Strathprints Institutional Repository

Public Spending and Scottish Devolution: crowding out, or crowding in?

Grant Allan*, Brian Ashcroft*+, Maria Plotnikova*+

Fraser of Allander Institute* and Centre for Public Policy for Regions+
University of Strathclyde

We are grateful to comments from participants at the David Hume Institute seminar *"Does size matter? - An investigation of the link between post-devolution growth in public spending and Scottish economic performance"*, sponsored by the ESRC and held in Edinburgh on 10 October 2006. Errors and omissions, however, remain our own.

Introduction

There has been a developing debate about the performance of the Scottish economy under devolution and the effect of the expansion of the public sector on Scottish growth. Several commentators have expressed concern that the size of the public sector in Scotland is now a drag on growth, while others take a more sanguine view. This debate is well summarised in Marsh and Zuleeg (2006). However, this is a debate in which the evidence is often not well marshalled and there is often more heat than light generated. There is a suspicion that arguments about the effect and role of the public sector often derive more from the ultimate values and political preferences of proponents than from hard analysis and evidence.

Table 1 makes clear that public spending in Scotland has grown rapidly under devolution. By 2007 the Scottish Executive's Total Managed Expenditure (TME) has grown by 46%, in real terms, on the 1999 base. Between fiscal year 1999-00 and fiscal year 2003-04 *total* public spending as a share of GDP in Scotland rose from 45% to 51% (UK 37% to 41%). The Scottish Exec's TME as a share of GDP rose from 20% to 25% over same period, while the public sector job share in Scotland remained unchanged at 23% between 1999 and 2003, rising to 23.5% by 2005 (UK 19% to 20%). It is understandable that these changes have led to fears of 'crowding out': the potential negative impact of the growth of the public sector on the economic performance of the private sector in Scotland and by implication on the growth of the economy as a whole.

In this paper we seek to shed some light on these matters by first considering the concept of crowding out in the context of Scotland's political economy. Secondly, we provide a detailed analysis of the growth performance of the Scottish economy since devolution, which we think is revealing. However, the analysis is largely illustrative and descriptive and does not control for all the exogenous shocks that might have impacted on the Scottish economy during the period. We seek to remedy this in the third part of the paper by modelling the impact of the growth in public spending directly using a

version of the AMOS – A Macro-Micro Model of Scotland – computable general equilibrium (CGE) model, which was developed by colleagues in the Fraser of Allander Institute, in the Department of Economics at the University of Strathclyde (Harrigan *et al* 1991, and Ferguson *et al* 2003). The final section of the paper concludes with some pointers for further research on the regional impacts of public spending growth.

1. The concept of crowding out and Scotland's political economy

Crowding Out: concepts and evidence

Taylor (1979) suggests "…the term 'crowding out' means expansion by the public (or administratively oriented) sector of the economy at the expense of the private (or market oriented) sector" (p.86). Taylor distinguishes between *resource* crowding out and *financial* crowding out. The former refers, in Taylor's view, to the crowding out that can occur when the economy is at or near to full capacity. In these circumstances an increase in public expenditure will bid up wages, prices and interest rates until the economy is back in a new equilibrium with higher money wages and prices, unchanged real wages, unchanged aggregate output, a lower volume of private sector output and a bigger public sector.

In contrast, Taylor suggests that crowding out may also occur due to the way in which public expenditure is financed even when there is considerable spare capacity in the economy. So for example, if a fixed money stock is maintained, interest rates will rise, crowding out private sector investment. Conversely, if the public spending increase is financed through increased taxation private sector spending will fall with any increase in aggregate demand no more and possibly less than the direct fiscal stimulus e.g. via the so-called 'balanced budget multiplier effect'. Finally, if the theory of 'Ricardian Equivalence'[1] holds household consumption will fall and savings

[1] This theory, first mentioned and then dismissed by David Ricardo has in modern times been revived and advocated by Robert Barro of Harvard University (Barro, 1989). The theory contends that private

rise as higher taxation is anticipated to finance the increase in public spending.

One simple way of looking at the crowding out issue is to recognise that the effect of a fiscal stimulus will depend on the position and elasticity of the aggregate supply (AS) and aggregate demand (AD) curves relating the aggregate price level to aggregate output in the economy in question. The traditional, or classical, view of crowding out discussed above assumes either of two possible situations in the face of a fiscal stimulus. First, an AS curve with zero price elasticity (vertical) is assumed, producing complete *resource* crowding out. Secondly, no change in aggregate demand occurs in the new equilibrium because private sector demand is wholly displaced through *financial* crowding out by, for example, an increase in interest rates, or through actual or anticipated tax increases, as public spending rises.

At the other extreme there is what might be termed a Keynesian 'fixed-price' situation, where the AS curve is infinitely price elastic (horizontal). Here the fiscal stimulus, in the absence of financial crowding out, generates a shift in aggregate demand equal to the size of the direct fiscal stimulus plus the secondary multiplier effects.

It can be argued that either assumption of a vertical or horizontal aggregate supply curve over reasonable time horizons is too extreme. Modern macroeconomics assumes that in the short run the AS curve will be upward sloping for one or more of 4 reasons: nominal wage or price rigidities, or stickiness, an explanation favoured by the so-called New Keynesians, and worker misperceptions and producer misinformation leading to confusion about real and nominal magnitudes. The latter two explanations are favoured by the so-called New Classicals who take the view that demand shocks only have real economic effects if they are unanticipated by workers and/or producers (Mankiw, 2006)

---

consumption will be cut, private savings rise, in the face of an increased government deficit due to the increase in taxation that households anticipate will be required to finance the increased deficit.

In the long run it is assumed that either wages and prices become flexible, or perceptions coincide with reality, with the economy adjusting to its natural rate of unemployment and potential output, so that the AS curve becomes vertical as in the traditional classical model. But the short run is likely to persist for some time particularly if wage and price rigidities dominate[2] and/or prices do not adjust quickly enough to clear markets. These circumstances would appear to offer the possibility of unemployment 'equilibria' above the natural rate and output 'equilibria' below potential or full employment output. The AS curve in a closed economy would then be upward sloping, with a decreasing elasticity approaching zero as full employment is reached. Madsen (1998) tests theories of aggregate supply using evidence from the OECD countries and concluded that the short-run AS curve was positively sloped due to sticky wages and prices. He could find no evidence in favour of the New Classical worker or producer misperception models. Moreover his findings indicate that it takes several years for wages and prices to adjust to their long-run equilibrium levels.

So, it would appear that increased government spending either generates financial crowding out or, if that does not occur, there is the possibility of resource crowding out. However, resource crowding out, if it occurs, will not be complete and may be minimal as both the aggregate price level and aggregate real output increase.

At this point several caveats should be entered. First, to the extent that crowding out of private sector activity does occur there is no way of knowing whether the value placed by the market on the private sector activity foregone is greater or less than the value to society of the increase in public spending on non-market activities such as health and education provision. Moreover, secondly, to the extent that private and public *investment* spending may raise

[2] Due for example to long-term contracts, the costs of changing prices – 'menu' costs, and risk of loss of sales due price fluctuations in face of customer preferences for stable prices; inflexible real wages may be due to: 'efficiency' wage effects as firms pay above market clearing wage to attract more productive workers, reduce absenteeism and shirking and reduce labour turnover; and to 'insider-outsider' effects as employees set a wage via union pressure above market clearing and the non-employed outsiders are unable to change the position. There is also evidence that the nominal wage is particularly inflexible downwards (Bewley, 1999).

potential output e.g. through investments in education, R&D and infrastructure, it is unlikely that the net impact on potential output can be determined without a lot more information and analysis. Issues to be addressed here would include, the balance between investment and consumption in the public expenditure increase, and the nature of both the specific private investments forgone and the extra public sector investments and their respective impacts on output potential.

Thirdly, there is also an inter-temporal dimension, which concerns the impact of increased public spending on growth. As noted above public spending investments in education, R&D and infrastructure may not only raise potential output but could move the economy to a higher growth path. Conversely, additional public spending whether on consumption or investment may through crowding out divert private sector spending and resources away from growth enhancing activities by reducing entrepreneurship, innovation, investment in physical and human capital and competition. This possible effect can be termed *dynamic* crowding out.

It is in the context of the above second and third caveats that the argument put forward by Kerevan (2006a) should be considered. Kerevan argues that it is not simply the *level* but the *composition* of public spending that is significant for crowding out. Kerevan contends that tax-financed public spending that funds transfer payments to private households is less distortionary than tax-financed state consumption. This is because in the former resources are returned to the private sector, whereas in the latter resources are diverted away from the private sector and, he contends, relative prices are distorted. But there is no certainty that the replacement of private consumption with state consumption necessarily produces an inferior outcome. Is a pound spent by a household on a foreign holiday to be valued more than a pound spent by the state on cancer treatment? However, Kerevan's particular worry appears to be the likely negative impact on private sector investment flows with, presumably, attendant implications for GDP growth. This could affect growth if private investment was affected but Kerevan does not specify the transmission mechanism whereby investment

would be damaged by high levels of state consumption. That does not mean of course that such a mechanism cannot be specified, via for example a fall in the returns to capital investment. But the increase in state consumption may well stimulate local suppliers raising expected future returns and thereby eventually encouraging more investment there. So, while such a harmful outcome of state consumption on investment and growth is possible it is not guaranteed and seems likely to depend on the particular circumstances surrounding the resource transfer and spending. In a recent overview of research in this area Handler *et al* (2005a) conclude that:

> " … the empirical literature …. is inconclusive: although the growth and composition of public expenditures and taxes as well as fiscal stance seem to have some effect in the short run, their long-run implications (on productivity and growth) cannot be easily quantified …" (page 1).

But Handler *et al* do note that different types or groups of public spending should be considered separately and their study only reviews the literature concerned with infrastructure, education, R&D and health spending. These spending categories embrace a varying mix of consumption and investment. But on health expenditures, which might be considered more social than economic spending with a high current consumption element, they conclude that

> "The evidence is mostly that health expenditures have a positive, sizeable, and statistically significant effect on aggregate output. Other studies question the size of estimated effects and claim that reverse causation may prevail." (pp 37-38).

Evidence is limited on the effect of public spending on other drivers of growth. Handler *et al* (2005a) conclude that the literature suggests overall that public expenditure on infrastructure appears to raise private sector output but with diminishing marginal returns (p. 36-37). Education improves the stock of human capital but there is much debate and conflicting evidence on its role in economic growth (Easterly, 2002). Handler *et al* (2005a) report that on the question whether government R&D expenditures crowd out research in the

private sector “the majority of estimates reject the crowding-out hypothesis.” (p. 37).

There is concern about the impact of high public spending and a large public sector on entrepreneurial activities. Handler *et al* (2005a) argue that the burden of income tax is of particular significance for the entry of new firms into markets. However, detailed research in this area suggests that the rate of entrepreneurial activity is affected by the tax structure rather than the rate of any particular tax. Under certain circumstances a high personal tax rate can encourage entrepreneurial activity[3] (Cullen and Gordon, 2002; Lee and Gordon, 2005). Others argue that existence of public sector wage premiums (Blanchflower, 2000) – even if temporary – may attract workers from more risky private sector activities, which could include starting new firms (Bellante and Link, 1981). Although as Bell and Elliott (2005) point out this should imply a private rather than a public sector wage premium. But presumably other things are not equal and the public premium is accounted for by other factors. Nonetheless, the risk that a public sector wage and conditions premium might induce individuals away from new firm formation in the private sector would appear to be real. Again the evidence is limited, and contradictory suggesting the need for further research. Alesina *et al* (2001) found that the scale of public employment discouraged market activities in the south of Italy and in some estimations they found evidence of a negative effect on entrepreneurial activity. In contrast, recent work involving two of the present authors (Ashcroft, Plotnikova and Ritchie, 2007) found a positive relationship between new firm formation in British counties during the 1990s and the share of employment in public sector exerted together with urban agglomeration factors. A more "singular" effect of public sector could be obtained at smaller spatial units of analysis.

A fourth caveat is that the performance and efficiency of the public sector and the impact of public spending on private sector economic activity

[3]A marginal personal income tax rate that is above the effective tax rate on business income provides an encouragement to self-employment. Moreover, since tax evasion may be easier for the self-employed, high personal rates of tax that affect employees more than the self employed may encourage individuals to start their own businesses (Lee and Gordon, 2005) p.1031.

may vary according to the scale of the public sector in the economy. On the issue of scale and the performance and the efficiency of the public sector Afonso *et al* (2005) in a study of OECD countries broadly find that countries with small public sectors – public spending in year 2000 below 40% of GDP - show better economic performance and efficiency than those with medium – between 40% to 50% of GDP – and large - more than 50% of GDP - public sectors. However, the literature survey of Handler *et al* (2005b) suggests that

> "Altogether, there are conflicting results concerning the relationship between government size and its performance. The discrepancies may be partly explained by differences in the country samples, the time period covered, and in the relations investigated."

Which leads them to conclude that

> "The size of government is perhaps too broad a concept to capture a unidirectional causal relationship with government performance" (page 21).

Turning now to the relationship between the scale of the public sector, crowding out, and the impact on productivity and growth Handler *et al* (2005a) conclude from their literature survey that

> "The evidence on the growth effects of government size points at a non-linear relationship: for small governments additional public expenditures have a positive impact on growth, while for large governments further additions tend to be growth retarding. It is an open question, however, where the optimum is located." (Page 1)

This finding of an inverted U shaped relationship would appear to have intuitive merit if smaller governments when increasing their spending do so on necessary infrastructure investments, while larger governments spend more on consumption and transfer payments. Some empirical support for this is provided by evidence from the study by Afonso *et al* (2005) who find that in economies with large governments incomes are on average more evenly distributed. So, there may be trade offs between equity and efficiency with respect to the size of government. But from the

standpoint of growth and efficiency it is not clear where the optimum is located, although Handler et al (2005) note that empirical estimates of the optimal size of public expenditures can be as low as 15% of GDP. They nevertheless argue, perhaps contentiously, that this is unduly low in a European context because of an effective path dependency reflecting a historic power struggle between various social groups, which could not be overturned without heavy costs. In view of this, they suggest that the optimum is around 40%.

A fifth and final caveat affecting the likelihood and scale of crowding out is the degree of openness of an economy to trade and factor flows. With a fixed exchange rate and an open economy, the Mundell-Fleming model[4] implies no financial crowding out following a fiscal expansion. An exogenous increase in domestic demand through the fiscal expansion generates capital inflows and an endogenous increase in the money stock. In the new equilibrium, the interest and exchange rates remain the same while aggregate demand rises by the full amount of the fiscal stimulus plus associated multiplier effects. This is not the case under flexible exchange rates where the appreciation of the exchange rate as the interest rate rises leads to a fall in export demand and a rise in import demand, with the result that the expansion of demand may be fully crowded out (Burda and Wyplosz, 1997). The significance of this result is that when the focus of attention is on the regional economic implications of fiscal stimuli then the situation is formally equivalent to the Mundell-Fleming model of a national economy with fixed exchange rates. Moreover, the elasticities of inward and outward flows of productive resources, such as labour and physical capital, with respect to relative regional wage, price and productive opportunities tend to be higher at the regional than at the nation state scale (Harrigan *et al*, 1996). Following a demand injection, through increased public spending, for example, the increase in real wages, intermediate input prices and greater employment and productive opportunities, will over time produce a net inflow of

[4] This is the open economy version of the traditional closed economy IS-LM macro model (Burda and Wyplosz, 1997).

productive resources. Aggregate supply will rise and any resource constraints prompted by the growth in public spending will be eased.

Scottish and regional economy considerations

It follows from the above analysis, that in a small, open economy that is part of a wider monetary and fiscal union the probability of financial crowding out due to an own fiscal stimulus is minimal. This is exactly the situation in Scotland, which under present constitutional arrangements shares the UK interest rate, the UK tax structure, and the exchange rate with the rest of the UK is fixed. In these circumstances, the money supply is endogenous, and taxes do not in the first instance have to rise to fund the expansion because of the subvention, via the Barnett formula and non-formula based funding, from London. Moreover, 'Ricardian equivalence' issues should be avoided given that taxes are set in London and experience suggests that Whitehall is prepared to sustain a Scottish budget deficit, which is small in the overall context of the UK's public finances. In these circumstances the continuation of the subvention to Scotland is a political not an economic issue.

The preceding discussion suggests that if Scotland is to be subject to crowding-out effects from its own fiscal stimuli they must occur via either the *resource* and/or *dynamic* crowding-out effects route, and more probably by the latter than the former.

Kerevan (2006b) provides one of the few thoughtful assessments of the potential for crowding out in the contemporary circumstances of Scotland's economy. He accepts the view that financial or 'classical' crowding out is irrelevant to the Scottish experience because we share common interest rates and tax rates with the UK. But he then goes on to offer an analysis of crowding out in Scotland that is simply untenable. Scotland is portrayed as a Third World country benefiting from windfall revenues from abroad – i.e. the UK Treasury. In Kerevan's view, this inflow of expenditure in excess of revenues – up to 10% of GDP - leads to a ballooning trade deficit, relative price distortions, and resource misallocation. All of which, for him, serve to

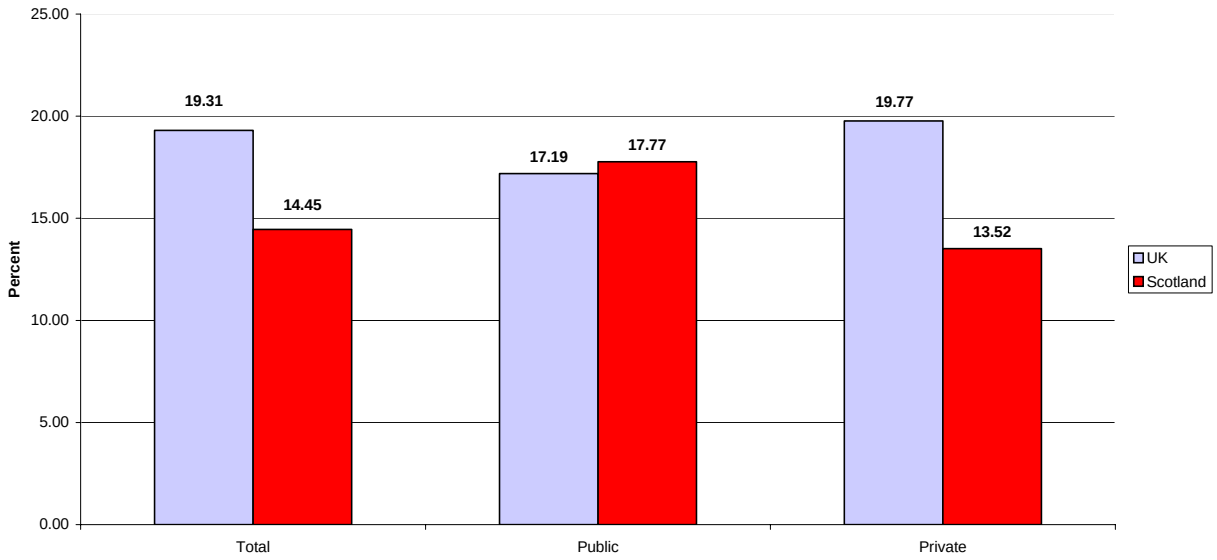
undermine Scotland's long-term growth and productivity, but no clear transmission mechanism is specified. Kerevan fails to acknowledge that in modern open economies, if not in the Third World, markets tend to adjust both within and between economies to ensure that resources flow in response to price and quantity signals. And as noted above these market adjustments are more powerful between the regions of a country. There is nothing in economics to suggest that a sustained financial subvention from the rest of the UK to Scotland will necessarily be damaging to Scotland's economic performance. While resource and dynamic crowding out effects cannot be ruled out, they may be partial and offset by the output level and growth promoting effects of the increased public expenditure. Ultimately the issue can only be resolved by careful empirical, and preferably model based, analysis.

2. Scottish growth under devolution

Figure 1 highlights the overall growth of GVA in Scotland and the UK between the start of devolution – taken as 1999q2 – and 2006q1, using the Scottish Executive's and ONS's published GVA data series. The Figure distinguishes the total growth of the economy from the growth of public and private sector over the period.[5] Over the 27 quarters since the Scottish Parliament took up its powers, the Scottish economy grew by just under 15%. The UK economy grew faster at just over 19%. The growth of the public sector is estimated to have been around 17% in both Scotland and the UK. Removing the growth of the public sector form the total leaves estimated private sector growth of under 14% in Scotland and just under 20% in the UK – a growth gap of just over 6 percentage points in the UK's favour.

[5] The public sector is taken to be the public administration, health and education and health sector. This is not a fully accurate measure of public sector production, since some private sector activity is included and a very small portion of public production is included in other sectors. There is no specific breakdown for public sector GVA as there is for public sector employment.

Figure 1: Scottish GVA Growth in Total and in Public and Private Sectors under Devolution - 1999q2 to 2006q1



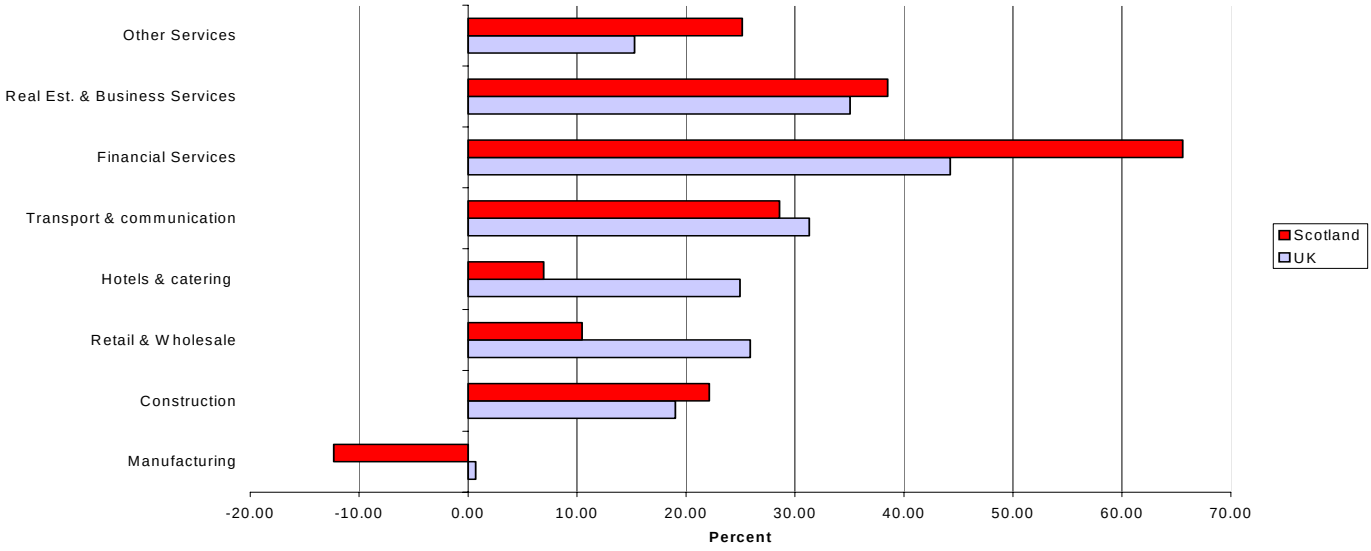
Source: Scottish Executive and authors' calculations.

Clearly, the private sector has laboured much more in Scotland during the devolution period than its counterpart in the UK. But it is difficult to argue that this weakness is due to the growth of the public sector in Scotland. The public sector grew comparably in both Scotland and the UK yet private sector growth was much weaker here. It is possible that the scale of the public sector in Scotland, at 22% of overall GVA compared to 18% in the UK, may be above some critical level so that comparable growth crowded out much more private sector activity here than in the UK. But as our model-based computable general equilibrium (CGE) analysis discussed below shows this is probably fanciful.

We do not need to look to the growth of the public sector and the complicated and uncertain process of 'crowding out' to see the most probable reason why Scotland's private sector growth was so much weaker during devolution. Figure 2 identifies the growth of GVA in key private sectors since devolution. The sectors account for 97% of private sector GVA and 76% of the economy as a whole. What is interesting in Figure 2 is that 4 sectors - other services, real estate and business services, financial services and construction - accounting for 47% of Scottish private sector GVA, all outperformed their UK counterparts, with other services and financial services

considerably outperforming them. The remaining 4 sectors all under perform their UK counterparts. The growth of transport & communication while weaker here was broadly similar at 29% compared to 31% growth in the UK, so it is the weakness of the three other sectors: manufacturing, hotels & catering, and retail & wholesale, that stands out and is worthy of further investigation.

Figure 2: Scottish GVA Growth in Key Private Sectors under Devolution, 1999q2 to 2006q1



Source: Scottish Executive and authors' calculations.

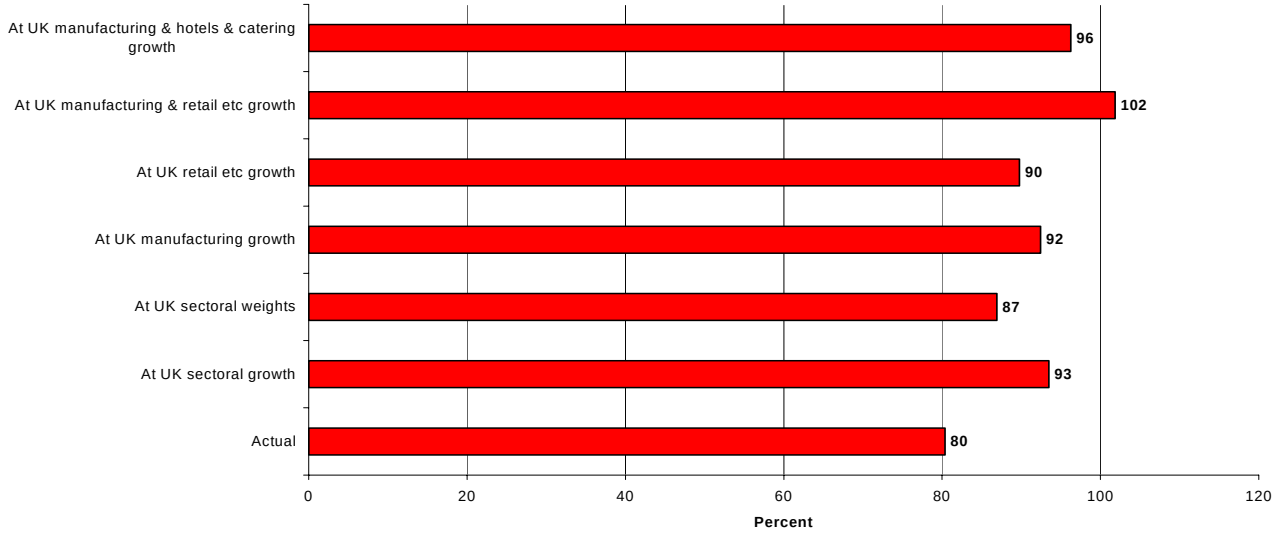
Manufacturing GVA has fallen by more than 12% in Scotland during devolution while UK manufacturing rose by just below 1% over the period. The reason for this should by now be well known. It very largely reflects the collapse of electronics production in Scotland due to the worldwide recession in the ICT industry and related structural readjustments. The structure of electronics in Scotland meant that the industry was hit harder by the recession than electronics in the UK (Ashcroft, 2006). Since devolution, electronics GVA has contracted by 34% in Scotland compared to a fall of 11% in the UK as a whole (which itself is affected by the Scottish contraction). The fall of 34% would have been sufficient to generate a contraction in Scottish manufacturing, which, other things equal, would have amounted to two-thirds of the 12% fall that actually occurred.

It therefore follows that a reasonable narrative is that the large decline in electronics output over the period, with a comparable decline in employment, led to cutbacks and postponements of the expenditure plans of the affected households and this lowered spending in the high street affecting retail & wholesale as well as hotels & catering compared to what otherwise would have been the case. Over the period to 2006q1, retail & wholesale and hotels & catering grew by 10% and 7% in Scotland compared to growth of 26% and 25% respectively in the UK. Since retail & wholesale is largely a domestically traded sector - hotels and catering are much less so - there seems to be no other obvious relative development in the Scottish economy during the devolutionary period that could account for the disparity between the sector's performance and its UK counterpart. It could be that Scottish households became more cautious over the period and began to save more but that seems an unlikely explanation for the scale of the performance differences in retail & wholesale between Scotland and the UK.

Figure 3 takes this analysis a stage further and offers the results of several simulations using shift-share analysis where we substitute the growth and weight of UK sectors for their Scottish counterparts. We take UK growth over the devolution period to be 100. Given that, actual Scottish growth was 20% lower at 80. When the growth of sectors in the UK is substituted for the growth rates of their Scottish counterparts this is sufficient to push overall Scottish growth to 93% of UK growth. But Scottish growth is not pushed to parity with the UK because some Scottish sectors were growing faster than their UK counterparts and the relative importance of each sector differs across the two countries. When the importance of each sector is held to be the same by applying UK sectoral weights to the actual Scottish growth in each sector, overall Scottish growth improves to 87% of the UK but not by much. This implies that Scotland's growth gap with the UK over the period was much less one of a different structure of industry and much more one of different sectoral growth rates. So, replacing the Scottish manufacturing growth rate with its growth in the UK is sufficient in itself to push Scotland's overall growth from 80% to 92% of the UK. Doing the same for retail and wholesale pushes Scottish growth to 90% of the UK. However, when we replace *both* Scottish

manufacturing and retail & wholesale growth rates by the growth of their UK counterparts this is sufficient to push overall Scottish growth to 102 i.e. 2%

Figure 3: Scottish GVA Growth under Devolution 1999q2 to 2006q1 - Simulations
UK Growth = 100



above actual UK growth.

Source: Scottish Executive and authors' calculations.

What all this suggests is that in seeking to explain the significant weakness of private sector growth in Scotland during devolution a very plausible story is that the cause was largely due to the collapse of electronics production and the knock-on demand, or multiplier, effects on high street spending. Nearly, half of the Scottish private sector, embracing financial services, business services & real estate, and other services, actually outperformed the UK private sector during the period. But the scale of the decline of the Scottish incidence of the world ICT recession, the decline in electronics and the dampening effect on the growth of high street spending was more than sufficient to outweigh the strong growth elsewhere in the Scottish service sector. The public sector grew comparably in Scotland and the UK and there would appear to be little justification for the view that weaker Scottish growth since devolution relative to the UK was due to growth of the public sector and the rise in its share of the economy.

3. CGE analysis of impact of growth in public spending under devolution

The analysis in the preceding section was largely illustrative and descriptive and does not control for all the exogenous shocks that might have impacted on the Scottish economy during the devolutionary period. We seek to remedy this in this part of the paper by modelling the impact directly of the growth in public spending under devolution from 1999 to 2007 using a version of the AMOS – A Macro-Micro Model of Scotland – computable general equilibrium (CGE) model, which was developed by colleagues in the Fraser of Allander Institute, in the Department of Economics at the University of Strathclyde (Harrigan *et al* 1991, and Ferguson *et al* 2003).

The base year of the model is a Social Accounting Matrix for Scotland in 1998, but we assume that this represents the economy in 1999 and model the same percentage increases in government expenditure observed in Scotland in the years since 1999. Total managed expenditure figures are used to calculate the government expenditure percentage increases. These are firstly annualised from financial years to calendar years, and then the increases in government expenditure relative to 1999 are calculated. These are given in the first two rows of Table 1. The shocks to the model are inputted in each period, and then the model is calculated for equilibrium in that period. The government expenditure shocks are "stepped" in, and are assumed to remain from 2008 onwards at the level of 2007. The percentage shocks inputted to the model are given in the final row of Table 1.

Table 1: Annualised Total Managed Expenditure (TME) and Changes from 1999 Base

Calendar years	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008+
TME(£millions) (2004-05 prices)	17746.3	18424.5	19746	20917.5	22238.8	23350	24305	25306.3	25926.5	25926.5
Cumulative change (%)	0.00	3.822	11.269	17.870	25.315	31.577	36.959	42.601	46.096	46.096
Annual change %)	0.00	3.822	7.173	5.933	6.316	4.997	4.090	4.120	2.451	0.000

Source: Answer to Scottish Parliament question S2W-24534 on 21 April 2006

The Model

The model used is a variant of the AMOS model, built around a 1998 Social Accounting Matrix for Scotland. A full description of the model is given in Ferguson *et al* (2003). For our purpose, it is should be noted that this is a regional general equilibrium model parameterised on Scottish data. In this CGE framework, there are three transactor groups – households, corporations and governments, 25 commodities and activities (represented by 25 sectors) and two exogenous external transactor groups (rest of the UK and rest of the world).

Production is determined through cost minimisation with multi-level production functions, exhibiting constant elasticity of substitution (CES) technology at all levels of the production hierarchy, with the exception of domestic intermediate transactions where a fixed coefficient (Leontief) form is assumed.

Final demand consists of four components – consumption, investment, exports and government expenditure. Consumption is a function of real disposable income. Exports (and imports) are determined via an Armington link (Armington, 1969)[6] and are therefore relative-price sensitive with trade substitution elasticities of 2. Nominal government expenditure is taken to be exogenous – and the shocks involve changes to this variable.

We assume a single Scottish labour market with perfect sectoral mobility, but, most importantly, we assume that wages are determined subject to a bargaining function in which the real consumption wage is directly related

[6] The Armington Assumption "allows domestically produced and foreign produced goods to be imperfect substitutes in use, making the consumption of quantities of domestically produced and imported variants of the commodity to enter the representative consumer's utility function as distinct elements. In empirical CGE formulations, this assumption helps to overcome the "specialization" problem. The Law of One Price implies extreme specialization in an economy where goods are produced under CRS and the number of commodities exceeds the number of factors of production." (Vargas, Schreiner, Tembo & Marcouiller, 1999) *Computable General Equilibrium Modeling for Regional Analysis* in The Web Book of Regional Science, Regional Research Institute, West Virginia University.

to workers' bargaining power, and therefore inversely related to the regional unemployment rate. The bargaining function of this wage curve is taken from the regional econometric work of Layard *et al* (1991).

We run the simulations below in a multi-period setting, given our interest in the period-by-period impacts of a series of expenditure shocks. These periods are interpreted as years, in that we have used annual data where we econometrically parameterise relationships, especially those that update variables between periods. Within AMOS, in each of these periods both the total capital stock and its sectoral composition are fixed, and commodity markets clear continuously. However, each sector's capital stock is updated between periods via a simple capital stock adjustment procedure, according to which investment equals depreciation plus some fraction of the gap between the desired and actual capital stock in each sector. This process of capital accumulation is compatible with a simple theory of optimal firm behaviour given the assumption of quadratic adjustment costs. Desired capital stocks are determined on cost-minimisation criteria and actual capital stocks reflect last period's stocks, adjusted for depreciation and gross investment. The economy is assumed initially to be in long-run equilibrium, where desired and actual capital stocks are equal.

Population adjusts in the central case through net migration between Scotland and the rest of the UK, where net migration to Scotland is positively related to the real wage differential, and negatively to the unemployment rate differential, with the rest of the UK. It is parameterised from the econometrically estimated model reported in Layard *et al* (1991). Through sensitivity analysis we vary these elasticities of substitution making migration less responsive to unemployment rate and real wage differentials.

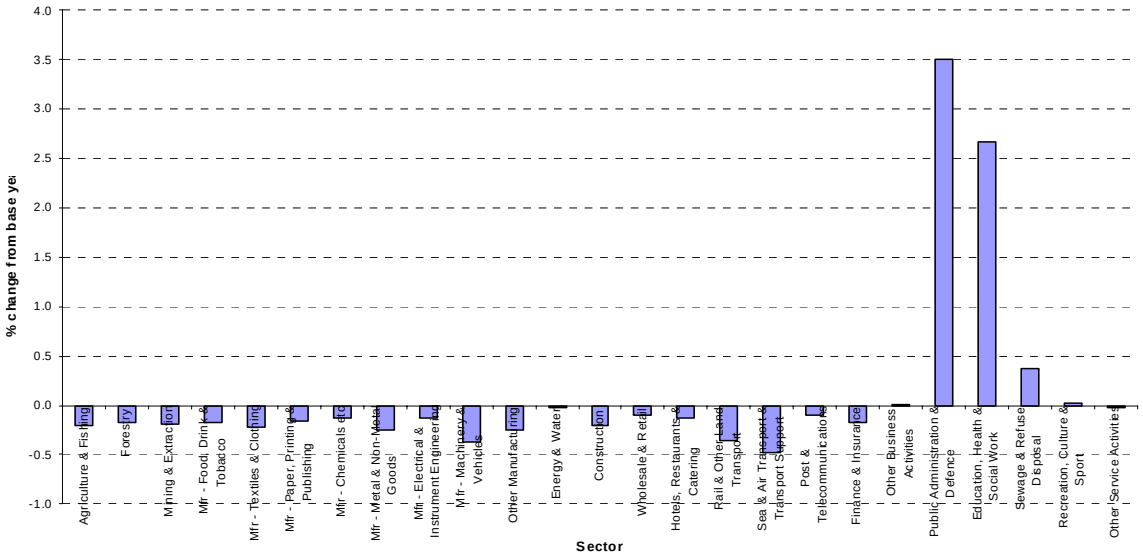
The model is not a forecasting model in the sense that paths of variables are assumed, e.g. population, GDP, oil prices, etc., rather we assume that the economy is initially in equilibrium so that if it runs forward with no shocks it will recreate the initial base year values. We run the model for 50 periods, with positive permanent shocks to government expenditure in period

1 to 8 and then no further shocks from period 9 onwards. The simulation results that we report here compare the simulation results to the constant base scenario in which there are no shocks to the model. All the differences therefore, can be attributed solely to the direct or indirect effects of the positive demand disturbance.

Central simulation

Initially, the increases in government expenditure raise demand for the products of those sectors from which the government purchases directly in the base year model. Demand increases significantly in the "public administration and defence" and "education, health and social work" sectors. The stimulus to demand in these sectors pushes up output prices, raising capital rental rates and increasing output. Some crowding out of output occurs in the first period (when sectoral capital stocks are fixed) as the expansion in demand raises wages and the price of intermediate inputs for all sectors. Sectors with the expenditure demand stimulus experience an increase in output, while those not stimulated directly experience a slight fall in output in the first period (2000) (Figure 4). At the aggregate level, the increase in wages and lowering of the unemployment rate leads to positive in-migration to Scotland from 2001.

Figure 4: Sectoral output in 2000, % change from 1999



From 2007 onwards, the increases in government expenditure stop and the economy begins adjusting to its new long-run equilibrium. By tracking the key variables to 2049 we can see the dynamic time path of GDP, employment, exports and imports. GDP increases significantly initially as government expenditure increases, but then from 2007 the rate of growth of GDP begins to slow. By 2049, GDP is around 14% higher than in 1999 (Figure 5). Sectoral output, shown in Figure 4 in 2000, has recovered and in 2049 the output of all sectors has increased relative to the 1999 (Figure 6).

Figure 5: GDP impact from 1999 to 2049, % changes from base

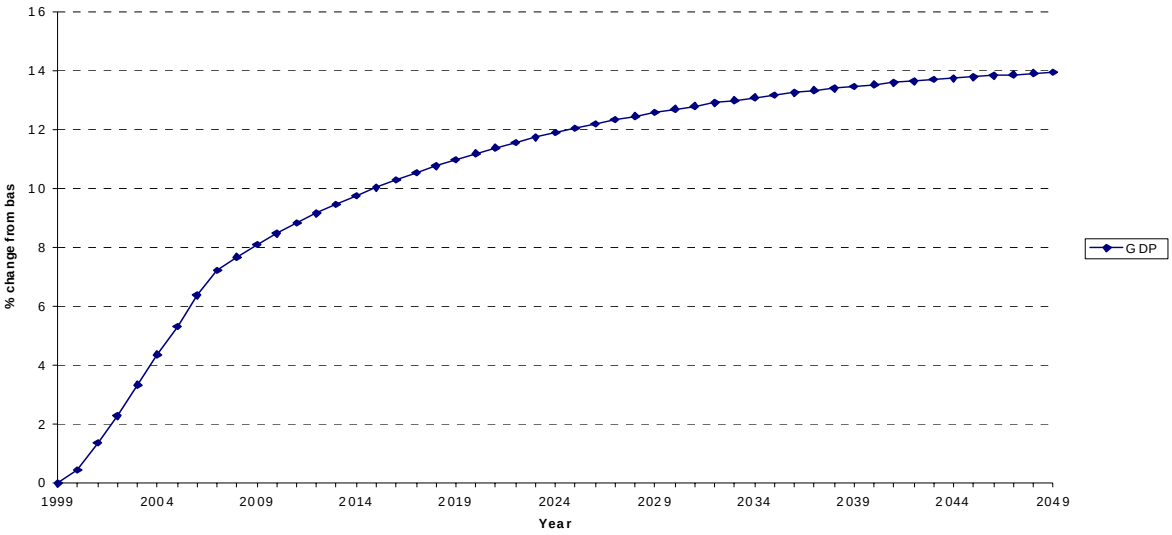
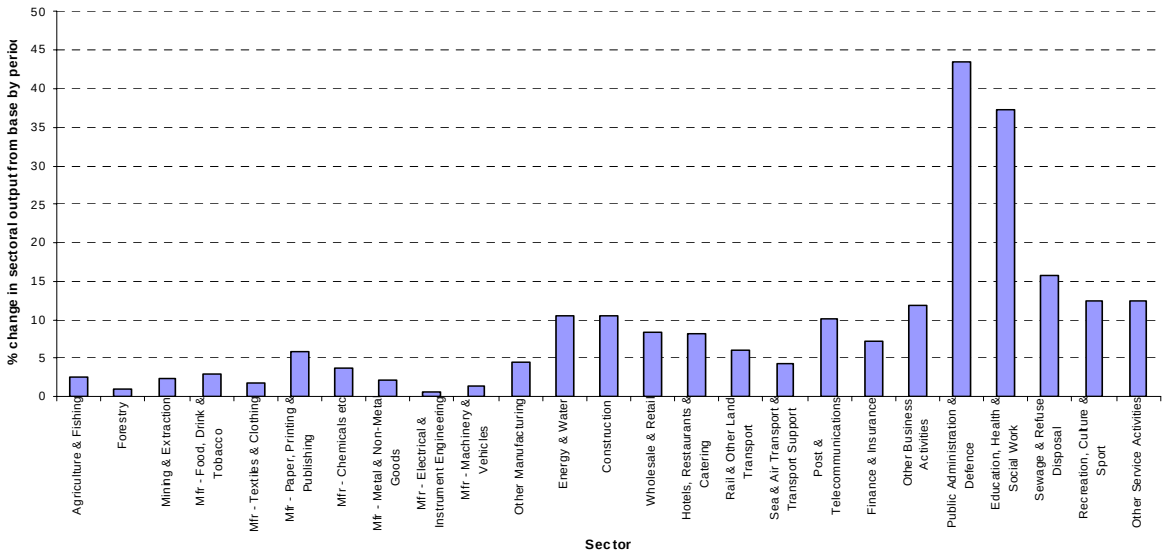
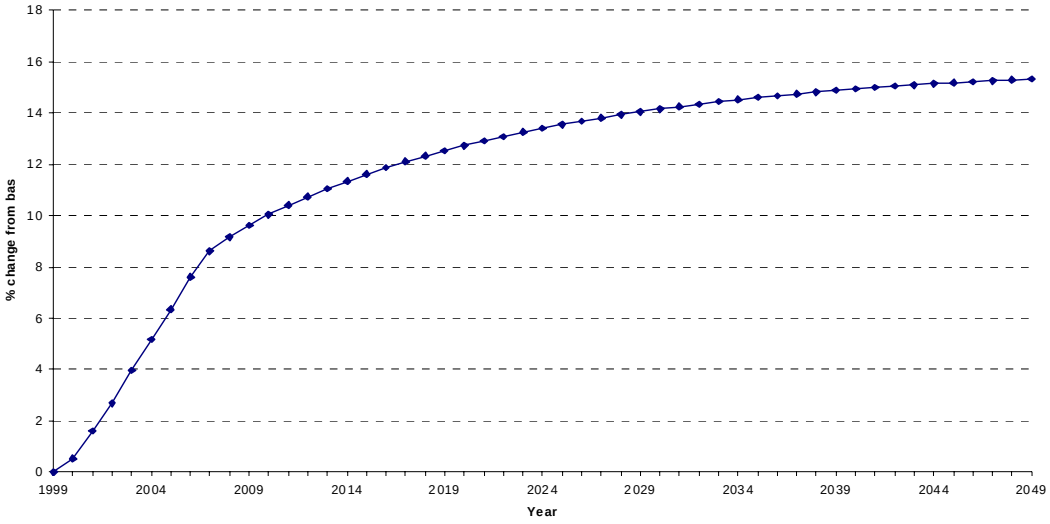


Figure 6: Sectoral output in 2049, % change from 1999



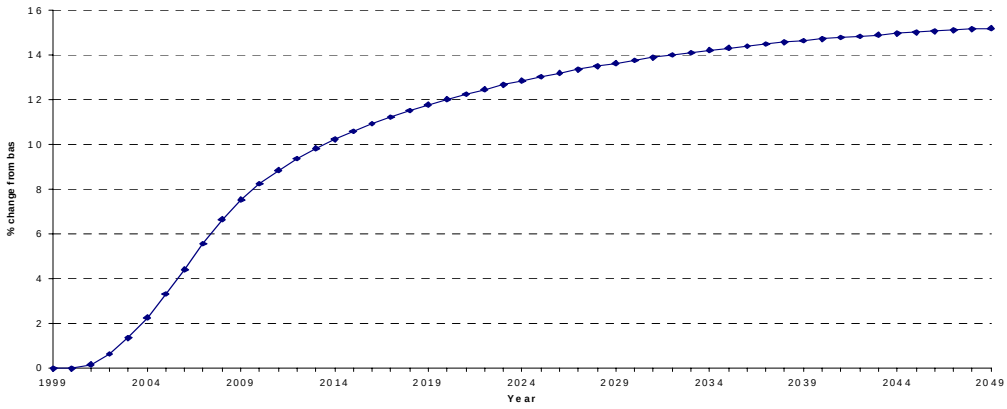
Employment also increases significantly in line with the higher real wage encouraging both migration into Scotland, and movement of Scottish non-workers into the labour force. The employment level by 2049 is around 15.3% higher than in 1999 at 2.3million (Figure 7).

Figure 7: Employment from 1999 to 2049, % change from 1999



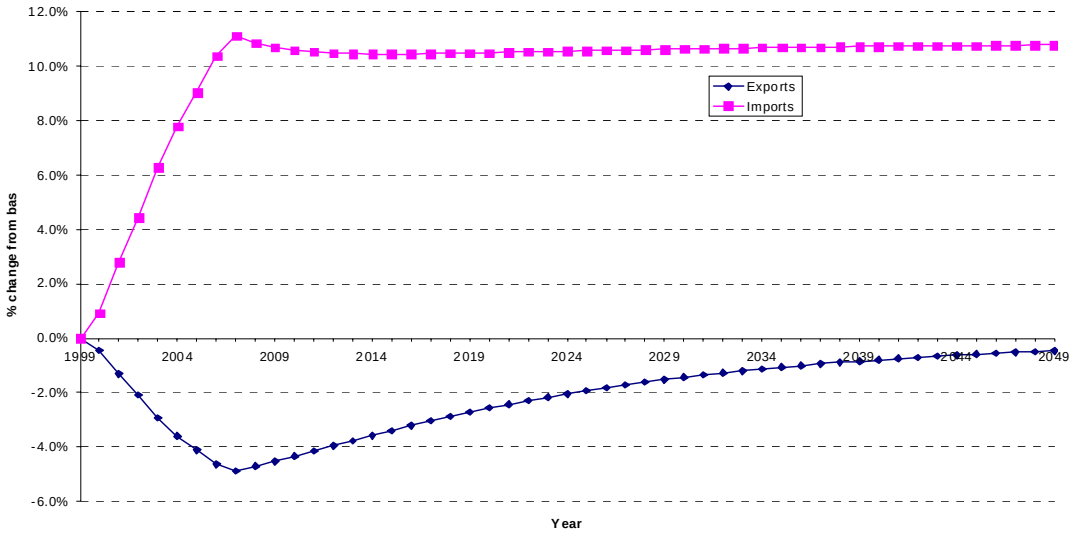
The population of Scotland also increases with positive net migration (all population change is driven by inter-regional economic migration – we make no assumptions about Scottish demographic profiles). Population increases significantly from 2001 onwards, before settling on its long-run equilibrium path movement. By 2049, the Scottish population is around 15.2% higher than in 1999 (Figure 8).

Figure 8: Population from 1999 to 2049, % change from 1999



Exports and imports to Scotland in aggregate can be tracked (Figure 9). In the first few years, the demand shock crowds out export activity in favour of imports. Output in some sectors is affected by increased labour and intermediate input costs, producing a loss of competitiveness and fall in GDP in these sectors. Initially, imports to Scotland increase significantly, to around 11.1% above the 1999 value in 2007, but this falls slightly over time, and in 2049 is 10.7% higher than in 1999. Exports from Scotland fall during the first eight years, falling by 4.7% by 2007, but by 2049, they have slowly recovered and are less than half a percent lower than in 1999.

Figure 9: Scottish exports and imports to Scotland, % change from 1999



The change in exports and imports can be shown broken down by sector. In 2049, all sectors have lower export values (apart from "sewage and refuge disposal" which shows no change) and increased imports (Figure 10). The demand for imports in absolute terms is stimulated most in the sectors most heavily affected by the government expenditure increase – "public administration and defence" and "education, health and social work" where imports increase by £447 and £637 millions respectively. The sectoral changes in the absolute volume of exports show small reductions. The greatest absolute fall in exports occurs in the "electrical and instrument engineering" sector where exports fall by £23 million.

Figure 10: Absolute change in exports and imports by sector in 2049, £millions

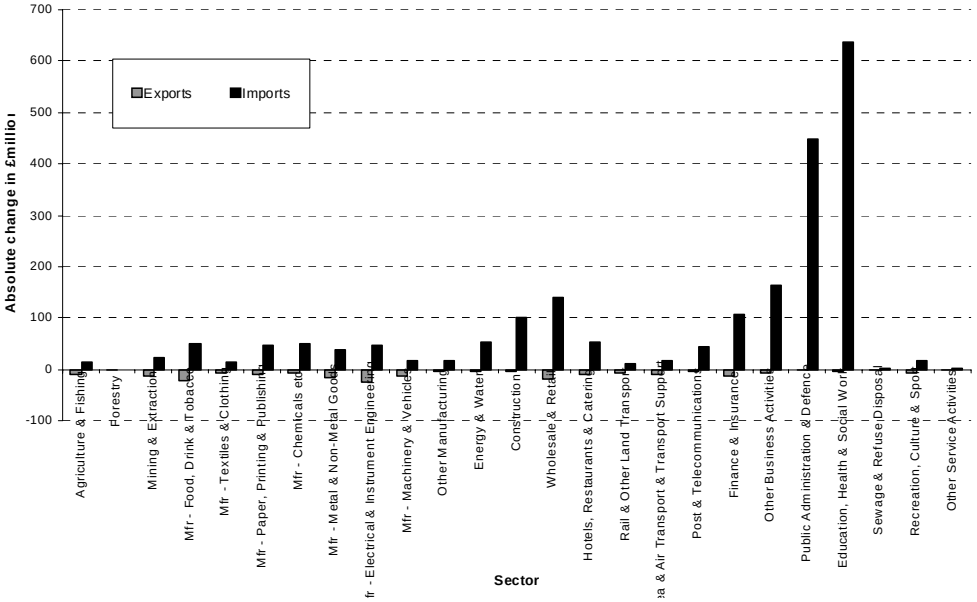


Table 2 summarises some of the key results of the central simulation.

Table 2: CGE analysis of Scottish Executive TME change 1999 – 2007, Central Simulation: key results

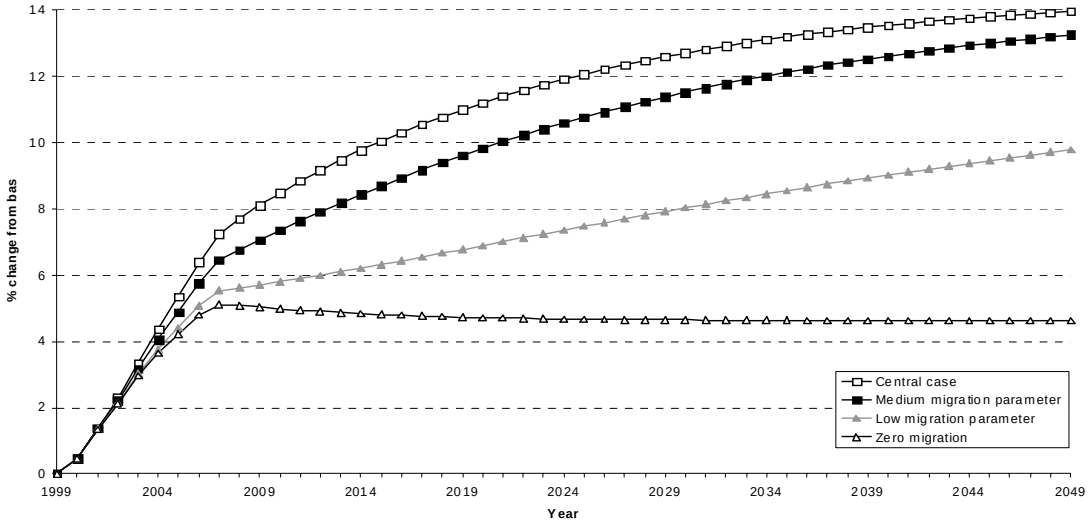
%	2007	2020	2049
GDP	7.2	11.2	14.0
Employment	8.6	12.7	15.3
Real wages	3.2	0.6	0.1
Investment (GFCF)	3.5	6.9	9.0
Exports	-4.7	-2.1	-0.5
Imports	11.1	10.8	10.7

Sensitivity analysis

Some sensitivity analysis was undertaken to check the robustness of the central case impacts to our assumptions about key variables, namely the speed of migration elasticities in response to unemployment and real wage differentials. We find that the results are generally robust for small changes in the elasticities, but less so for significant changes.

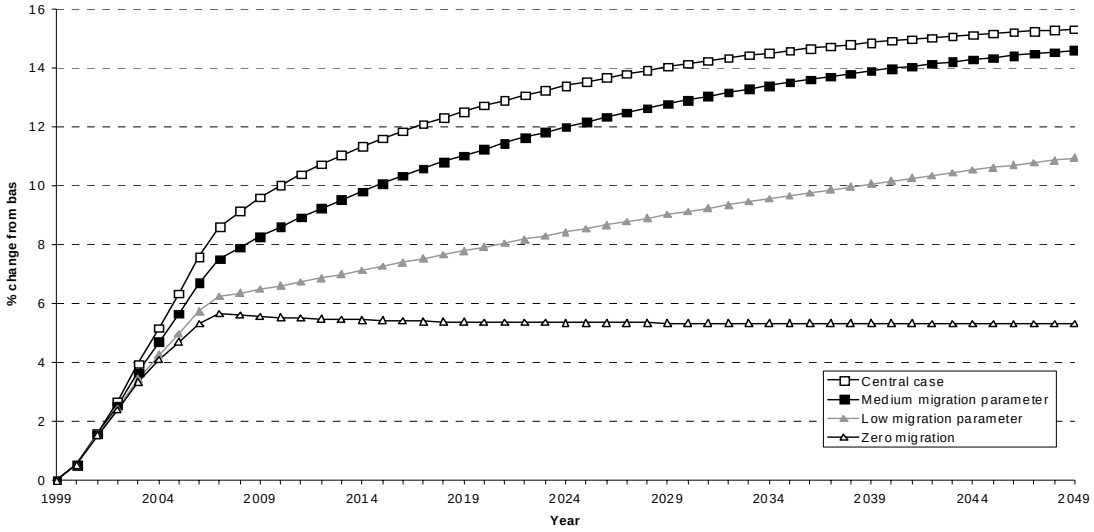
The GDP impact (Figure 11) with medium migration elasticities is slightly lower than the central case for the fifty years from 1999 to 2049. However, after 2012 the percentage difference between the central case and the medium migration case is falling, with the medium migration case getting closer to the central case results. By 2049, GDP in the medium migration case is 13.3% higher than in 1999, only slightly below the central case (14.0%). Both the low migration elasticity and the zero migration case reduce the scale the GDP impact. Scottish GDP is 9.8% higher in the low migration elasticity case, and 4.6% higher in the zero migration case.

Figure 11: GDP impact with different migration assumptions from 1999 to 2049, % change from base



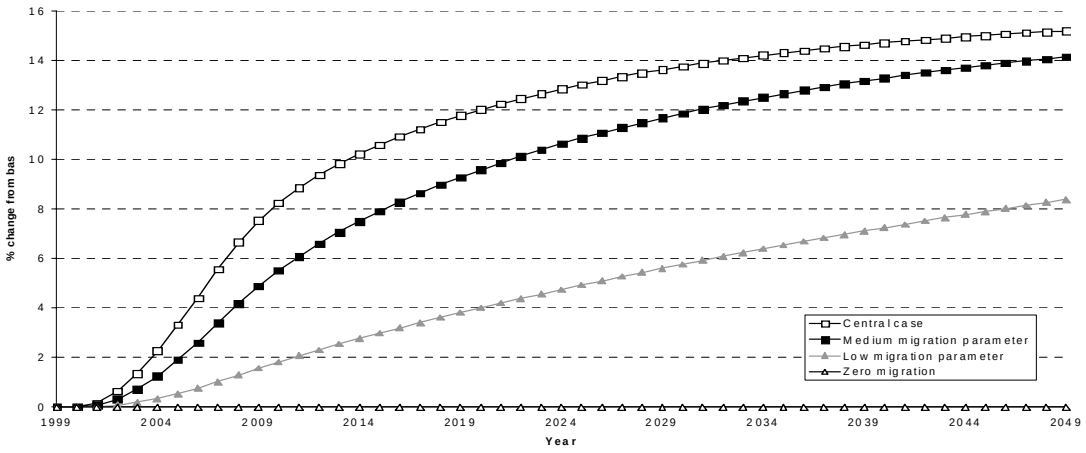
The employment impacts under the different assumptions about migration are qualitatively similar to those for GDP, with the less responsive cases producing a smaller impact on employment than the central case (Figure 12). Again, the medium migration case is similar in scale to the central case.

Figure 12: Employment impact with different migration assumptions from1999 to 2049, % change from base



Clearly the no-migration case will not produce any changes in population, however by reducing the migration elasticities we see a smaller increase in population. The Scottish population by 2049 is between 8.4% (in the low elasticities case) and 15.2% (in the central case) higher (Figure 13).

Figure 13: Population change with different migration assumptions from 1999 to 2049, % change from base



Trade is an important feature in the central case. Exports declined and then recovered to close to their initial level, while imports increased and remained higher than in the base year. Our sensitivity results for exports (Figure 14) show that with migration less responsive to wage and unemployment differences, the adjustment path is more gradual or, in the case of zero net-migration, flattened (i.e. not showing a movement back towards the initial level). Imports, on the other hand (Figure 15), are around 11% higher in 2007 than in 1999, and remain between 10.8% and 9.6% higher in 2049 when compared to 1999.

Figure 14: Scottish exports with different migration assumptions from 1999 to 2049, % change from base

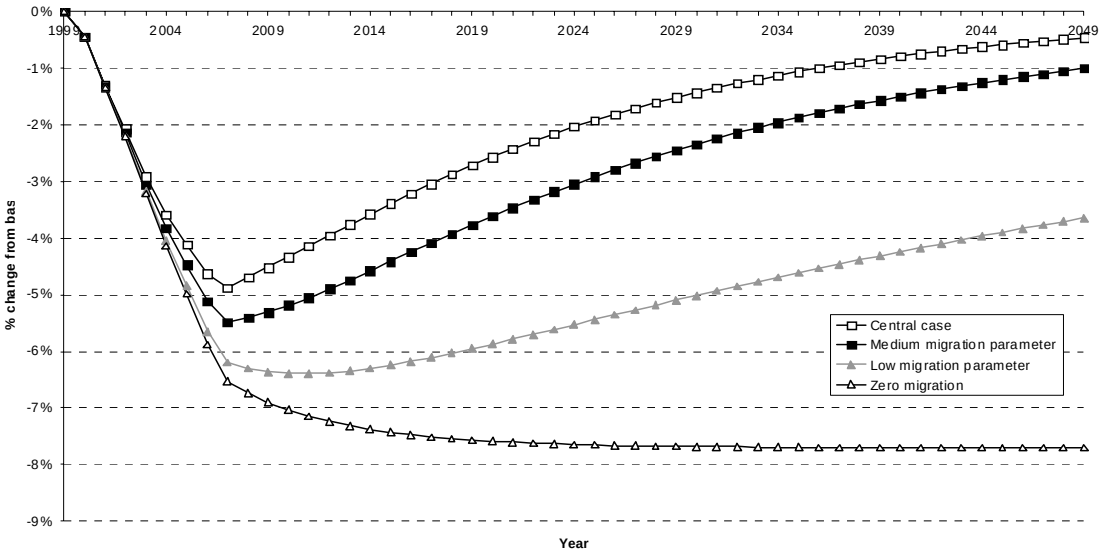
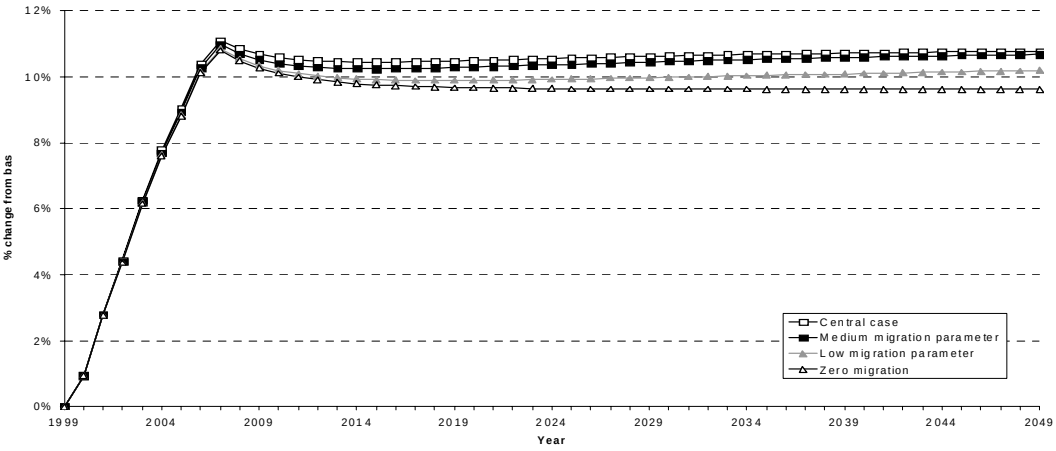


Figure 15: Imports to Scotland with different migration assumptions from 1999 to 2049, % changes from base



4. Conclusions

In this paper we have tried to shed some light on the issue of the hypothesised crowding out of private sector economic activity in the face of a large and growing public sector in Scotland. Our initial discussion of the concept of crowding out concluded that increased government spending may either generate *financial* crowding out or, if that does not occur, there is the possibility of *resource* crowding out. Further, *dynamic* crowding-out or crowding-in effects, with the scale and growth of the public sector affecting the drivers of growth, are also possible. Moreover, crowding out, if it occurs, need not be complete and may be minimal as both the aggregate price level and aggregate real output increase. And it should not be forgotten that public spending might, through investment, have resource creating and growth promoting effects.

Within the context of Scotland's political economy, a small, open economy that is part of a wider monetary and fiscal union, the probability of financial crowding out due to an own fiscal stimulus is minimal. So, if Scotland is subject to partial or complete crowding-out effects from its own fiscal stimuli they must occur via either the *resource* and/or *dynamic* crowding-out effects route, and more probably by the latter than the former. Moreover, in small, open, regional economies such as Scotland markets tend to adjust both within and between economies to ensure that resources, in the form of migrant labour and physical capital, flow in response to price and quantity signals. Following a demand injection, through increased public spending, for example, the increase in real wages, intermediate input prices and greater employment and productive opportunities, will over time produce a net inflow of productive resources. Aggregate supply will rise and any resource constraints prompted by the growth in public spending will be eased.

In view of the varying possibilities it was concluded that in any given case, such as the recent Scottish experience, the issue can only be resolved by careful empirical, and preferably model based, analysis.

Two pieces of analysis were offered: an assessment of growth during the period, and a model-based simulation of the effect of the 46% real rise in Scottish Executive spending under devolution between 1999 and 2007.

In the first piece of analysis, output is shown to have grown by 19% in the UK and by 14% in Scotland. Within this total, the private sector grew by around 20% in the UK but by only 14% in Scotland, while the growth of the public sector was much the same at around 17%. In view of this, we concluded that it is difficult to argue that the relative weakness of the private sector in Scotland could be attributed to the growth of the public sector. A more plausible narrative is that the overall weak performance of the private sector was due to the collapse of electronics production and the knock-on effects on high street spending. Moreover, nearly half of the Scottish private sector, embracing financial services, business services & real estate, and other services, actually outperformed the UK private sector during the period. Clearly, there was no obvious force dragging all of the private sector down. The sectors underperforming were precisely those that one would expect to be affected by the electronics collapse.

The computable general equilibrium analysis in fact suggests that the rise in Scottish Executive spending[7] during devolution is likely to have raised GDP and employment in the Scottish economy. *Resource* as opposed to *financial* or *classical* crowding out does occur in much of the private sector as competitiveness is lowered through higher real wages and intermediate input costs following the stimulus to demand due to the 46% real rise in Scottish Executive spending between 1999 and 2007. But the crowding out is insufficient to cancel out the overall boost to demand and output growth caused by the rise in public spending. Hence, Scottish GDP rises by 7.2% overall by 2007. Moreover, the crowding out effects on the Scottish private sector diminish over time and eventually are removed once supply fully adjusts. Supply adjusts as real wages increase reducing unemployment,

[7] It should be remembered that spending undertaken by the Scottish Executive only has a partial, all be it major, influence on potential crowding out effects (Cumbers and Birch, 2006). In 2004-05, Scottish Executive spending accounted for 67% of identifiable public expenditure in Scotland and 54% of aggregate – including non-identifiable – spending (Scottish Executive, 2006).

raising the activity rate and stimulating net in-migration into Scotland. The balance of trade deteriorates as reduced competitiveness damages exports and higher real income leads to more spending on imports. But as supply adjusts thereby diminishing cost pressures, the trade balance improves, although it remains worse than in 1999 because GDP and income are higher leading to greater spending on imports. But the worsened trade balance is sustainable because it reflects the continuing net financial subvention from London.

Sensitivity analysis was undertaken to check the robustness of the central case impacts to our assumptions about key variables. In view of the importance of migration, we changed the speed of the migration elasticities to medium, low and zero. In the no migration case, Scottish GDP and employment still rise – for GDP to a 5% peak in 2007 - due to lower unemployment, increased real wages and higher consumption. There is a permanent crowding out effect on most private sectors as loss of competitiveness is sustained, but this is not sufficient to produce a negative GDP growth rate.

The AMOS model is a sophisticated simulation model of the Scottish economy with a fully specified supply side, incorporating capacity constraints and endogenous wage and price competitiveness effects. The version of the model used is based around a social accounting matrix for Scotland for 1998, which provides a separate set of accounts for key agents in the economy including government, households, industries and the external sector, identifying the income flows within and between each group. Key relations are parameterised from estimates based on actual Scottish, or UK regional data.

However, the model does not allow for any supply creating effects of the additional public sector spending e.g. via education spending. Nor does it allow for changes that might produce *dynamic* crowding out or, indeed, *crowding in* effects that concern the drivers of growth, for example, the impact on entrepreneurship, innovation, skill formation etc. that would affect the longer-term performance of the economy. If there is to be a sustained

crowding out impact of a large and rising public sector since devolution then a negative impact on entrepreneurship appears the most likely possibility. A public sector wage premium consequent upon the growth in public spending, even if temporary, may attract workers away from more risky entrepreneurial activities such as starting new firms. But, positive effects through increased direct and indirect demand links, particularly to local service firms, are also possible. We are undertaking research on these matters in both Scotland and the UK regions but as yet do not have conclusive results.

References

Afonso, A, Schuknecht, L and Tanzi, V (2005) “Public sector efficiency: An international comparison” *Public Choice*, 123 pp. 321-347.

Alesina, A, Danninger, S, and Rostagno, M (2001) “Redistribution Through Public Employment: The Case of Italy” *IMF Staff Papers* Vol. 48, No. 3

Armington, P. (1969), "A Theory of Demand for Products Distinguished by Place of Production", IMF Staff Papers, Vol. 16, p157-178.

Ashcroft, B (2006) “Outlook and Appraisal: Reflections on the performance of Scottish electronics”, *Quarterly Economic Commentary* Vol. 30. No. 4, March, Fraser of Allander Institute, University of Strathclyde, Glasgow

Ashcroft, B, Plotnikova, M, and Ritchie, D (forthcoming 2007) “New Firm Formation in British Counties: Comparing the 1990s with the 1980s” *Centre for Public Policy for Regions* Working Paper, Universities of Glasgow and Strathclyde.

Barro, R (1989), “The Ricardian Approach to Budget Deficits”, *Journal of Economic Perspectives*, 3: pp. 37-54.

Bell, D and Elliott, R (2005) “The Earnings Consequences of Moving Between the Private and Public Sectors in Great Britain.” Mimeo, University of Stirling.

Bellante, D and Link A. N. (1981) “Are public sector workers more risk adverse than private sector workers?” *Industrial and Labor Relations Review,* 34: 408 -12

Bewley, T (1999) *Why Wages Don’t Fall during a Recession.* Cambridge, MA: Harvard University Press.

Blanchflower, D. (2000) “Self-Employment in OECD Countries”, *Labour Economics*, Vol. 7, Special Issue on Self-Employment, 471-505.

Burda, M, and Wyplosz, C (1997) *Macroeconomics: a European text*, Second edition, Oxford University Press

Cullen, J B and Gordon, R. H. (2002) “Taxes and Entrepreneurial Activity: Theory and Evidence for the US”, *NBER Working Paper* No 9015

Cumbers, A and Birch, K (2006) “Adding Value: Public Sector Spending and Scotland’s Economic Development”, UNISON Scotland, Glasgow.

Easterly, W (2002) *The Elusive Quest for Growth*, The MIT Press, Cambridge, Massachusetts.

Ferguson, L, Learmonth, D, McGregor, P G, Swales, JK, and Turner, K (2003), "The impact of the Barnett formula on the Scottish economy: a general equilibrium analysis", *Strathclyde Discussion Papers in Economics*, No. 03-04 http://www.strath.ac.uk/media/media_34462_en.pdf

Handler, H, *et al* (2005a) "The impact of public budgets on overall productivity growth" WIFO, Austria , Working Papers no. 255

Handler, H *et al* (2005b) "The size and performance of public sector activities in Europe" WIFO, Austria , Working Papers.

Harrigan, F, McGregor, P G, Dourmashkin, H, Perman, R, Swales, J K, and Yin Y P (1991) 'AMOS: a macro-micro model of Scotland' *Economic Modelling*, 10, pp. 424-79.

Harrigan, F, McGregor, P G, and Swales, J K (1996) "The System-Wide Impact on the Recipient Region Of A Regional Labour Subsidy" *Oxford Economic Papers* 48, pp.105-133

Kerevan, G (2006a), "Sweden holds no answers to our public sector crowding-out problem", *Scotsman,* 28 June 2006.

Kerevan, G (2006b) "Devolution: A deepening economic policy failure" Ch 3 in Bill Jamieson (Ed.) *Scotland's Ten Tomorrows: The devolution crisis and how to fix it*, pp. 51-68, Continuum, London and New York

Layard, R, Nickell, S and Jackman, R (1991) *Unemployment* OUP, Oxford.

Lee, Y, and Gordon, R H (2005) "Tax structure and economic growth", *Journal of Public Economics*, 89 pp. 1027 – 1043.

Madsen, J B (1998) "New Keynesian Versus New Classical Theories of Aggregate Supply: Evidence from The OECD Countries" *Scottish Journal of Political Economy*, Vol. 45, 3, pp. 273-293.

Mankiw, N G (2006), *Macroeconomics*, Worth Publishers, 6th edition.

Marsh, R and Zuleeg, F (2006) *The Scottish Public Sector: Does Size Matter?* The David Hume Institute, Edinburgh

Scottish Executive (2006) *Government Expenditure and Revenue in Scotland 2004 – 2005*, Scottish Executive, Edinburgh. http://www.scotland.gov.uk/Resource/Doc/159996/0043602.pdf

Taylor, C T (1979) "Crowding Out: Its Meaning and Significance" Ch. 4 in S T Cook and P M Jackson (Eds.) *Current Issues in Fiscal Policy*, Martin Robertson, Oxford.

Vargas, E E, Schreiner, D F, Tembo, G and Marcouiller, D W (1999) "*Computable General Equilibrium Modeling for Regional Analysis*" in *The Web*

Book of Regional Science, Regional Research Institute, West Virginia University http://www.rri.wvu.edu/regscweb.htm