



EXTENDED ABSTRACT

Fiscal Autonomy in a regional system.

The Balanced Budget impact of Current and Capital Government Expenditure.

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Subject area: *Sector público y financiación autonómica*

Keywords: numerical general equilibrium analysis, fiscal federalism, fiscal policy.

JEL codes: C68, D58, H71, H72, R13, R50.

Introduction

This paper investigates the impact of a balanced budget fiscal policy expansion in a regional context within a numerical dynamic general equilibrium model. Essentially, this is a multi-sectoral, intertemporal version of the regional Layard, Nickell and Jackman (2001) model, augmented to capture key elements of the analysis of fiscal expansions in the recent macroeconomics literature, in which current government expenditure matters to consumers and a distinction is made between current and capital government expenditure (e.g., Aiyagari *et al.*, 1992, Campbell, 1994, Baxter and King, 1993, Devereux *et al.*, 1996, Perotti, 1999, Blanchard and Perotti, 2002, Chen, 2007). While our model shares some features of these macroeconomic models, its regional characteristics render it distinctive, in terms of the extent of openness (reflected in the regional database and macroeconomic closures), the regional bargaining function and the importance of migration.

The traditional intertemporal model is augmented with imperfectly competitive features in the labour market and a net-migration model (Layard et al, 1991). Unlike the standard model that allows for substitution between consumption and leisure where the representative consumer chooses the quantity of labour to supply according to a flexible nominal wage, our model contains a wage bargaining function sensitive to the movement of the unemployment rate and labour supply increases through population due to in-migration.

We separately analyse the effects of an increase in current and capital government expenditure for the Scottish Economy. The increase in current government expenditure affects the marginal utility of consumption to a degree determined by the elasticity of substitution of the consumption bundle defined over private and public consumption. Therefore, our results critically depend upon the value assigned to the elasticity of substitution, ε . Many studies estimate the degree of substitutibility between private and public consumption (e.g. Kormendi, 1983; Aschauer, 1985; Karras 1994; Ni 1995; Ho, 2001; Fleissing and Rossana, 2003) however the estimates found in the literature vary



widely¹. Moreover, we cannot use previous estimates directly because they are based on parametric specifications that are not consistent with our model. Indeed, most of the estimates are obtained assuming an intra-temporal linear utility function (such as $\tilde{C} = C + \varepsilon \cdot G$) whilst our model is assuming that private and public consumption are imperfect substitutes, to accommodate the analytical findings of Linnemann and Schabert (2002). For this reason we compare three outcomes obtained by imposing $\varepsilon = 0.2$, $\varepsilon = 2$ and $\varepsilon \rightarrow \infty$.

When we simulate the internally founded increase in public investment we set the congestion parameter η equal to 0.5 and government current consumption does not enter in the consumer's utility function.

The impact of a permanent increase in current government spending.

We analyse the effect of 1.10% increase in current government expenditure. Results for different values of ε are reported in Table 1 where we distinguish between the short-run (SR) and the long-run (LR) impact. The short-run corresponds to the first period of the model where we impose capacity constraints; that is in this time interval the supply of all factors of production is fixed. The long-run is the last period of the model where we impose steady-state conditions.

Low elasticity of substitution ($\varepsilon = 0.2$)

For the case of $\varepsilon = 0.2$, the increase in government purchases raises the marginal utility of consumption that counteracts the negative wealth effect, producing a general expansion in regional activity.

In the short run a positive impact on output is accompanied by a rise in investment (0.29%) and consumption (0.74%). The replacement cost of capital is above its benchmark equilibrium (0.34%) because of capital constraints. The labour force is fixed, though labour demand rises because aggregate demand expands, reducing the unemployment rate (-0.63%). Consequently, the bargaining power of workers increases and so does the real wage (pre-tax, 0.42% and after-tax, 0.07%).

Over time the behaviour of both migration and investment allow total output to rise further. The rise in the real take home wage and the fall in the unemployment rate result in an increase in population. In turn, the growth in labour supply eases the pressure on the wage until the real post tax wage is restored to its original level. Capital stock expands, driven by increases in investment.

The demand side effect of government purchases is reinforced by an increase in the individual's marginal utility that increases consumption offsetting the adverse (supply) effects of an increase in taxation and real labour cost. So the crowding in effect upon private consumption acts as a (demand side) counterbalancing stimulus to profitability thereby raising investment demand and then capital stocks.

In the model, exports are price sensitive. The increase in regional prices generated by the demand shock, through a rise in the nominal wage, has an adverse effect on

¹ Some of them show that substitutability would best describe the relationships between public and private spending while others are clearly supporting the case of complementarity.



competitiveness. However, the contraction in RUK and ROW exports, in the short and long run are not enough to offset total output, because production is supported by domestic consumption that stimulates domestic output.

High elasticity of substitution ($\varepsilon = 2$)

When the elasticity of substitution is set to a high value, output, employment and consumption decline in the long run. The results are compatible to a degree with previous business cycle models. Here the positive demand-side effect of an increase in government purchases is unable to outweigh the adverse supply-side effects of an increase in taxation that is made worse by the decline in consumption. In this scenario although government expenditure enters individuals' utility functions, the marginal utility of consumption is prevented from rising by the high degree of substitution between private and public consumption. Since nominal and real wages rise so as to restore the net of tax wage, Scottish population and employment fall below their initial steady state values.

Turning to a sectoral analysis, we see that only Public administration (PAD) and Education (EDU) exhibit positive change in activity, in the long run. The intensity of government purchases (in the benchmark data) is more marked in PAD and EDU than other sectors, so that, the positive demand effect in these sectors is able to produce capital expansion. However, this is insufficient to counteract the general contractionary effect in all of the other sectors. Figure 1 shows the evolution of the real shadow price of capital for all sectors. Note that only for PAD and EDU the shadow price of capital is higher than the replacement cost of capital, thus stimulating investment with positive effect on output. However, the magnitude of the impact on these sectors is insufficient to produce an overall expansionary effect.

Perfect substitution

The results we would expect when the utility function is defined over a consumption bundle \tilde{C} where perfect substitution between private and public consumption is imposed ($\varepsilon \rightarrow \infty$) are those where government purchases do not enter in the individual utility function.

Figure 2 shows the change in gross domestic product (GDP) and consumption for the case where perfect substitution between private and public consumption is imposed and the case where government expenditure does not enter in the consumer's utility function (indicated respectively *a* and *b* in the Figure). The change in GDP and consumption when $\varepsilon \rightarrow \infty$ approximates the case in which public spending has no direct impact on household utility. From the chart it seems that the percentage changes are almost equal in the two cases and will converge in the new steady state.

Even in this case the response of an income tax-financed expansion in government spending is, both in the short and long-term, contractionary². As the case of $\varepsilon = 2$, the positive demand effect of an increase in government expenditure is more than totally

² The sign of the balanced budget multiplier is sensitive to labour market assumptions. Indeed, under a fixed nominal pre-tax wage what we would expect is a positive balanced budget multiplier in the short and long-run.

offset by the adverse supply effect that an increase in taxes has on the bargained nominal wage and therefore competitiveness.

Table 1

Short-run and long-run results for key variables. Current expenditure shock. Percentage change with respect to the initial steady state

<i>Key parameters</i>	$\varepsilon=0.2$		$\varepsilon=2$		$\varepsilon \rightarrow \infty$	
	<i>SR</i>	<i>LR</i>	<i>SR</i>	<i>LR</i>	<i>SR</i>	<i>LR</i>
<i>Time</i>						
Income tax	2.00	1.47	2.49	2.47	3.00	3.56
Gross Domestic Product	0.03	0.31	-0.04	-0.19	-0.12	-0.71
Consumer Price Index	0.38	0.17	0.21	0.29	0.04	0.42
Unemployment Rate	-0.63	0.00	0.73	0.00	2.13	0.00
Total Employment	0.05	0.27	-0.06	-0.25	-0.18	-0.82
Nominal Gross Wage	0.80	0.43	0.57	0.72	0.32	1.04
Nominal Wage after Tax	0.45	0.17	0.13	0.29	-0.20	0.42
Real Gross Wage	0.42	0.26	0.35	0.43	0.28	0.62
Real Wage after Tax	0.07	0.00	-0.08	0.00	-0.24	0.00
Replacment cost of capital	0.34	0.15	0.21	0.26	0.07	0.38
Working population	0.00	0.27	0.00	-0.25	0.00	-0.82
Households Consumption	0.74	0.82	-0.05	-0.12	-0.86	-1.12
Government Consumption	1.10	1.10	1.10	1.10	1.10	1.10
Private Investment	0.29	0.39	-0.01	-0.08	-0.34	-0.58
Output						
<i>Agriculture</i>	-0.22	0.01	-0.23	-0.42	-0.24	-0.89
<i>Mining</i>	-0.54	-0.22	-0.38	-0.57	-0.21	-0.95
<i>Manufacturing</i>	-0.32	-0.11	-0.25	-0.36	-0.18	-0.62
<i>Energy</i>	-0.19	0.06	-0.20	-0.45	-0.21	-0.99
<i>Construction</i>	-0.34	0.03	-0.32	-0.57	-0.31	-1.21
<i>Distribution</i>	0.12	0.45	-0.25	-0.39	-0.63	-1.29
<i>Transport</i>	-0.29	0.10	-0.35	-0.56	-0.40	-1.27
<i>Financial</i>	-0.21	0.13	-0.25	-0.48	-0.30	-1.13
<i>Public admin</i>	0.98	1.03	0.98	0.97	0.97	0.91
<i>Education</i>	0.65	0.83	0.56	0.53	0.47	0.22
<i>Other services</i>	-0.05	0.29	-0.21	-0.34	-0.37	-1.01
Total Export (RUK+ROW)						
<i>Agriculture</i>	-0.34	-0.19	-0.17	-0.32	0.01	-0.46
<i>Mining</i>	-0.43	-0.22	-0.27	-0.38	-0.11	-0.55
<i>Manufacturing</i>	-0.39	-0.20	-0.25	-0.34	-0.11	-0.48
<i>Energy</i>	-0.37	-0.21	-0.17	-0.36	0.05	-0.51
<i>Construction</i>	-0.42	-0.22	-0.26	-0.40	-0.09	-0.59
<i>Distribution</i>	-0.89	-0.36	-0.46	-0.61	-0.01	-0.88
<i>Transport</i>	-0.64	-0.32	-0.39	-0.55	-0.12	-0.79
<i>Financial</i>	-0.58	-0.29	-0.29	-0.50	0.02	-0.72
<i>Public admin</i>	-1.24	-0.45	-0.92	-0.76	-0.60	-1.10
<i>Education</i>	-1.30	-0.57	-0.93	-0.96	-0.55	-1.38
<i>Other services</i>	-0.79	-0.35	-0.46	-0.59	-0.13	-0.85

Figure 1

Shadow price and replacement cost of capital.

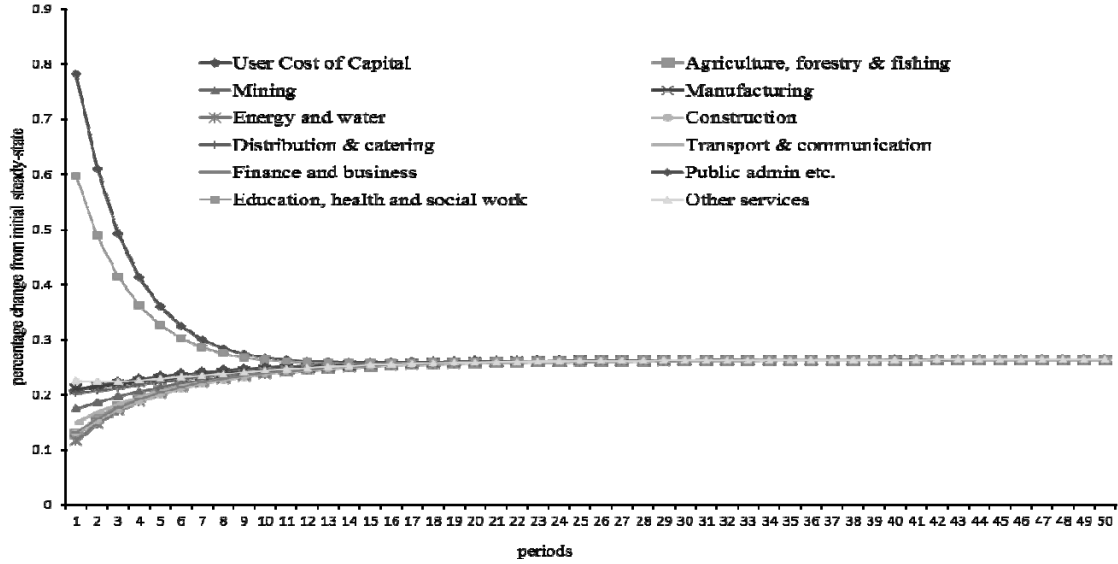
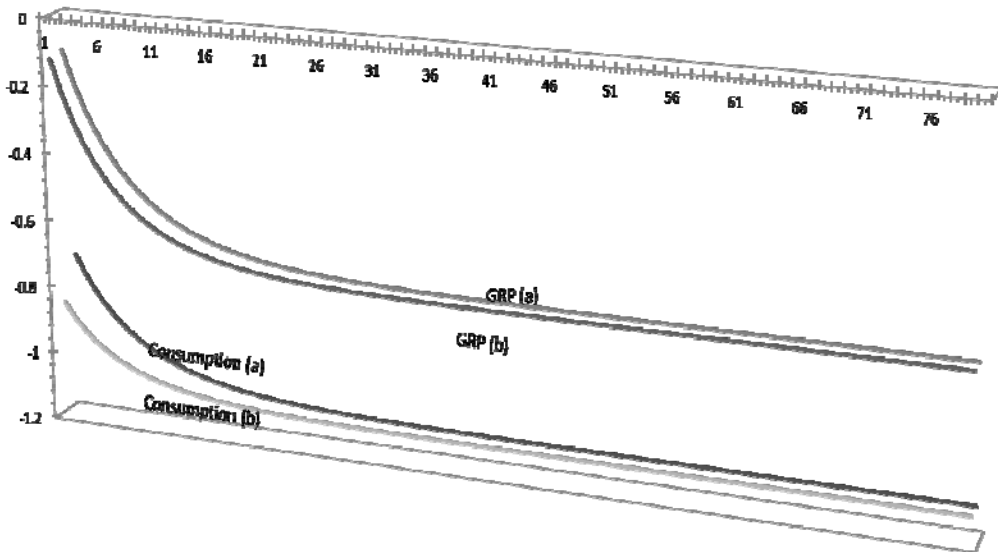


Figure 2

Consumption and investment





The impact of a permanent increase in public investment.

In this section, we analyse the effect of a 12.2% increase in public investment (which correspond to the same amount of a 1.10% increase in government purchase of goods and services), again financed by an increase in income taxation. The results are reported in the first column of Table 2.

In the short run, given the capacity constraint for private and public factors of production, the increase in public investment does not correspond to an expansion in the public capital stock by shifting the marginal product schedules, but can be seen as a simple stimulus to final demand. Therefore, in this time frame, we can distinguish two main simultaneous effects: the positive demand side effect associated with an increase in public investment and a negative effect of a resource cost related to an increase in taxation expanding the wedge between before and after tax wage.

Our results suggest a negative impact on employment and GDP. . The decline in regional activities does also correspond to a reduction in welfare where household consumption falls slightly. GDP declines by 0.08% as a result of a reduction in employment of 0.15% with respect to the base year. This is the result of an increase in the production cost of labour. Indeed, in the regional bargaining process, workers make adjustment in their pre-tax income after government expansion, which has implied a 2.19% increase in income tax. However, workers are unable to claim more, to maintain the same level of purchasing power, so the real wage after tax declines by 0.19%. With the fall in labour demand, unemployment rises, reducing the worker's bargaining power and so the real take-home wage.

After the first period the situation changes significantly. In addition to the demand stimulus of an increase in investment and to a negative supply side effect of the distortionary tax, we also have an increase in the public capital stock that produces positive supply side effects. All capacity constraints are relaxed allowing public and private capital stock to accumulate over time while migration increases the working population. Turning to the dynamics in the labour market, (see Figure 3) only after the ninth period does total employment begin to rise. Wages are still high in the first eight periods so that, we have a positive impact on labour input only at the beginning of period ninth. The combined effect of a rise in the real wage after tax and reduction in unemployment rate encourage in-migration. Simultaneously, in-migration puts downward pressure on the real wage which gradually returns to its benchmark value. The labour market clears, at this point, where the change in employment equalizes the change in working population, and consequently the unemployment rate comes to rest at its original position.

From inspection of Figure 4 we can see that consumption increases relative to the initial steady state, although the average income tax rate is above its initial equilibrium. This reflects the important impact of the public capital stock: it produces a positive supply-side multiplier, by which increases in capital expenditure and tax rates induce a rise in output that in turn does not require additional increases in tax rates. As we can see from the chart the change in the average tax rate is positive but its magnitude decreases period by period coming to rest gradually at 0.015%. This is not an unexpected result since even in the very first periods we were able to see that the output effect of an increased public capital stock is able to offset the adverse resource cost effect of



taxation. In other words given the nature of public capital stock its accumulation acts as an induced structural change that encourages private factors on the supply-side of the economy which ultimately more than totally mitigates the distortionary cost of taxation.

The representative agent increases investment since the accumulation of public capital stock stimulates a strong rise in the marginal product of capital. Furthermore, the increase in private capital stock puts downward pressure on the capital rental rate, producing a system wide efficiency stimulus lowering commodity prices, which in turn puts downward pressure on the replacement cost of capital relative to the change of the shadow price of capital, so that Tobin's q moves procyclically, ultimately encouraging additional investment.

In the long-run, where all factors of production are fully adjusted, private investment increases by 0.90%, which is different from the percentage increase in output, implying that, the capital coefficient is not the same as the initial steady state. Consumption and employment rise by 0.62% and 0.59% respectively.

Given fixed capital stock in the first period, the short-run results obtained here share similar features with the short-run outcomes that corresponds to the scenario where we run an increase in current government expenditure where there is no direct effect of government expenditure on the marginal utility of private consumers ($\varepsilon \rightarrow \infty$). In both cases, and only in the short-run, the experiment is configured as a demand side shock of the same magnitude. So, *ceteris paribus*, we would expect the same short-run outcome as the base case, where the demand side effect is not able to offset the negative adverse supply side effect of the increase in taxation. However, this expectation is not fulfilled, most obviously because consumption and investment are forward looking with rational expectations.

Difference between forward looking and myopic agents

Thus it seems useful to compare results with that obtained running the model with myopic expectations. So that, in Figure 5 we show the evolution of consumption and investment for the forward looking (FL) and myopic case (MYP). In the myopic case initially consumption and investment, are below the original steady state level. In the first period, consumption falls by 0.77% while investment falls by 0.88%. These figures are lower than the forward looking case. Only when public capital expands does investment and consumption increase. Investment takes positive variation after three periods while for consumption it takes 10 periods to achieve a positive proportionate change. Of course, consumption and investment in both models finally converge to the same steady state equilibrium. In the new steady state, as intuitively we would expect, regardless of dynamic structure, both myopic and forward looking model must reach the same long-run equilibrium³.

The main difference between the myopic and forward looking cases is in the adjustment towards the new steady state. Consumption in the myopic model is determined, period by period, by current household income. This decreases in the initial periods because nominal wages fall and the income from physical assets dramatically decline. Private capital initially falls as a result of disinvestment generated by the falling capital rental rate.

³ This particular outcome has not always been recognised in CGE models; see Lecca et al. (2013).

In the forward looking model, consumers base consumption decisions on expected future income and in the dynamic path there is no fixed link between consumption and current income. Investment is determined by profit expectations which are stimulated by the amplification effect of the increase in public capital stock. So, consumers and producers expect, from the outset, a positive stimulus due to the output effect that arises when public capital accumulates over time, as discussed above.

Figure 3
 Labour market dynamic

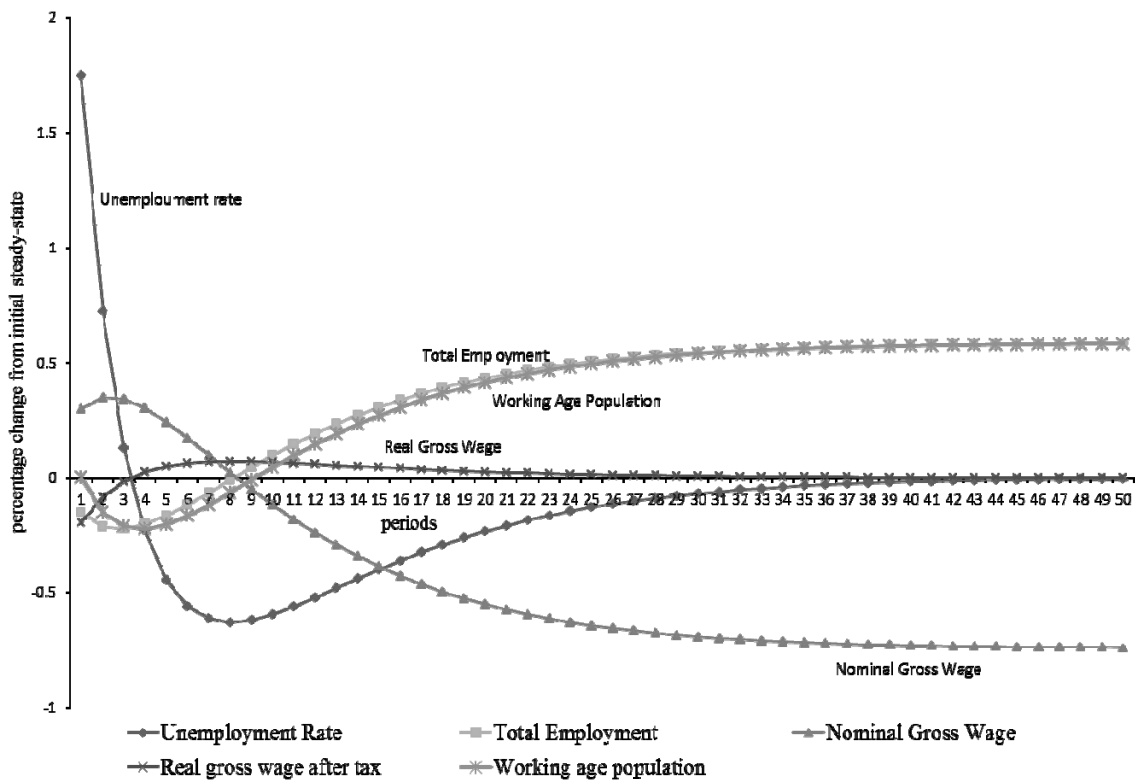


Figure 4

Consumption, Investment and Income tax evolution.

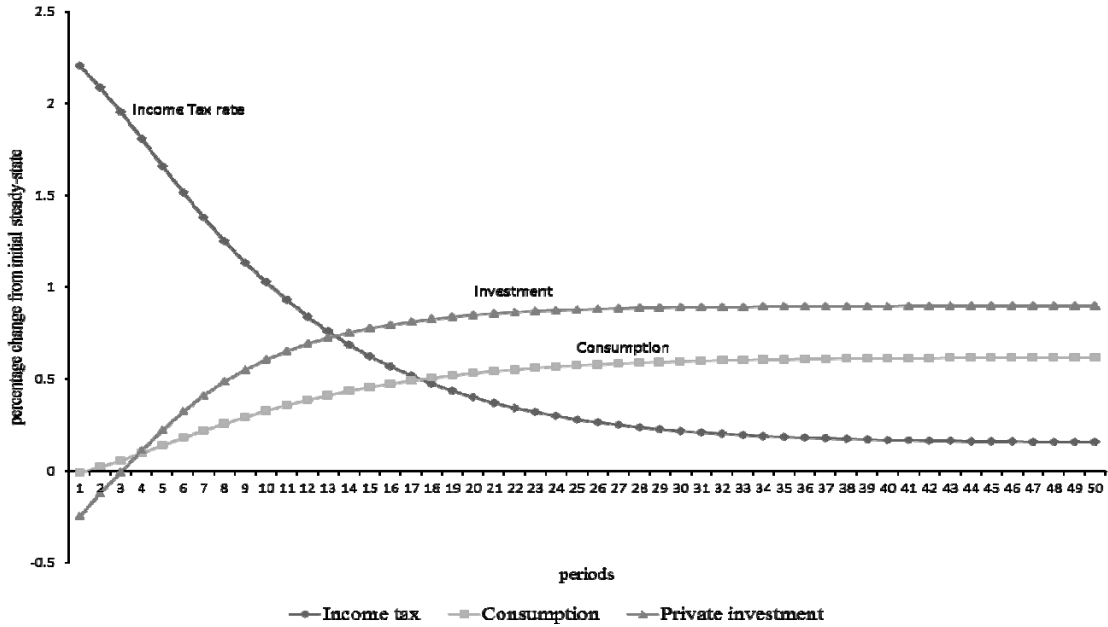
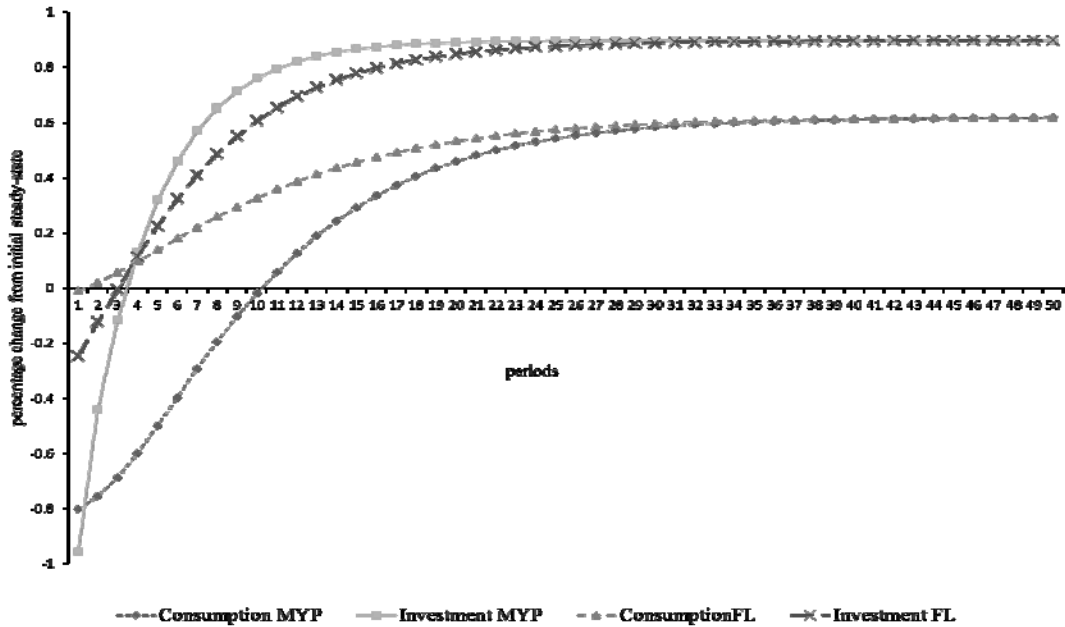


Figure 5

Myopic vs. forward looking: private consumption and investment.





Conclusions

In response to a balanced budget fiscal expansion the model suggests that: an increase in current government purchase on goods and services has a negative multiplier effects only if the elasticity of substitution between private and public consumption is high enough to move the marginal utility of private consumers downward; public capital expenditure crowds in consumption and investment in the long-run, however crowding out effects might arise in the short-run.

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