 (0.0317)</td>
<td>-0.0512* (0.0290)</td>
<td>-0.0504* (0.0291)</td>
</tr>
<tr>
<td>Eastern</td>
<td>0.0206 (0.0225)</td>
<td>0.0362 (0.0301)</td>
<td>0.0004 (0.0274)</td>
<td>-0.0019 (0.0273)</td>
</tr>
<tr>
<td>London</td>
<td>0.0373 (0.0331)</td>
<td>0.0627 (0.0409)</td>
<td>0.0176 (0.0393)</td>
<td>0.0147 (0.0394)</td>
</tr>
<tr>
<td>South East</td>
<td>0.0523** (0.0229)</td>
<td>0.0745*** (0.0288)</td>
<td>-0.0086 (0.0268)</td>
<td>-0.0104 (0.0269)</td>
</tr>
<tr>
<td>South West</td>
<td>0.0253 (0.0242)</td>
<td>0.0384 (0.0308)</td>
<td>-0.0089 (0.0272)</td>
<td>-0.0115 (0.0273)</td>
</tr>
<tr>
<td>Scotland</td>
<td>-0.0033 (0.0190)</td>
<td>-0.0054 (0.0260)</td>
<td>0.0769*** (0.0237)</td>
<td>0.0724** (0.0229)</td>
</tr>
<tr>
<td>Spatial lag parameter;</td>
<td>0.3338*** (0.0982)</td>
<td>0.3186** (0.1016)</td>
<td>-0.0731 (0.1091)</td>
<td>0.0030 (0.1156)</td>
</tr>
<tr>
<td>Spatial error parameter</td>
<td>(0.0331)</td>
<td>(0.0409)</td>
<td>(0.0393)</td>
<td>(0.0394)</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>186.3</td>
<td>185.6</td>
<td>163.0</td>
<td>162.8</td>
</tr>
<tr>
<td>β</td>
<td>-0.0096</td>
<td>-0.0088</td>
<td>-0.0027</td>
<td>-0.0027</td>
</tr>
<tr>
<td>Spatial B-P test for heteroskedasticity probability</td>
<td>0.0020*** (0.0982)</td>
<td>0.0017*** (0.1016)</td>
<td>0.6140 (0.1091)</td>
<td>0.6374 (0.1156)</td>
</tr>
<tr>
<td>Spatial lag /error dependence test probability</td>
<td>0.4094</td>
<td>0.3776</td>
<td>0.1493</td>
<td>0.1045</td>
</tr>
</tbody>
</table>

Notes: Dependent variable: log real Gross Value Added (GVA) per capita end year – log real GVA per capita base year
Standard errors in parenthesis.
Significance at *10, **5 and ***1%.
Base region: Wales
β is the estimated annual speed of convergence
Number of observations = 128
Table 8.4 Conditional beta convergence estimates – Wales and adjoining regions using NUTS 3 data

<table>
<thead>
<tr>
<th></th>
<th>Spatial lag</th>
<th>Spatial error</th>
<th>Spatial lag</th>
<th>Spatial error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.0471</td>
<td>-0.0443</td>
<td>0.1133*</td>
<td>0.1024</td>
</tr>
<tr>
<td></td>
<td>(0.0671)</td>
<td>(0.0687)</td>
<td>(0.0602)</td>
<td>(0.0635)</td>
</tr>
<tr>
<td>Base year income per head</td>
<td>0.0051</td>
<td>0.0049</td>
<td>-0.0118*</td>
<td>-0.0102</td>
</tr>
<tr>
<td></td>
<td>(0.0073)</td>
<td>(0.0075)</td>
<td>(0.0065)</td>
<td>(0.0068)</td>
</tr>
<tr>
<td>North West</td>
<td>0.0005</td>
<td>-0.0001</td>
<td>-0.0050</td>
<td>-0.0051</td>
</tr>
<tr>
<td></td>
<td>(0.0063)</td>
<td>(0.0094)</td>
<td>(0.00625)</td>
<td>(0.0095)</td>
</tr>
<tr>
<td>West Midlands</td>
<td>-0.0007</td>
<td>-0.0042</td>
<td>-0.0028</td>
<td>-0.0019</td>
</tr>
<tr>
<td></td>
<td>(0.0066)</td>
<td>(0.0099)</td>
<td>(0.0064)</td>
<td>(0.0100)</td>
</tr>
<tr>
<td>South West</td>
<td>-0.0007</td>
<td>-0.0052</td>
<td>-0.0041</td>
<td>-0.0068</td>
</tr>
<tr>
<td></td>
<td>(0.0066)</td>
<td>(0.0101)</td>
<td>(0.0065)</td>
<td>(0.0102)</td>
</tr>
<tr>
<td>Spatial lag parameter; spatial error parameter</td>
<td>0.4092***</td>
<td>0.4262***</td>
<td>0.4207***</td>
<td>0.4467***</td>
</tr>
<tr>
<td></td>
<td>(0.0949)</td>
<td>(0.0936)</td>
<td>(0.0931)</td>
<td>(0.0919)</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>319.9</td>
<td>320.0</td>
<td>322.2</td>
<td>322.2</td>
</tr>
<tr>
<td>β</td>
<td>-0.0013</td>
<td>-0.0012</td>
<td>0.0015</td>
<td>0.0013</td>
</tr>
<tr>
<td>Spatial B-P test for heteroskedasticity probability</td>
<td>0.0000***</td>
<td>0.0000***</td>
<td>0.0000***</td>
<td>0.0000***</td>
</tr>
<tr>
<td>Spatial lag/error dependence test probability</td>
<td>0.0230**</td>
<td>0.0729*</td>
<td>0.0061***</td>
<td>0.0117**</td>
</tr>
</tbody>
</table>

Notes: Dependent variable: log real Gross Value Added (GVA) per capita end year – log real GVA per capita base year. Standard errors in parenthesis. Significance at *10, **5 and ***1%. Base region: Wales. β estimated annual speed of convergence. Number of observations = 128.

8.4 Modelling Welsh Endogenous Growth with Spatial Weights

Chapter 7 presented estimates of an endogenous relationship for Welsh relative economic performance explained by spending on economic development and educational achievement in the labour force. This analysis was undertaken implicitly assuming that economic regions are independent of each other. I continue by relaxing this assumption as the regional input-output tables discussed in chapter 3 suggest that expenditure leakages between countries are significant. This evidence in favour of regional inter-dependence is also supported by the
snapshot of commuting behaviour discussed in chapter 7 and the statistical
analysis of spatial convergence undertaken earlier in this chapter.

A one-way net flow of commuting will enhance the output of the
destination of commuters at the expense of the commuters’ regions of domicile
and will be evident in regressions as a negative association of the growth of
income per head that produce spatially autocorrelated residuals in growth
regressions (Fingleton 2003). In the analysis that was undertaken in chapter 7, I
used a lagged dependent variable to capture the influence of omitted variables
such as regional economic structure or capital intensity, but of equal significance
as an omitted variable, is the inter-regional trade in final, intermediate and
primary goods and services that occurs between regions. Additionally, all UK
regions are affected by UK central government policy and by global trading
conditions and will transmit these knock-on effects to their regional trading
partners, and for these reasons it is necessary to take explicit account of inter-
regional effects.

Formally, recall equation (7.3) that was explained in the previous chapter:

\[
\log(y_{it}) = A + b_1 \log(y_{it-m}) + b_2 \log(PE_{it-m}) + b_3 \log(Q_{it-m}) + b_4 D + b_5 D^* \log(PE_{it-m}) \\
+ b_6 D^* \log(Q_{it-m}) + e_{it}
\]  

(8.6)

This specification implies that the regional economies are dissimilar
through capital structure and independent of each other, consistent with the ideas
of conditional convergence or club convergence and different regional steady-
states.
To introduce regional interaction into this formulation I have used the weights matrices that were used to estimate absolute beta-convergence above.

Consequently, equation 8.6 can be adjusted to estimate and test for a Welsh endogenous growth relationship with spatial autocorrelation as follows:

\[
\log(y_{it}) = A + b_1 \log(y_{it-m}) + b_2 \log(PE_{it-m}) + b_3 \log(Q_{it-m}) + b_4 D + b_5 D \ast \log(PE_{it-m})
\]
\[
+ b_6 D \ast \log(Q_{it-m}) + b_7 W y_{jt-m} + e_{it} \quad (j \neq i)
\]

where \( W \) represents the weights matrix and the other variables recall the analysis undertaken in chapter 7.

The model was estimated by adding spatial weights to the results estimated as Table 7.11. The results are reproduced below as Table 8.5:
### Table 8.5 Panel Least Squares Regression Estimates: 1995-2008.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.0017</td>
<td>0.0038</td>
<td>0.0013</td>
<td>-0.0002</td>
<td>-0.0007</td>
<td>-0.0010</td>
</tr>
</tbody>
</table>
<pre><code>                          | (0.0131)         | (0.0127)   | (0.0116)   | (0.0111)   | (0.0107)   | (0.0101)   |
</code></pre>
<p>| Lagged dep. var.                | 0.9927***        | 0.9932***  | 0.9853***  | 0.9859***  | 0.9849***  | 0.9845***  |
| (0.0127)         | (0.0133)   | (0.0133)   | (0.0133)   | (0.0132)   | (0.0129)   |
| Public spending                 | 0.0339           | 0.0434**   | 0.0214     | 0.0223     | 0.0212     | 0.0217     |
| (0.0217)         | (0.0214)   | (0.0169)   | (0.0143)   | (0.0140)   | (0.0138)   |
| Public spending(-1)             | -0.0464**        | -0.0567*** | -0.0311**  | -0.0305**  | -0.0267**  | -0.0274**  |
| (0.0187)         | (0.0180)   | (0.0143)   | (0.0126)   | (0.0126)   | (0.0123)   |
| Education                       | 0.0189           | 0.0449**   | 0.0496**   | 0.0507***  | 0.0542***  | 0.0569***  |
| (0.0246)         | (0.0221)   | (0.0194)   | (0.0157)   | (0.0154)   | (0.0150)   |
| Education(-1)                   | -0.0071          | -0.0303    | -0.0325*   | -0.0360**  | -0.0381**  | -0.0390**  |
| (0.0256)         | (0.0231)   | (0.0195)   | (0.0158)   | (0.0154)   | (0.0149)   |
| Dummy (D)                       | -0.0218          | -0.0238    | -0.0224    | -0.0223    | -0.0164    | -0.0128    |
| (0.0163)         | (0.0167)   | (0.0167)   | (0.0171)   | (0.0182)   | (0.0192)   |
| D<em>public spending               | -0.0499</em>         | -0.0606*   | -0.0053    | 0.0139     | 0.1412**   | 0.1527**   |
| (0.0295)         | 0.0306     | (0.0377)   | (0.0530)   | (0.0680)   | (0.0720)   |
| D<em>public spending(-1)           | 0.0745</em>**        | 0.0875***  | 0.0323     | 0.0120     | -0.1191*   | -0.1294*   |
| (0.0268)         | (0.0278)   | (0.0356)   | (0.0515)   | (0.0655)   | (0.0700)   |
| D<em>education                     | 0.0356           | 0.0052     | -0.0119    | -0.0075    | -0.0048    | -0.0111    |
| (0.0300)         | (0.0289)   | (0.0316)   | (0.0323)   | (0.0345)   | (0.0357)   |
| D</em>education(-1)                 | -0.0385          | -0.0140    | 0.0050     | 0.0027     | -0.0046    | -0.0062    |
| (0.0309)         | (0.0298)   | (0.0320)   | (0.0325)   | (0.0352)   | (0.0369)   |
| Spatial lag                     | 0.0009           | 0.0009     | 0.0010     | 0.0011     | 0.0013     | 0.0012     |
| (0.0023)         | (0.0024)   | (0.0024)   | (0.0024)   | (0.0024)   | (0.0024)   |
| Adjusted R-squared              | 0.9927           | 0.9918     | 0.9913     | 0.9913     | 0.9912     | 0.9914     |
| F-statistic                     | 1452.4           | 1415.5     | 1343.7     | 1343.7     | 1317.3     | 1348.9     |
| Prob. (F-statistic)             | 0.0000           | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     |
| Standard error of regression    | 0.0117           | 0.0118     | 0.0121     | 0.0122     | 0.0123     | 0.0121     |</p>

**Notes:**
Dependent variable: log (Real Gross Value Added (GVA) per capita Wales/ Real GVA per capita other UK regions).
Education variable: log (HE qualifications Wales/no qualifications other UK regions)
Standard errors are shown in parentheses
Total panel (balanced) observations = 130
*** Significance at 1%, ** significance at 5%, * significance at 10%.
The null hypothesis represented by this specification, is that Welsh economic performance relative to other regions, is positively associated with spending on economic development, higher educational achievement in the working population as a proportion of the working population without educational qualifications and a spatial lag dummy represented by regions that share a border with Wales. The results indicate that the spatial lag is positive but not statistically significant over any of the time dummies. The overall effect of current spending on economic development is consistently negative before Devolution. This is mitigated to some extent after Devolution when the slope dummies make this relationship positive although the signs of the slope dummies are not consistently positive; there is evidence that WAG spending policies have been successful in influencing real incomes after Devolution. The education variable appears to have a net positive effect and is statistically significant, while the education time dummies are not statistically significant and appear to have little influence on relative Welsh economic performance; there is no evidence that WAG education policy has built on the successful influence of the education sector on the Welsh economy relative to other regions. Indeed, there is recent evidence suggesting that WAGs decision in 2001 to abolish schools league table positions resulted in ‘markedly reduced school effectiveness in Wales’ (Burgess et al 2010).

In general the results reported above as Table 8.6 do not support the hypothesis that regional externalities can be used to augment the previous endogenous specification and improve our understanding of Welsh economic
performance. The evidence does support the hypothesis that spending on economic development has made a positive contribution to Welsh economic growth, and that the efficacy of this spending has improved after Devolution as WAG economic policy evolved. The interpretation of the results for Welsh education policy is unclear as they depend on how the educational attainment of other regions’ populations is changing relative to that of Wales. The estimated spatial lag is positive but not statistically significant suggesting that we cannot conclude that Welsh economic performance, as it is influenced by development spending and education policy is related to the regions with which it shares a border.

Care must be taken not to take these results at face value, for example, public expenditure received by UK regions is characterised by inertia in terms of the block grant calculations under the Barnett formula, and the use of the monies as between competing departmental bids is likely to be autoregressive as current plans are constrained by previous years commitments. Additionally, poor Welsh economic performance may be attracting additional aid for the purpose of economic development resulting in a negative relationship; in short, there may be issues concerning the direction of causality between economic growth and spending on economic development. The education figures may also be prone to misinterpretation owing to the inter-regional migration of graduates and those with or without other qualifications; and the population of working age includes students who may not decide to remain and work in Wales. Furthermore, this
result should also be treated with caution as the association between educational achievement and economic performance may also be ambiguous concerning the direction of causality. Within the Welsh income distribution, households with median or greater incomes may be more willing and able to service the debt associated with undertaking higher education; in other words, the maldistribution of the benefits of modest growth in Wales may lead to increasing demand for higher education and not the other way around. The detection of a significant impact of devolution through the devolution dummy and through the slope dummy on public spending on economic development is consistent, as this spending represents the principal financial leverage that WAG may exert to influence economic change beyond its recurring expenditure on public services, however, there is no way of knowing if the significance of public spending would have occurred in the absence of Devolution.

8.5 Conclusion
In this chapter I addressed the final research question by controlling for the spatial dimension of regional economic variations that is omitted from conventional neoclassical and endogenous growth specifications. I estimated absolute beta convergence; augmented by regional dummies, and found evidence of economic divergence within the UK and little evidence of convergence between Wales and its neighbours before Devolution. Furthermore, during the years 2000 to 2008 there is no evidence of convergence within the UK and for Wales and its neighbours.
I also estimated an endogenous model using a spatial lag to investigate evidence of spatial spillovers between regions and found mixed evidence that spending on economic development and education, and the policy changes associated with post-devolution governance were all important in understanding Welsh relative economic performance. Nevertheless, if the economic statistics are accurate they do not provide evidence that the potency of these effects has been sufficient to change the growth trajectory of the Welsh economy and realize the WAGs ambition for an improvement in Welsh relative economic performance. A limitation of this approach is the use of NUTS 1 data for estimation which may be too aggregated to capture the effect of spatial spillovers.

These results can be interpreted in both a positive and a negative manner for the future of Welsh Assembly economic policy-making. The lack of evidence of strong regional interaction suggests that economic improvement in nearby regions will tend to have a muted economic benefit for the Welsh economy. This implies continuing path dependency for the Welsh economy in the absence of domestic autonomous growth, namely, the persistence of a sizable difference in economic performance when compared with the rest of the UK. However, weak inter-regional economic spillovers also provide an opportunity since it suggests that the leakages from the Welsh economy attendant on spending on economic development will be lower than would be the case with higher regional spillovers.
Chapter 9

Conclusion: The Abstraction of What Might Have Been?

9.1 Introduction

This thesis has discussed and analysed the economic consequences of Welsh devolution over the last 10 years. Economic success in Wales is important for the Welsh people and for taxpayers in other parts of the UK who contribute to its funding. The Welsh Assembly Government has published ambitious aspirations and targets for the Welsh economy and in 2011 a referendum was held in which a majority of voters agreed to extend the WAGs legislative powers without requiring the agreement of Westminster. The results of the referendum give this question a greater urgency since the possibility of the WAG being given powers similar to those of the Scottish Parliament may involve the power to levy taxes and increase the impact of WAG policy on the Welsh economy.

My purpose in setting out on this research project was to investigate the economic consequences of Welsh devolution and its significance for Welsh economic development and economic convergence with other UK regions. The Welsh Assembly Government has managed the Welsh economy for more than ten years within the limitations imposed by the Devolution settlement. It has published its aspirations (Welsh Assembly Government 2002; 2005) for the Welsh economy to improve its performance relative to the rest of the UK as measured by GVA per head. The analysis undertaken in this research finds little evidence of
progress towards this goal but does reveal policy areas that have the potential to increase the potency of the Assembly Government’s leverage upon the pace of development.

It was argued in chapter 2 that the success of Welsh Devolution does not depend exclusively upon its economic consequences. However, the expectation of economic improvement by the WAG gives the referendum question added significance since it implies that the devolution of Wales from the UK can be interpreted as an adjunct to regional economic policy. In general it suggests that when regions integrate or a nation-state goes through a process of devolution the economic consequences and the repercussions for citizens of the affected regions and for the greater economy as a whole are unlikely to be neutral.

The economic performance of a region affects citizens’ living standards and the quality of life. Furthermore, the effects of decentralization may have implications not only for Wales, but for the growth prospects of the UK economy as a whole. The difference between the funding for Wales from Westminster and the tax revenue raised from Welsh income generation and spending has consequences for the tax burden for all UK taxpayers; Welsh devolution also affects economic agents who are not residents of Wales.

The conclusions presented here were distilled from a rigorous examination of secondary and primary evidence. I began in Part I by discussing the theory of public choice and economic growth. From this discussion I developed a theoretical specification explaining Welsh economic performance. In Part II I used this
specification to undertake an empirical investigation of Welsh economic growth relative to other UK regions by estimating and testing a number of hypotheses designed to explain Welsh economic change resulting from Devolution.

In this final chapter of the thesis, I develop conclusions from my analysis, and suggest how this research should be extended for further development. This chapter is structured as follows: In section 8.2 I return to my original research questions and provide a brief summation and explanation of the key findings in the context of this thesis.

In section 8.3, I briefly consider the questions and issues that emerged during the course of this thesis and reflect on how I tackled these and what, with the benefit of hindsight, I might have done differently. I finish by suggesting a future area of research building upon my work here.

Finally, in section 8.4, I offer some comments on the significance of this original piece of research. Ultimately, Devolution has led to a major change of governance within the UK. But it is uncertain how much change has taken place for the economies of devolved territories and ultimately for the UK as a whole. This thesis is a contribution towards understanding the effects of devolution for the Welsh economy in its first decade as a devolved territory.
9.2 The Economic Consequences of Welsh Devolution

My principal question in this thesis was: to what extent can the policies of a devolved government affect the economic performance of a recently devolved territory? I answered that by addressing four specific research questions on which I reflect in turn in this section, before returning to my principal question in section 8.4.

My first question was: what is the policy context of devolution as an expression of regional economic policy in terms of the expectations of the theory of public choice and theories of economic growth? In order to answer this question I began in chapter 2 by reviewing Welsh economic performance within the context of the theory of fiscal decentralization.

In chapter 2 I presented evidence that suggests that the Welsh economy has been under-performing relative to other UK regions (measured in GDP or GVA per head) before Devolution and possibly since as far back as the 1870s. This problem has persisted in spite of attempts by successive UK governments to take corrective action using various types of regional policy. The persistence and consistency of the Welsh under-performance over this period suggests that the nature of the problem is structural in the sense that the capital base of the Welsh economy has failed to generate jobs and incomes in a manner equivalent to those created by better performing regions of the UK.

UK monetary policy cannot be fine-tuned to discriminate between the varying conditions and needs of the different UK regions, while other aspects of
policy may permit of regional variations with the political will. Regional
variations in such things as culture, demography, industrial structure and relative
income provide a rationale for the decentralization of governance and economic
management. Perhaps the failure of regional economic policy as a remedy of
regional disparity contributed to the support for decentralization as Devolution
can be seen as a way of permitting regional government to engage with local
problems and focus resources on a region’s special needs.

Consequently, 1999 was a year of important developments for Welsh
citizens. After some 800 years the political and economic integration of Wales with
England came to an end with Devolution. Wales moved onto a new political path
which has begun with the devolution of public spending and the power to enact
secondary legislation and in the future these powers may be extended and lead to
greater self-reliance.

The policy context of devolution influences the structure of devolved
government, the limits of its powers and is influenced by theories of public choice
and economic growth. I investigated the policy context in the first part of the
thesis and evaluated the significance of existing economic paradigms for the
expectations of devolution as promoting regional economic change.

In spite of optimism regarding the economic consequences of devolution on
the part of WAG politicians, an investigation of public choice theory suggests that
there is no theory of devolution that unequivocally predicts its economic
consequences. Fiscal decentralization distinguishes between the provision of local
Chapter 9: Conclusion

public goods by sub-national agencies and the delivery of pure public goods by central government agencies. The theory involves conjectures about possible changes to the costs and benefits of service delivery arising from decentralization but does not predict a general consequence. One theoretical justification for decentralization can be found in the Tiebout hypothesis, which provides a rationale for decentralization based upon the assumed allocative benefits of inter-jurisdictional competition for taxpayers between sub-national administrations. Such competition already existed before Devolution between Wales and other UK regions, and between local authorities within those regions that provide amenities partly funded by local taxes. However, the persistence of economic differences between UK regions casts doubt upon the efficacy of the price-mechanism acting in favour of the equalization of incomes across UK regions.

Another issue of relevance for the analysis of the economic consequences of devolution relates to the limits of the powers that were devolved to Wales under the 1999 settlement. Devolution less than full independence means that the UK central government retains control over economic policy, taxation, primary legislation and foreign policy. Consequently, the policy options of the Welsh devolved government are severely limited by the absence of powers to directly influence economic policy and are constrained to the allocation of its budget between competing spending departments.

I presented evidence suggesting that WAG expenditure choices may be biased towards social policies to alleviate social deprivation at the expense of
economic development. Section 2.6 suggested that between 1996/97 and 2011/12 spending on economic development by the Welsh Assembly fell in real terms, while spending on health and social services increased in real terms. One explanation for this is that Welsh Devolution has the effect of creating a jurisdiction with a low average income per head, low levels of economic participation and pockets of social deprivation. In such conditions there will be a high demand for public services and social services and consequent electoral support for political parties that maintain a commitment to this spending. Furthermore, since Devolution the WAG may have been inclined to provide more generous social provision to increase electoral support in favour of devolution in view of the slender electoral majority in the referendum. This possibility means that spending by the WAG on economic development may have a lower priority than social spending to win support for the devolution programme as well as to alleviate need and deprivation in Wales. Additionally, the WAG, in the decade since Devolution, may be sensitive to accusations of a lack of a marked improvement in the quality of life resulting from devolved government. It may have responded to this criticism by engaging in high profile public spending to achieve political popularity and short-term electoral advantage, at the cost of more substantial economic priorities that offer less short-term acclaim. This policy has other consequences for economic development as local public social goods tend to have a low productivity with limited opportunities for improvement and such spending crowds out spending on economic development. This means that the
opportunity cost of diverting spending from economic development to social relief
in less developed regions such as Wales is much higher than in other more
prosperous regions.

The literature concerning economic convergence surveyed in chapter 3 is
well-rehearsed and does not require repetition here. Its relevance for my research
is that the neoclassical growth model implicitly assumes that economic
jurisdictions are homogeneous and fails to recognise the significance of alternative
political configurations for economic activity. There has been little empirical
research undertaken of the economic convergence of UK regions with which to
compare my results, and the conclusions of the work that has been undertaken are
inconclusive or weak.

The regions within the UK may be heterogeneous in some aspects of culture
but in terms of economic characteristics such as the mobility of information,
labour, capital and goods, there has been unimpeded movement between regions.
Nevertheless there is little evidence in support of unconditional convergence
between UK regions and an investigation of convergence between UK regions
before Devolution could proceed as an investigation of conditional convergence.
In spite of the limited obstacles to factor mobility, in theory at least, Wales and the
regions of the UK can be expected to converge towards different steady-state rates
of growth.

In conclusion, my investigation of the policy context of devolution
establishes that within the field of public choice theory there is no theory of the
consequences of devolution that predicts whether devolution will result in an unambiguous economic benefit. For Wales, the devolution settlement may have undesirable unintended consequences by promulgating a dependency mentality and encouraging policies consistent with short-term electoral gain. Such policies are unlikely to be sustainable under the exigencies of UK economic policy and the application of the Barnett Formula.

The second question I asked was: is there evidence of an improvement in the performance of the Welsh economy after Devolution based on the analysis of official statistics? I undertook an empirical analysis of Welsh economic performance using statistical and analytical techniques in chapter 6 by analyzing descriptive statistics of the Welsh economy. I examined evidence of beta convergence and sigma convergence based upon changes in the distribution of GVA per head and by estimating absolute beta convergence coefficients.

My analysis of the behaviour of the mean values of GVA per head of each country suggests that Wales grew more slowly than England and Scotland. I found that the measure of the coefficient of variation of GVA per head for each territory worsened up to the year 2000 and then stabilized suggesting that sigma divergence took place up until this year. These findings were consistent with calculations of the variance of the log of GVA per head which was also found to have increased between 1995 and 2008 suggesting that the dispersion of this statistic became wider over the sample period.
Inspection of the skew of the Welsh income distribution revealed that it is becoming less symmetrically distributed and is developing a bias in the right-hand tail but not sufficient to reject the assumption of symmetry. Measured by kurtosis, the Welsh income distribution does not appear to exhibit a significant peak as is evident in the English data. Estimates of the Moran (I) statistic for the UK, a measure of spatial autocorrelation, were found to be significant suggesting evidence of spatial dependence or spill-over effects between adjacent regions.

These conclusions are tentative as they are limited to the superficial evidence of summary statistics and the restrictive assumptions of estimating unconditional beta convergence consistent with the neoclassical paradigm. Estimates of beta convergence are influenced by the economic performance of all members of the group under investigation; evidence of convergence is the outcome of poorer regions improving their relative position and of wealthier regions slowing. My estimates of beta convergence do not provide an explanation for the changes that were observed and it would be unwise to assume any causation resulting from the changes in governance during this period as an explanation of these statistical results.

I estimated coefficients of beta convergence for each country and for the three groupings of the UK regions that are used typically for regional analysis. I was not able to find evidence of beta convergence for Wales and adjacent regions or for the outer periphery group of regions of which Wales is a member. I conclude that this analysis was unable to provide evidence of beta convergence or
sigma convergence over this period between Wales and other regions of the UK using estimates of GVA per head. In fact my evidence supports the findings of Roberts (2004) whose analysis of UK regions between 1977 and 1993 also found no evidence of beta convergence and evidence of sigma divergence.

The third question I asked was: is there evidence of spontaneous convergence or conditional convergence that is predicted under assumptions of neoclassical and endogenous growth theories? I probed this question in depth by constructing and estimating an endogenous model of Welsh relative economic growth that explains performance in terms of spending on economic development and the educational attainment of the workforce. This model, estimated using panel data, focuses upon the significance of targeted public expenditure for economic development and the educational attainment of the workforce as explanations for variations regional economic performance.

I conclude from this analysis that public spending on economic development has become significant for explaining relative economic performance following Devolution but was found to be of limited importance before Devolution. However, the estimated value of the public spending coefficient following Devolution is lower compared with the long-run education coefficient, which suggests that it requires a large amount of public spending to achieve a modest relative improvement in GVA per head.

I also discovered evidence that educational attainment within the workforce is important in explaining Welsh economic performance relative to
other regions and that this effect was not found to be sensitive to the devolution dummy; apparently the importance of education transcends political change. The inability of spending on development and investment in human capital to increase Welsh relative income growth may be partly explained, in chapter 7, by inter-regional multipliers that explain why these expenditures leak rapidly from the Welsh circular flow of income.

The statistical significance of the education variables was decomposed and reveals that the estimated value of the higher education coefficient was greater than the negative coefficient of the effect of no qualifications. This supports the belief in the importance of education and training for income generation. In terms of the WAG policy, it suggests that education funds may be better utilized by focusing scarce resources upon increasing the proportion of the workforce with higher education qualifications than at lower levels of educational attainment, possibly because the number of jobs available for work-seekers who lack education is declining.

In my final research question I considered if there is evidence that the economic fortunes of the UK regions are independent or bound together in a mutual dependence. Wales and the regions of the UK are not self-sufficient and self-sustaining autonomous economic jurisdictions. The significance of regional divisions in an integrated national economy lies in the tendency for them to develop regional specialization in economic activity and for the regions to develop inter-regional trading links in production and final markets. Consequently, the
demand for goods and services in Wales is generated partially by demand in other regions that gives rise to inter-regional trade and spillover effects. For Wales, until recently, regional specialization has meant a legacy of dependence upon heavy industry, and in particular coal-mining and iron and steel production. Additionally, as we saw in Table 2.4, over the last decade the Welsh economy has depended more upon manufacturing and public administration than other regions of the UK. It is not entirely clear whether the higher Welsh employment in the public sector is a cause of economic under-performance or the consequence of employment creation resulting from regional policy. For example, the Royal Mint was gradually relocated from London to Llantrisant in South Wales between 1968 and 1980 and the Patents Office was relocated to Newport between 1988 and 1992. Both of these relocations and other relocations from London to other parts of the UK were motivated partly by the desire to reduce regional economic imbalance (Ashcroft et al 1982a; 1982b and 1988). However, other regions of the UK apart from Wales also benefited from the relocation of public services and this would reduce any relative benefit enjoyed by Wales.

In chapter 3 I presented secondary evidence suggesting that the industry sector output multipliers in Wales are lower than those of England and Scotland. This can be interpreted as an indication of the extent of the expenditure leakages out of the Welsh economy that benefit these other UK territories. Leakages of this type may be indicative of persistent inter-regional economic dependence and spillover effects and a reminder that the economic ambitions of Devolution’s
effectiveness in promoting economic development is constrained by the legacy of
the previous integration of the UK economies.

On the basis of the evidence of inter-dependence between the countries of
the UK I continued by developing a spatial model to investigate evidence of
spatial dependence at the sub-regional level of disaggregation. I undertook further
investigation of the existence of beta convergence between Wales and the other
regions by testing for evidence of beta convergence in the presence of spatial
effects. The results suggested that there is evidence of absolute beta divergence
within the UK before Devolution and some evidence of limited convergence
within the UK between 1995 and 1999 and between Wales and its neighbours in
the years between 2000 and 2008, after allowing for inter-regional linkages.

The results of the endogenous model with spatial effects suggest that Welsh
relative economic performance is weakly associated with the WAGs public
spending on economic development, and the educational achievement of the
workforce, although there is little evidence of an effect associated with the change
in governance after Devolution. However, these results may be open to
misinterpretation as the direction of causation between public spending, education
and economic growth is ambiguous. For example, increasing economic affluence
may generate a higher demand for education and public services, and competition
among UK regions for inward investment may explain greater public spending on
economic development.
In section 9.4 I draw together the critical issues discussed in this section, returning to my principal research question and offering some final comments on the significance of my research. Before that, in the following section, I consider any questions that were not fully addressed in my thesis and reflect on whether or not I might have tackled the subject slightly differently.

9.3 A Work in Progress

When I began this thesis Welsh devolution was in its infancy. Ten years have now elapsed and the Welsh Assembly Government is growing in confidence but there is little evidence to suggest that the decentralization of power through devolution has been an effective remedy for Welsh economic underachievement. The central research question of this thesis is to determine whether Devolution in Wales has made a difference to Welsh economic performance. I conclude that the evidence does not suggest that this is the case using data available up until 2007-08, nor is there is evidence to support the hypothesis of economic convergence that can be attributed to Welsh Devolution.

The structure of the Welsh economy inherited from the years of dependence upon heavy industry, its greater reliance upon public sector employment, and the evidence of a deficit in basic skills, suggests avenues for further investigation regarding Welsh economic development policy and the progression of this research. The analysis undertaken in Part II represents an econometric investigation of the economic consequences of devolution for Wales and is necessarily limited by the quality and availability of data and the choice of
model specification. I continue by suggesting further avenues of research to extend the work I have undertaken.

In undertaking this work it has become apparent that researchers’ ability to perceive and understand the economic consequences of jurisdictional change is compromised by the uncertainty surrounding the quality of data. These problems were considered at length in chapter 5; some of the deficiencies in the quality of data will be addressed by the changes following on from the Allsopp Review (Allsopp 2004). Other issues such as the data implications of tax evasion, the underground economy, and the omission of trade undertaken as barter and non-monetary payments may continue to reduce the clarity of official statistics.

One problem that is particularly troublesome in undertaking regional economic analysis is the effect of inter-regional commuting. Workplace-based estimates of GVA do not include the incomes earned by Welsh residents commuting to other regions for work, and do include those of the workers coming into Wales from other regions; this is likely to be a problem for every territory and region within the UK when attempting to estimate regional economic activity. If commuting balanced out between each pair of regions, the overall effect would be neutral, but recognizing the different demographic characteristics of the regions suggests that this is unlikely. The implications of these problems are that there are discrepancies between the income and output for regions where inter-regional commuting is significant and that the problems surrounding regional data are such as to introduce uncertainty into the analysis. The incidence of inter-regional
commuting obscures the location of economic activity associated with administrative regional boundaries. One possible approach to reducing these problems is provided by applying the concept of functional economic areas that uses data concerning commuter flows to create economic boundaries over geography that better represent the spatial distribution of economic activity (Casado-Diaz 2000; Anderson 2002; Barkley et al 2005). Consequently, the results reported in chapters 6 and 7 could be re-estimated using estimates of UK functional economic areas to test their robustness and sensitivity to using this alternative data.

It is also recognized that there are deficiencies with the econometric methods used to investigate regional economic relationships. The assumptions of linearity and the normal distribution of economic characteristics that underpin most quantitative methods are unlikely to reflect reality, and the attempts to transform the data to adjust for these problems may introduce further problems that obscure the meaning of the original data. Having noted problems with the data used and methods employed, our interpretation of the results is undertaken with caution.

In future work I plan to continue developing the endogenous model I estimated in chapter 7. The analysis can be deepened by using other methods of estimation such as generalized method of moment and by including variables representing the distribution of different industry groups between the regions. This would enable me to identify differences between regions’ industrial
structures that may offer an explanation of their different performance. Such an analysis could also assist in the identification of the industrial sectors of Wales that would benefit most from additional development resources.

My results in chapter 8 suggest that distance is important in explaining differences in regional economic performance and this is suggestive of regional interactions that can be explained using analytical methods known as gravity models (Tinbergen 1962; Poyhonen 1963; Verleger 1972 and Westerland et al 1997). A possible resolution of this issue would be to test a gravity model as an additional method of explaining Welsh economic performance relative to other UK regions and I have undertaken preliminary research of this nature as background to this work.

The hypothesis of a positive relation between measured higher educational attainment within the working population and economic development may be naïve. The present analysis does not distinguish between the subject areas of degrees or the awarding institution and therefore assumes that all awards are homogenous as investments in human capital. It would be instructive to enhance the qualifications data to estimate and test for the significance of these differences. Additionally, a breakdown of the working population in Wales by industrial sector may reveal a bias in the distribution of the educationally qualified in favour of working in the public sector. In short, a general index of academic achievement may be too coarse to explain the evidence of persistent deterioration of the Welsh
economy and this can be investigated using disaggregated measures of education in the workforce together with disaggregation of industrial sectors.

The completion of a research project conveys upon the researcher the benefits of reflection and hindsight. There are usually several methods to investigate a research question and often the researcher is seduced into using methods that were adopted by those who engaged similar questions in the past. Having had the benefit of prolonged exposure to this field of study I would refine my method of investigation if I were to repeat the exercise. Greater statistical detail of regions’ economic structure, inter-regional commuting and regional input-output information are now available. This data can be combined with data from the Annual Business Inquiry (ABI 2009) and make it possible to analyze Welsh economic activity as a set of input-output relations with other UK regions (Riddington et al 2006). This approach enables the analysis of Welsh economic performance at the sectoral level of output and consequently of each sectors contribution to Welsh economic growth and to expenditure leakages to other regions. Such detail would enable a more informed assessment of the nature of Welsh economic performance.

9.4 Time Present, Time Past and Time Future

In section 9.2 I restated my principal research question which sought to assess to what extent the policies of a devolved government affect economic performance. In this final section I return to that question and offer some concluding comments.
The political momentum for devolved government may be the inevitable outcome of the erosion in confidence of central government that can be traced back to the 1979 Conservative government. Regional economic policies sponsored by central government that achieved little success may also have suffered the same fate and nurtured a shift towards local government.

In the answers to my questions above it is clear that in the decade that has elapsed since Welsh Devolution there is little evidence of a change in Welsh economic fortunes. In *Wales: A Vibrant Economy* (Welsh Assembly Government 2005) the WAG acknowledges the importance of economic growth for creating jobs and increasing incomes to narrow the gap between Wales and other regions. Devolved government is acknowledged as having the ability and responsibility to change the economic growth trajectory of the Welsh economy. However, whether for reasons of political expediency explaining a bias in policy, or for reasons of the scarcity of resources, there is little evidence that the Welsh Assembly Government has affected Welsh economic performance.

Discussions on decentralization and devolution, for the most part, focus on questions of funding as though the resolution of this single issue offers a remedy for Welsh lacklustre economic performance. However, as I explained in chapter 2 there is no consensus opinion that decentralization is beneficial for economic activity or as to how politicians in a devolved government can be expected to exploit their local knowledge to good economic effect.
Devolution does not necessarily provide the Assembly Government with greater leverage over economic affairs than the Westminster government. Indeed, I argued that WAGs influence is severely limited by the funding arrangements and the imperative of political expediency to maintain electoral support for the devolution project. Arguably, by focussing resources on the more vulnerable members of Welsh society has enabled WAG to maintain support for devolution but while such policies may be politically expedient, they are not sustainable in the long term.

The contribution of any one thesis to a field of knowledge is always necessarily limited. My own work represents the first foray into the field of post-Devolution econometric analysis in Wales and is thus a significant contribution to the field of regional analysis. As outlined in the previous section, this leaves me plenty of scope for future work, and it means that I do not have the benefit of other similar work with which to compare my conclusions. I hope that this work, especially once the more important findings are published in the literature, may inspire other academics to follow my example and undertake econometric analyses of the impact of devolution on Welsh economic life.

As well as its significance for the study of devolution, and especially of devolution in Wales, my thesis may be considered as a modest contribution of new knowledge to the area of public finance theory, as currently there is no paradigm within economics that provides an expectation concerning the economic consequences of devolution associated with fiscal decentralization. The elapsed
time since the Welsh Devolution limits the available data for the empirical
enquiry; nevertheless it provides the beginnings of an ongoing project to fill a
lacuna in the body of theoretical economics. This econometric investigation
represents the first modest contribution to understanding the impact of devolution
upon Welsh economic performance and is a contribution to the general analysis of
regional economic growth and regional convergence as most work in this area has
focussed upon the dispersion of growth between nation-states.

The WAG has inherited an economy that appears to be underperforming in
relation to the average performance of UK regions. WAGs economic strategy
explicitly recognises this deficit in economic achievement, and aims to increase the
standard of living in Wales to that of the UK within a generation. This aspiration is
supported by a range of action points that presuppose that the WAG has correctly
identified the correct policy variables and policy instruments suitable to achieve
leverage of economic performance. My thesis critically explores the association
between economic growth and some of the Assembly Government’s policy levers,
and provides a foundation for further discussion of policy alternatives to achieve
an improvement in Welsh economic performance.

In this thesis I set out to explore the influence of the political process of
devolution on the economic life of the Welsh economy, especially in the context of
the stated aim of the WAG to reduce the gap between the Welsh standard of living
and the average of the UK as a whole. My findings suggest that this has not been
achieved, which is an important conclusion, and one that I hope other researchers
will support or disprove in work of their own. While economic success is only one measure of the achievements of the process of devolution, it is an important one. The ability of devolved government to cultivate a society that reflects the social and ethical aspirations of its citizens depends ultimately on its success in wealth-creation to provide the resources that are required to achieve such a goal.

My thesis has shown that the theoretical expectations for decentralization are ill-defined and that the results of empirical investigation of convergence are at best, mixed. Academic theory and empirical research of convergence cannot be used as a rationale for decentralization or devolution that is motivated by the desire for economic development. Devolution was not debated solely on the basis of expected economic benefits and it would be wrong to judge it accordingly. Nevertheless, to establish a Welsh society that is autonomous and confident and one that reflects Welsh values and ethics requires indigenous resources to avoid promulgating a culture of dependency and to being a hostage to the fortunes of the UK economy.

This thesis has provided the first detailed quantitative analysis of the devolved Welsh economy since its establishment in 1999. Early reports by the WAG were ambitious and optimistic about the progress of the Welsh economy and subscribed to the view that local knowledge exercised by local elected officials would contribute to closing the gap between the economic performance of Wales and other UK regions. My research paints a rather different picture. Evidence suggests that while the balance of public opinion supports devolution that this
support may have been bought by focussing on social policies that are unsustainable in the long term. There is no evidence that devolved government in Wales has had a perceptible influence using conventional measures of economic development.

Notes

1. The possibility that UK economic policy has different effects upon different regions is discussed by Dow and Montagnoli (2007).
2. There is a possibility in this respect for Devolution to result in government failure if AMs are persuaded to spend funds to curry electoral popularity from projects offering media attention instead of improving the Welsh sustainable growth path.