

Coordination of Monetary and Fiscal Policy in a Monetary Union: Policy Issues & Analytical Models*

by

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August 23, 2006

* This lecture was prepared for the 38th annual conference of the Money, Macro and Finance Research Group, September 2006, University of York. I would like to thank my colleagues Bob Cumby, Behzad Diba and Dale Henderson for many discussions on these topics; however, the responsibility for the views expressed here is mine.

I. Introduction

Twelve countries – each with its own tax and spending policies – are now married by a common monetary policy, and this Economic and Monetary Union (EMU) has given birth to some new and interesting questions about the coordination of monetary and fiscal policy. While this marriage was being contemplated, an academic marriage between the Real Business Cycle (RBC) model and more traditional Keynesian notions of nominal inertia was consummated, leading to the New Neoclassical Synthesis (NNS).¹ NNS models are now being used at leading academic and policy-making institutions to evaluate monetary and fiscal policy. In this lecture, I would like to discuss some of the questions EMU has raised, the answers that NNS models currently seem to be giving to those questions, and whether the answers can be trusted.²

To set the stage for my lecture, I will begin with a discussion of the general nature of the coordination problem, and how it might differ in the Dollar and Euro areas. Then, I will move on to some difficult questions about the Euro-area experience and the way NNS models are being used to answer them. In particular, I will ask what caused the surprisingly large national inflation differentials we have observed, and what the proper response to them might be. I will argue that there is an “inconvenient correlation” in the data that current NNS models have great difficulty explaining, and that this may imply that the answers they are currently giving to important policy

¹ Goodfriend and King (1997) described the New Neoclassical Synthesis, and gave it the name. Woodford (2003) provides a masterful introduction to this class of models. The academic literature on NNS models is voluminous. NNS modeling now plays a prominent role at a number of official institutions (including the Federal Reserve Board, the European Central Bank, the IMF, and the central banks of Canada, England, New Zealand (?), Norway and Sweden; a special issue of the Journal of Economic Dynamics and Control (edited by Canzoneri and Henderson) will highlight some of these efforts.

² A comprehensive review of the literature on macroeconomic policy coordination in EMU is well beyond the scope of this lecture. The reader is forewarned that important contributions to this literature are not even mentioned.

questions are quite biased. Then, I will review the recent NNS literature on optimal monetary and fiscal policies, and optimal policy rules. And finally, I will speculate on their implications for my preferred characterization of the coordination problem.

The general thrust of my lecture will be that EMU raises some interesting questions that expose some weaknesses in current NNS modeling. The paradigm is a good one for studying the policy coordination questions, but more work may need to be done before we can trust the answers they give.

II. The Nature of the Coordination Problem in the Dollar Area and in the Euro Area

Views on the interaction between monetary and fiscal policy have evolved over the years. Monetary policy discussions before the advent of the RBC model (where adherence to an intertemporal budget constraint became mandatory) tended to ignore fiscal policy. Those that did not – such as Alan Blinder's 1982 Jackson Hole paper – tended to attribute different goals (and in some cases different commitment capabilities) to monetary and fiscal policymakers: independent central banks and their governments were thought to be engaged in strategic games over inflation and output stabilization, with outcomes that were often bad for the economy. This view of the coordination problem is still popular in the literature.³

I have been advocating a different view. In my 2002 Jackson Hole paper with Bob Cumby and Behzad Diba, we presented evidence suggesting that legislative processes are too slow for the

³ Additional early examples include: Alesina and Tabellini (1987), Dobelle and Fischer (1994). Recent examples include: Adam and Billi (2004) and Lambertini (2006a) Recent discussions of a currency union include: Dixit and Lambertini (2003), Pappa (2004), Lombardo and Sutherland (2004), Kirsanova, Satchi, Vines and Wren Lewis (2005), and Beetsma and Jensen (2006); see also Pogorelec (2006).

discretionary component of fiscal policy to interact strategically with monetary policy at business cycle frequencies. Figure 1, which is taken from Canzoneri, Cumby, Diba and Mykhaylova (2006), plots the (forward looking) change in U.S. structural surpluses against the GDP gap. (Graph 1.3 in EC (2001) provides similar evidence for the EU.) Observations in the SW and NE quadrants might be viewed as examples of countercyclical episodes, while observations in the NW and SE quadrants are examples of procyclical episodes. By this measure, there have been roughly an equal number of procyclical and countercyclical episodes. However, even this limited evidence for countercyclical policy becomes suspicious when intent is taken into account. For example, the 1982 episode is the Regan tax cut. It just happened to coincide with a recession, causing some to refer to President Regan as the “accidental Keynesian”.

Automatic stabilizers do, of course, provide macroeconomic stabilization. Legislation establishing tax rates, unemployment benefits and other entitlements make fiscal policy react to macroeconomic shocks in a systematic way. And since the reaction is automatic, there are not the delays that are inherent in the discretionary component of fiscal policy: automatic stabilizers act at business cycle frequencies.

This suggests an alternative view of the coordination problem: how should the automatic stabilizers set by legislatures be coordinated with the monetary policy of the central bank.⁴ To be more precise, I will characterize monetary policy by a standard interest rate rule:

⁴ This approach is certainly not new. It is consistent with the view taken by John Taylor in his 1995 Jackson Hole paper, with the official views expressed in EC (2002), and with the discussion in Alesina et al. (2001). However, the alternative approach I advocate here has not been widely adopted in the academic literature. Indeed, even my references to Taylor’s papers may be misplaced. Taylor put the output gap in his fiscal policy rules; however, his discussion suggests that he interprets the rules as reflecting automatic stabilizers.

$$(1) R_t = \alpha + \beta \cdot \text{inflation}_t + \gamma \cdot \text{gap}_{k,t}$$

where β and γ measure the strength of the central bank's reaction to inflation and an output gap.

Here, I discriminate between two kinds of output gap: a "good" gap, defined as $\text{gap}_{g,t} = Y_t - Y_{\text{potential},t}$; and a "bad" gap, defined as $\text{gap}_{b,t} = Y_t - Y_{\text{trend}}$. By trend output, I simply mean smoothed output. At the risk of oversimplifying, we will characterize fiscal policy by a deficit rule:

$$(2) \text{deficit}_t = [(\text{interest payments})_t + (\text{discretionary tax and spending})_t] + (\text{automatic stabilizers})_t \\ = \phi_t - \eta \cdot Y_t$$

where η measures the strength of the automatic stabilizers, and ϕ_t can be viewed as a macroeconomic shock.⁵ The alternative approach I have been advocating is to ask how the parameters β , γ and η should be coordinated.⁶

Suppose for example that the U.S. Congress cuts taxes and entitlement programs in a way that weakens automatic stabilizers. One might think that the Federal Reserve would respond by increasing γ : with weaker stabilizers in place, an increase in aggregate demand would have more affect on output and inflation, and the Federal Reserve would want to respond more aggressively. In Euro Area, the Maastricht Treaty specifies price stability as the primary goal of the ECB. If over time we observe that the ECB responds to this mandate by choosing a smaller γ than was in effect before EMU, then it may make sense for national legislatures in the euro area to strengthen their

⁵ ϕ_t is certainly not independent of macroeconomic developments at business a cycle frequency, as it includes interest payments. And, in the longer term, the automatic stabilizers may not be sufficient to stabilize the debt. But, when thinking about stabilization issues at this level of abstraction, I think it is reasonable to view ϕ_t as a macroeconomic shock.

⁶ This approach eschews the problems of time consistency and commitment. The NNS paradigm I will be discussing generally (but not always) takes the view that commitment is no longer a problem for central banks in OECD countries. Governments may well have commitment problems when it comes to questions of fiscal solvency, but that not my focus here.

automatic stabilizers. Notice however that actual GDP appears in the deficit rule, while it is the GDP gap that appears in the interest rate rule. The NNS paradigm makes much of this difference, and I will argue later on that this complicates the simple intuition just given.

How has – from this point of view – the coordination of monetary and fiscal policy been achieved in the past? Legislation establishing tax rates, unemployment benefits and similar entitlement programs affects market efficiency and income distribution; this legislation seems to have been determined largely by microeconomic and political considerations in the Dollar Area and – at least until recently – in the Euro Area. In the U.S., I think the Federal Reserve has adapted its monetary policy (parameters γ and β) to an exogenously given – but evolving – fiscal policy (parameter η).

In the Euro Area, the situation is more complicated. There are 12 national fiscal policies:⁷

$$(3) \text{ deficit}_{i,t} = \phi_{i,t} - \eta_i \cdot Y_{i,t} \quad i = 1, \dots, 12.$$

Once again, my impression is that legislation establishing national automatic stabilizers has in the past been largely determined by microeconomic and political considerations. The ECB has had to adapt its monetary policy to a weighted average of these 12 national fiscal policies. This may be a source of the well known disparities in national economic performance pictured in Figure 2 (which is taken from Canzoneri, Cumby and Diba (2002)) and Figure 3; I will return to this issue later.

Conditions in the Euro Area now seem to be forcing national legislatures to take macroe-

⁷ One might ask if I am making too much of this asymmetry between the Euro Area and the Dollar Area. There are 50 states in the U.S., and state and local spending accounts for about 2/3 of total public spending. However, most states are bound by some kind of balanced budget rule, and the automatic stabilizers that are the focus of attention here are largely federal. By contrast, the “federal budget” in the EU is quite small, and the automatic stabilizers are almost entirely at the national level.

conomic considerations into account when they set the strength of automatic stabilizers. The much maligned Stability and Growth Pact has led to the prescription that national fiscal budgets should be brought into structural balance, so that when the country goes into recession, the deficit will be less likely to broach the 3% of GDP limit. And more generally, the disparity of national growth rates – and the recognition that the common monetary policy is ill equipped to do anything about them – has shifted attention to national fiscal stabilization. Much of the attention is, of course, focused on current discretionary policy. However, in line with our earlier discussion, it would be interesting to know whether countries that tend to experience deeper recessions, and countries that are less affected by a change in interest rates, are also the countries that have stronger automatic stabilizers. This would be an easy question to answer, since the raw data is already available in various EC publications; however, I have never seen anyone put the data together in this way.

My main point here is that formation of the Euro Area has brought renewed interest in – and new questions about – the coordination of monetary and fiscal policy. In the next sections, I will focus on a few specific questions, and what the new NNS paradigm seems to be saying about them.

III. Is the Way Current NNS Models Explain Inflation Differentials Credible?

Differences between national inflation rates in the Euro area have proven to be larger than many had anticipated.⁸ Figure 2 illustrates the average inflation differentials since the Euro's

⁸ ECB (2003) provides an extensive documentation of the early inflation differentials. Altissimo, Benigno and Rodriguez Palenzuela (2004) perform an interesting statistical decomposition of the early inflation differentials. See also Angeloni and Ehrmann (2004).

inception;⁹ they range from a high of 1.8% p.a. in Ireland to a low of - 0.6% p.a. in Germany. These inflation differentials are also quite volatile; for example, the standard deviation of the inflation differential between France and Germany is 1.6% p.a. Some have claimed that inflation rates are converging, but Figure 3 shows that a wide disparity still exists in the most recent data.

I am not aware of any rigorous analysis of the welfare consequences of these inflation differentials, but the way in which they are being viewed seems to depend upon what is thought to be generating them. When the differentials are thought to be driven by unstable fiscal policies, then the presumption seems to be that the Stability and Growth Pact (or something like it) may be useful in controlling them. When the differentials are thought to be driven by other national demand disturbances, the presumption seems to be that the Stability and Pact is getting in the way of automatic stabilizers embodied in the national fiscal policies. And finally, when the differentials are thought to be driven by national productivity shocks, the presumption seems to be that the differentials reflect relative price movements that do not need to be corrected. The last interpretation lets the ECB off the hook, and allows it too simply concentrate on aggregate (or area wide) inflation.

III. A. An Inconvenient Correlation

It is clearly of interest to know what is driving the inflation differentials. Modeling them incorrectly will almost certainly lead to erroneous policy conclusions. Figures 1 and 2 illustrate what might be described as a cross-sectional Phillips Curve for the Euro area: in Figure 1, average

⁹ Quarterly inflation differentials for country J are computed as $4(\log(P_{J,t}/P_{J,t-1}) - \log(P_{E,t}/P_{E,t-1}))$, where $P_{J,t}$ is the average over the three months of quarter t of the HIPC for country J and $P_{E,t}$ is similarly defined for the Euro Area. Real growth differentials are computed similarly by taking annualized averages of quarterly growth rates of real GDP and subtracting the annualized average quarterly growth rate for the Euro Area. The source for both the HIPC and real GDP data is Eurostat.

HICP inflation differentials are positively correlated with average GDP growth differentials (the correlation is 0.69); and in Figure 2, the correlation is similarly positive (0.62). This positive correlation has in fact been rather well documented. Similar graphs appear in Angeloni and Ehrmann (2004), and Chart 16 in ECB (2003) illustrates a positive correlation between average HICP inflation and cumulative output gaps. In addition, the time series correlations appear to be consistent with the cross sectional correlations; for example, the correlation between French and German inflation and growth differentials is 0.58.

These correlations suggest that national inflation differentials are being driven by demand shocks, and not by productivity shocks. This does not tell us what kind of demand shock – public private – is at work here. Canova and Pappa (2004) used VAR techniques to argue that 14% to 23% of the variability in inflation differentials could be explained by fiscal shocks. But in any case, it is hard to see how a model driven by productivity shocks would be able to explain the positive correlation between inflation differentials and differentials in economic activity.

III.B. What Do NNS Models Say About Inflation Differentials?

What drives inflation differentials in the NNS models? As far as I am aware, there are not many NNS papers on this issue. However, the few studies I have seen are giving an answer that I am afraid was rather predictable: they strongly suggest that inflation differentials in the Euro area are driven by productivity shocks. Duarte and Wolman (2002) and Altissimo, Benigno and Rodriguez-Palenzuela (2004) developed small two-country NNS models to study inflation differentials in a monetary union. Duarte and Wolman calibrated their model to (very roughly) fit French and German data. They found that productivity shocks alone were sufficient to explain the observed volatility in the French and German inflation differential; the volatility of their model's

inflation differential was little affected by the addition of government spending shocks. Similarly, Altissimo, Benigno and Rodriguez-Palenzuela found that fiscal shocks played a very minor role in their model's variance decomposition for inflation differentials: productivity shocks explain about 95% of the variation in their inflation differentials and over 95% of the variation in their output differentials.¹⁰ Neither of these papers tried to address the "inconvenient correlation".

Why do I say this answer was predictable? Productivity shocks and markup shocks play an important – perhaps inordinate – role in current NNS modeling,¹¹ and impulse response functions show that these shocks make inflation move counter-cyclically. In models that do not include the markup shock, productivity shocks are generally the only important source of volatility in inflation. The Altissimo, Benigno and Rodriguez-Palenzuela (2004) model is an example. In my ISOM paper, we (roughly) calibrated a small model to European data. The model contained government spending shocks, interest rate shocks, and shocks to labor and consumption tax rates. But, all the fiscal variables combined only explained about 2% of the variation in inflation; the productivity shock explained about 90%.

Most of the larger NNS models include markup shocks. Ireland (2004) studied a relatively small model that included a preference shock, an interest rate shock, a productivity shock and a markup shock. Impulse response functions showed that the first two shocks made inflation move pro-cyclically, while the last two made inflation move counter-cyclically. In his variance decompositions, the markup and productivity shocks accounted for about two thirds of the volatility in

¹⁰ Altissimo, Benigno and Rodriguez-Palenzuela (2005) laid out an elegant flexible price model to study the long run determinants of inflation differentials. They found that the differentials were primarily explained by productivity shocks in the non-traded goods sectors.

¹¹ Markup shocks are shocks to the elasticity of demand for individual firms' products.

inflation, with markup shocks doing most of the work. The larger models include an abundance of shocks (making their classification difficult), and variance compositions are not always reported. However, Smets and Wouter's (2005) variance decompositions for inflation (in their Dollar-area model and in their Euro-area model) are consistent with Ireland's.

It seems unlikely that modeling of this sort will be able to produce a model that can explain the "inconvenient correlation". One possibility is that demand shocks are either missing or incorrectly modeled in the current batch of NNS models. Smets and Wouters (2005) have investment shocks, but these shocks do very little to explain the volatility of inflation in their models. The demand shock that has received the most attention recently is the government spending shock.

III. C. Are Government Spending Shocks Inadequately Modeled?

There is a new controversy in the empirical literature about the effects of a government spending shock on private household consumption. The conventional result is due to Blanchard and Perotti (2002), Fatas and Mihov (2003) and others. Using VAR techniques on U.S. data, they showed that a government spending shock increases private consumption. However, in subsequent work Perotti (2004), Mihov (2003) and Bilbiie, Meier, and Muller (2006) found that a structural break may have occurred around 1980. Perotti, for example, extended his work include Germany, Canada, Australia and the U.K. His impulse response functions for Germany, Canada, Australia and the U.K. showed that a government spending shock raised consumption in the pre-1980 sample, but lowered it in the post-1980 sample. For U.S. data, the response of consumption was still positive, but considerably weakened. So, at this point, it is not entirely clear what "stylized fact" the NNS models should try to replicate.

Impulse response functions from NNS models tend to show that a government spending

shock decreases consumption, and this result is generally taken to be a weakness of the models. Gali, Lopez-Salido and Valles (2005), Erceg, Guerrieri and Gust (2005), Coenen and Straub (2005) and others have tried – with mixed success – to make consumption rise following a government spending shock by modeling “rule of thumb” consumers. These households do not have access to financial (or capital) markets; they simply make a labor-leisure decision and spend their current incomes.

III. D. Modeling More Demand Shocks or Rule of Thumb Consumers

None of the studies referred to in the last subsection sought to explain the “inconvenient correlation”. In my 2006 paper with Cumby, Diba and Mykhaylova, we developed a small two country currency union model, calibrated (very roughly) to French and German data, and we tried to explain the correlation by adding demand shocks and modeling rule of thumb households (in addition to optimizing households). This model had home bias in both consumption and investment, and it had Calvo-style wage and price setting. We used Collard and Dellas’s (2002) estimate of a bivariate process for French and German productivity. Our auto-regressive processes for government spending were also based on Collard and Dellas’s estimates. The central bank’s monetary policy was governed by a rule that made the interest rate respond to lagged interest rates and aggregate inflation (an average of the two national inflation rates). We did not include an interest rate shock, since it would have fallen on both countries, with little or no effect on inflation and growth differentials. However, the central bank’s reaction to aggregate inflation transmits shocks occurring in one country to the other; this is a topic I will return to later.

The benchmark version of the model is Ricardian. There are no rule of thumb agents, and lump sum taxes balance the budget. The only shocks are the shocks to government spending and

productivity shocks. Figure 4 shows the home country effects of a home country government spending shock. As expected, this demand shock makes inflation move pro-cyclically. But, consumption is crowded out, while investment is crowded in. This is just the opposite of what Blanchard and Perotti (2002) found (using U.S. data). The real exchange rate falls, indicating a positive inflation differential. Table 1 shows the variance decompositions and the unconditional correlation between inflation and growth differentials. The government spending shocks explain about 75% of the variation in growth differentials, but the productivity shocks explain over 90% of the variation in inflation differentials. The correlation between inflation and growth differentials is negative, - 0.32; recall that the correlation between French and German inflation and growth differentials is 0.58.

Then, we added some non-Ricardian elements to the model. We modeled rule of thumb households (in addition to the optimizing households), transfers payments, and distortionary labor, capital and consumption taxes (calibrated to EU averages). To stabilize debt dynamics, we made both transfers and government spending respond to the debt to GDP ratio. Figure 5 shows the home country effects of a home country government spending shock. In this model, a government spending shock increases aggregate consumption and crowds out investment. And the net effect on aggregate demand and inflation are larger here than in the Ricardian model. Table 2 reports the variance decompositions for this model. The government spending shocks explain more of the variation in the inflation and growth differentials. All of this looks promising, but the correlation between the inflation and growth differentials just rises from -0.32 to -0.13, well short of the 0.58 observed for France and Germany.

Finally, we returned to the benchmark Ricardian model, and we added a second kind of

demand shock. We wanted to put a shock in each country that would shift demand between home and foreign production; in our modeling, an obvious choice was a parameter that determined the degree of home bias in consumption and investment. We let the standard deviation of these shocks be large enough to make the standard deviation of the inflation differential in the model match the standard deviation of the differential for France and Germany. This required the shocks to be large: their standard deviations were about one and three quarters larger than those of the government spending shocks.

This did the trick, in the sense that the correlation between inflation and growth differentials rose to 0.57, which is almost identical to the correlation observed for France and Germany. However, we do not really view this as a modeling success. Table 3 shows why. These private spending shocks are large enough to explain more than 80% of the variation in the inflation differential and virtually all of the variation in the growth differential. We followed standard practice in choosing the standard deviations of these shocks: we chose them to help the model match a standard deviation in the data – here the standard deviation of the inflation differential for France and Germany. But these preference shocks are not observable, and it is hard to know exactly what they represent, or how to gauge their realism.

These home bias shocks may well be standing in for a number of structural shocks that have yet to be modeled, and for the way they propagate through aggregate demand to inflation and growth. Our modeling may be a step in the right direction, but we think that more work needs to be done to properly identify the missing demand shocks.

III. E. Are NNS models Ready for Prime Time?

So, what have we learned about inflation differentials in the Euro-areas? Are they a response

to productivity shocks, and therefore something to be applauded? Or they a response to demand shocks, and if so, which shocks? And where does this leave us with respect to the Stability and Growth Pact? NNS models were designed to give us answers to such questions, but I am not sure that they are ready yet.

I certainly do not intend my comments to be a condemnation of the NNS paradigm. Indeed, I think NNS models are the best models we currently have for evaluating conceptual issues about monetary and fiscal policy. However, they have their weakness, just as any other models do, and these weakness may bias the policy conclusions coming from them in unfortunate ways. I personally worry about the modeling of demand shocks, but there are other issues as well. There is great effort in academia and at policy making institutions to improve the models, and to make them more consistent with the data. But, given their current popularity at many central banks, I worry that they might be oversold, and then rejected. I think that would be a tragedy.

IV. Optimal Monetary and Fiscal Policies and Optimized Policy Rules

In this section, I will draw lessons from the monetary policy literature, from the literature on optimal monetary and fiscal policies, and from the literature on operational monetary and fiscal policy rules. Here again, the apparent primacy of productivity shocks in current NNS modeling will be a fundamental issue. In the next section, I will try to apply those lessons to my preferred characterization of the coordination of monetary and fiscal policy in a currency union.

IV. A. Lessons from the Monetary Policy Literature

I think most central bankers recognize the importance of productivity, and worry about potential output. In the NNS literature, potential output is usually identified with a measure of what

output would be under flexible wages and prices.¹² But however potential output is defined, it is difficult to measure in practice, and some would assert that publicly available measures of potential output are little more than smoothed output. It is unclear, from a positive point of view, which gap should be entered in equation (4).

From a normative point of view, however, it is clear that what I have labeled the good gap is preferred. Ever since Rotemberg and Woodford (1997), a central tenets of NNS models has been that it is bad macroeconomic policy to simply smooth output. A positive productivity shock raises actual (and potential) output above trend, but it should be accommodated since households want to consume and invest more. In Canzoneri, Cumby and Diba (2006), we calibrated to U.S. data a model with Calvo-style price and wage setting, investment, and shocks to productivity, government spending, and interest rates; the model was able to capture many – but certainly not – features of the U.S. business cycle. We used the model to calculate the “cost of nominal” rigidity, that is, welfare in the flexible wage/price solution minus welfare in the sticky wage/prices solution. This cost was substantial: in our benchmark case, households would be willing to give up 3% of their consumption each period to obtain the flexible price solution.¹³ But, our benchmark case assumed an interest rate rule with the bad output gap; the model seemed to fit the data better with the bad output gap. When we used the good gap instead, the cost fell to about 1% of consumption.

These results are consistent with the Rotemberg-Woodford admonition against smoothing

¹² There is a controversy in the NNS literature over how to view capital when calculating this measure; in our modeling we follow the example of Niess and Nelson (2003).

¹³ There are obvious ways in which we overstate and understate these costs. Since we never model the reasons why agents opted for sticky wages and prices in the first place, we are probably overstating the cost. On the other hand, since we don't model unemployment, and we do model complete markets for sharing consumption risk, we are probably understating the cost.

output. And, of course, the results depend on productivity shocks playing an important role in the economy. And, once again, this raises the question of whether productivity shocks play an inordinate role in current NNS modeling. Table 4 reports the variance decompositions for our model. Productivity shocks explain over 90% of the variation in inflation, and about 50% of the variation in consumption and output. I have no way of knowing whether or not this is realistic, but I will note that the unconditional correlation between inflation and output in our model is - 0.36; in the U.S. quarterly data from 1960 to 2003, the correlation is about 0.33.¹⁴ I personally view this as another indication that demand shocks may be missing or inadequately modeled, but I admit that this view is controversial.

If we take the NNS models at face value, and if we assume that central banks can estimate potential output accurately, then results like those in our 2006 paper suggest that monetary policy has a big advantage over automatic stabilizers in stabilizing the economy. In fact, the automatic stabilizers may actually be counterproductive (at least in terms of the distortions created by wage and price stickiness). This is not the traditional Keynesian view. And, it is at odds with the simpler view that the gap term in the interest rate rule and the automatic stabilizers in fiscal policy are basically substitutes.

IV. B. Optimal Monetary and Fiscal Policies: A Guide for Operational Policy Rules?

Until recently, NNS policy papers focused almost exclusively on monetary policy. Now, there is a growing literature on monetary and fiscal policy. Much of the attention has been on optimal policies – the choices of a social planner – and not on operational rules or automatic stabilizers. As far as I am aware, only a few of these papers have studied optimal policies in a

¹⁴ See Canzoneri, Cumby and Diba (2006) for data sources.

currency union: Gali and Monacelli (2004), Beetsma and Jensen (2005), Lambertini (2006b) and Ferrero (2005) are however notable examples.

Optimal policies are not the focus of attention here, but they can be used to characterize the outcomes that more operational rules should try to emulate.¹⁵ Unfortunately, we shall see that some of the results in this literature seem to depend on how the price and wage rigidities are modeled.

Chari, Christiano and Kehoe (1991) provided a rather unexpected benchmark for this literature. In a model with flexible wages and prices and perfect competition, they showed that surprise inflations were a non-distortionary tax (on existing nominal assets) that could be used to finance innovations in government spending, allowing distortionary taxes to be smoothed over time. The optimal inflation rate was extremely volatile. When Calvo-style price setting is added, aggregate price fluctuations create a dispersion of firm prices that distorts households' consumption bundles and lowers welfare. King and Wolman (1999) showed that a policy of aggregate price stability would eliminate the need for firms to reset their prices, and eliminate the welfare loss due to sticky prices, achieving a (constrained) optimum; but, they did not model a meaningful tax smoothing problem. In a model with Calvo-style price setting and distortionary labor taxes, Benigno and Woodford (2003) showed that optimal inflation rates were quite stable, while the optimal tax rates were volatile; in other words, the welfare loss created by sticky prices far exceeded the loss from fluctuating tax rates. Schmitt-Grohe and Uribe (2004a) and Chugh (2005) obtained similar results in models with Rotemberg-style price setting (which does not imply a price dispersion).¹⁶ There

¹⁵ The linear-quadratic approach, pioneered by Benigno and Woodford (2003), does result in what proponents describe as simple "targeting rules" that lead to optimal solutions.

¹⁶ See also Siu (2004).

appears to be a consensus here, and inflation targeting at least can certainly be modeled as a simple interest rate rule.

When sticky wages are added to the mix, things become more complicated. Christiano, Eichenbaum and Evans (2005) and Smets and Wouters (2005), using very different methods to calibrate their models, found that both Calvo price setting and Calvo wage setting were needed to make their NNS models fit the data. Erceg, Henderson and Levin (2002) showed that with Calvo wage and price setting, it was no longer optimal to simply stabilize prices; there was a tradeoff between stabilizing price and wage inflation (or equivalently an output gap). Canzoneri, Cumby and Diba (2005, 2006) showed in a series of calibrated models that the distortions caused by Calvo wage setting were far more important than the distortions caused by Calvo price setting; given the choice, wage inflation targeting strongly dominated price inflation targeting. But Canzoneri, Cumby and Diba did not include a meaningful tax smoothing problem. Schmitt-Grohe and Uribe (2006) modeled distortionary labor taxes along with Calvo wage and price setting, and they found that the tradeoff between price and wage stability was resolved “overwhelmingly in favor of inflation stability”. I suspect that their result was strongly affected by the way they calculated the disutility of work.¹⁷ Chugh (2005) also found that it was optimal to favor price stability over wage stability, but I suspect that this result comes from the fact that he modeled Rotemberg-style price and wage setting rather than the Calvo version.¹⁸

¹⁷ Schmitt-Grohe and Uribe assumed that each household supplied labor to all of the firms. They therefor summed the household’s work effort across firms and put it into a convex disutility for work. Canzoneri, Cumby and Diba assumed each household worked at only one firm. Their aggregate disutility of work was therefor a sum of convex disutilities.

¹⁸ With Rotemberg price and wage setting, there is no dispersion of wages and work efforts across firms. As explained in the last footnote, this lowers the disutility of work and

I have neither the time, nor the inclination, to go into a detailed discussion of how this diversity of results comes about. Here is my main point: there is a general consensus for the notion that, if price stickiness is the only nominal rigidity, inflation should be stabilized at the expense of smoothing taxes; but if wage stickiness is added to the mix, the choice between stabilizing price or wage inflation (or equivalently an output gap) seems to depend on the precise way in which the nominal rigidities are modeled. And there is not a strong consensus about that.

So, what guidance does this literature on optimal monetary and fiscal policy give us for the design of more operational policy rules? Strict inflation targeting may do well if you think that the economy is characterized by sticky prices and flexible (or non-allocative) wages. But, if you think – as I do – that wages are sticky (and allocative), then the monetary and fiscal policy rules that perform well may depend on technical choices made by the modeler, choices rarely discussed at any length.

All of the discussion so far has been about single country models. I am only aware of a few NNS modelers – Gali and Monacelli (2004), Beetsma and Jensen (2005), Ferrero (2005) and Lambertini (2006b) – who have studied optimal monetary and fiscal policies in a currency union.¹⁹ All of the models in these papers posit Calvo price setting and flexible wages. None of the models have capital formation or capital taxation; some have distortionary taxes on labor or consumption. All of the models have productivity shocks, but they differ in their inclusion of other shocks (markup shocks, consumption shocks, government spending shocks, etc). All take the interest rate as the monetary policy instrument, but they differ in their choices of the fiscal instrument (government

decreases the importance of stabilizing wage inflation.

¹⁹ Some of these authors have multiple papers on the subject.

spending or one of the tax rates).

These modelers have made so many different choices, and they have derived such a variety of results, that it may seem rather bewildering. But, I think a comparison of the Gali and Monacelli (2004) and Ferrero (2005) papers will illustrate both the diversity of the modeling efforts and the basic similarity of the conclusions. Ferrero follows the others in modeling two large countries; Gali and Monacelli buck the trend by modeling a continuum of small countries. Ferrero's fiscal policy instrument is a distortionary sales tax, while government spending is an exogenous stochastic process; Gali and Monacelli's fiscal instrument is government spending, while a lump sum tax balances the budget. Ferrero finds that the optimal monetary policy stabilizes aggregate inflation, while national tax rates fluctuate to finance innovations in government spending and to stabilize a (rather fancy) national output gap. Gali and Monacelli find that the optimal monetary policy stabilizes aggregate inflation, while national government spending rates have to trade off the stabilization of national output gaps with the efficient provision of public goods. In each case, a strict form of inflation targeting is combined with a flexible fiscal policy that takes care of asymmetric distortions that the common monetary policy is ill suited to cope with.

These results seem to me like a natural generalization of the single country results when sticky prices are modeled along with flexible wages. And, strict inflation targeting can certainly be modeled as a simple interest rate rule; the fiscal policies coming from this literature are rather elaborate. I suspect that if sticky wages were added to the models discussed above, the results for inflation targeting would become more complicated, and in the ways I have already indicated.

IV. C. Operational Monetary and Fiscal Policy Rules

Optimal monetary and fiscal policies can be very complicated, and (one suspects) very model

specific. Indeed, Ramsey policies can not generally be expressed in closed functional form; they are often characterized by simulation. It is not clear that these policies could actually be implemented. So, there is an obvious interest in simple policy rules, and in how close they come to replicating an optimal solution. We can also study more complex models – ones including investment – in this setting.

Kollmann (2004) and Schmitt-Grohe and Uribe (2004b) provide interesting and complementary papers.²⁰ Both studied implementable rules for monetary and fiscal policy in single country models with investment, stochastic processes for government spending and productivity, Calvo price setting and flexible wages. Both modeled an income tax that distorts work and investment decisions, and both took the interest rate as the instrument of monetary policy and the income tax rate as the instrument of fiscal policy. Kollmann studied the welfare consequences of simple and not so simple policy rules; Schmitt-Grohe and Uribe emphasized the welfare consequences of bad policy rules.

Kollmann computed a benchmark for welfare in a version of the model without distortions (ie without monopolistic competition, income taxes or sticky prices). Then, he reintroduced the distortions and studied the welfare consequences of simple rules (in which the interest rate reacts to inflation and the tax rate reacts to the level of the debt and to the shocks to productivity and government spending) and more complicated rules (in which both instruments respond to a wider array of variables). Optimized versions of the richer set of rules did quite well in this environment, and interestingly, the optimized versions of the simple rules did virtually as well. The rules produced a very stable inflation rate, and a fluctuating tax rate. Reintroducing flexible prices (but

²⁰ See also Beetsma and Jensen (2005) and Chadha and Nolan (2004). Their setups are somewhat different than those discussed here.

keeping the monopoly and tax distortions), the optimized rules called for a stable tax rate and a fluctuating inflation rate. These results mirror those discussed above for the optimal policy rules (when wages are flexible).

Schmitt-Grohe and Uribe emphasized the negative welfare implications of bad policy rules. Adding what I have called the bad output gap to the interest rate rule, they showed that welfare deteriorated considerably. (This is reminiscent of Rotemberg and Woodford's (1997) admonition against smoothing income in an economy with productivity shocks.) The welfare consequences of perturbations in the interest rate rule's response to inflation (as long as the Taylor Principle was not violated) or perturbations in the tax response to debt were of secondary importance; the important thing was not to the bad output gap in the interest rate rule.

So, at least in models with flexible wages, the results for optimized policy rules seem to be consistent with the results for optimal policies. Strict inflation targeting and fluctuating tax rates are the order of the day. And, the monetary policy literature's admonition against smoothing income in an economy driven by productivity shocks carries over to an environment with fiscal policy. I am not aware of any papers that study optimized monetary and fiscal policy rules in NNS models with sticky wages or in NNS models of monetary unions.

V. Policy Coordination in a Single Country and in a Monetary Union

Now, I will return to my preferred characterization of the monetary and fiscal policy coordination problem. I will again think of monetary and fiscal policy as being governed by interest rate and deficit rules:

$$(4) R_t = \alpha + \beta \cdot \text{inflation}_t + \gamma \cdot \text{gap}_{k,t}$$

and

$$(5) \text{ deficit}_{i,t} = \phi_{i,t} - \eta_i \cdot Y_{i,t}$$

where $i = 1$ for the Dollar-area and $i = 1, \dots, 12$ for the Euro-area, and where $\phi_{i,t}$ is viewed a macroeconomic shock. And once again, I want to emphasize that automatic stabilizers – tax and benefit legislation – make deficits respond to the level of GDP, while the interest rate responds to an output gap. And I want to discriminate between good gaps ($\text{gap}_{g,t} = Y_t - Y_{\text{potential}}$) and bad gaps ($\text{gap}_{b,t} = Y_t - Y_{\text{trend}}$, where trend output is simply smoothed output).

The fiscal policies discussed in the last section were clearly discretionary policies. Even when the fiscal policy depended on output, it responded to some kind of sophisticated output gap term. Automatic stabilizers respond to the level of output. Moreover, a big component of the automatic stabilizers reflect benefit legislation: they are transfers between households. Modeling distortionary taxes does break up Ricardian equivalence and make transfers matter. However, modeling heterogeneous agents would also seem to be relevant. Modeling rule of thumb households would introduce heterogeneity, and it may beef up the demand side of the economy and help the model to explain the “inconvenient correlation” discussed in Section II.

I am not aware of any NNS modeling that quite does this. However, for currency unions, Ratto et al (2006) and Muscatelli et al (2006) have made a good start. Here, I can only speculate – based on the discussion in Section III – what the results of such an modeling effort might be.

Consider a single country model with thumb households in addition to optimizing households. Let there be a distortionary labor tax, and stochastic processes for productivity and government spending. Let there be Calvo price setting and flexible wages. Let the automatic stabilizers include counter cyclical transfers that go primarily to the rule of thumb households. Let tax rates

respond to the level of debt in a way that ensures fiscal solvency. Suppose the central bank can measure potential output accurately, and use the good gap term in the interest rate rule.

Once again, strict inflation targeting would be the best policy against the relative price distortion (created by sticky prices). Automatic stabilizers would presumably smooth output, but this would probably not be harmful as long as the central bank can continue its policy of strict inflation targeting. And, the automatic stabilizers would help the rule of thumb households smooth their income. In this economy, there is only one distortion (the one created by sticky prices), and one monetary instrument can take care of it; there is no tradeoff between inflation targeting and output gap targeting.

Introducing Calvo-wage setting, there are two distortions: a price dispersion and a wage dispersion. So, monetary policy faces a tradeoff between stabilizing inflation and stabilizing the output gap. Automatic stabilizers will smooth output, and I suspect that this will worsen the tradeoff, and increase the welfare losses due to nominal rigidities. Of course, the automatic stabilizers will also help the rule of thumb households stabilize their consumption, and in the end this may be more important than the increased losses due wage and price distortions.²¹

Moving from a single country to a currency union, we would have asymmetric national shocks that a common monetary policy is ill suited to address. It is unclear what role the national automatic stabilizers might play in this context. International transfers, and a consolidated federal budget, may also be useful, but that is far beyond anything that is being seriously contemplated.

All of this is, I am afraid, mere speculation. What is needed is a rigorous analysis, and a

²¹ For example, the rule of thumbers may be able to compensate the optimizers for the loss of utility the transfers cause them. Or, the rule of thumbers may be able to out vote the optimizers.

calibrated model capable of assessing quantitative significance. As I said at the beginning, EMU has given birth to some new and interesting questions about the coordination of monetary and fiscal policy. I have argued that automatic stabilizers and the role of productivity are at the heart of many of the questions. And NNS modeling is, in my view, the best paradigm for studying these questions, but NNS modeling has a long way to go, and the new questions have in my view exposed some of its potential weaknesses.

Table 1: Variance Decompositions for the Ricardian Currency Union Model

Corr ($\Delta\pi$, Δgrowth) = - 0.32	combined asymmetric productivity shocks	combined government spending shocks
growth differential	23.6%	76.4%
inflation differential	92.5%	7.5%

Table 2: Variance Decompositions for the Non-Ricardian Currency Union Model

Corr ($\Delta\pi$, Δgrowth) = - 0.13	combined asymmetric productivity shocks	combined government spending shocks
growth differential	13.5%	86.5%
inflation differential	88.3%	11.7%

Table 3: Variance Decompositions for Ricardian Currency Union Model with Preference Shocks

Corr ($\Delta\pi$, Δgrowth) = 0.57	asymmetric productivity shocks	government spending shocks	private spending shocks
growth differential	0.4%	1.2%	98.4%
inflation differential	16.2%	1.3%	82.5%

Table 4: Variance Decompositions in Closed Economy Model

	productivity shock	interest rate shock	public spending shock
inflation	94.3%	5.7%	0.0%
output	49.8%	50.0%	0.1%
investment	43.0%	56.7%	0.3%
consumption	52.9%	41.6%	5.6%
hours worked	7.8%	92.0%	0.2%

**Figure 4: Discretionary Policy and GDP Gaps
(US data, 1960 - 2001, Fiscal Year)**

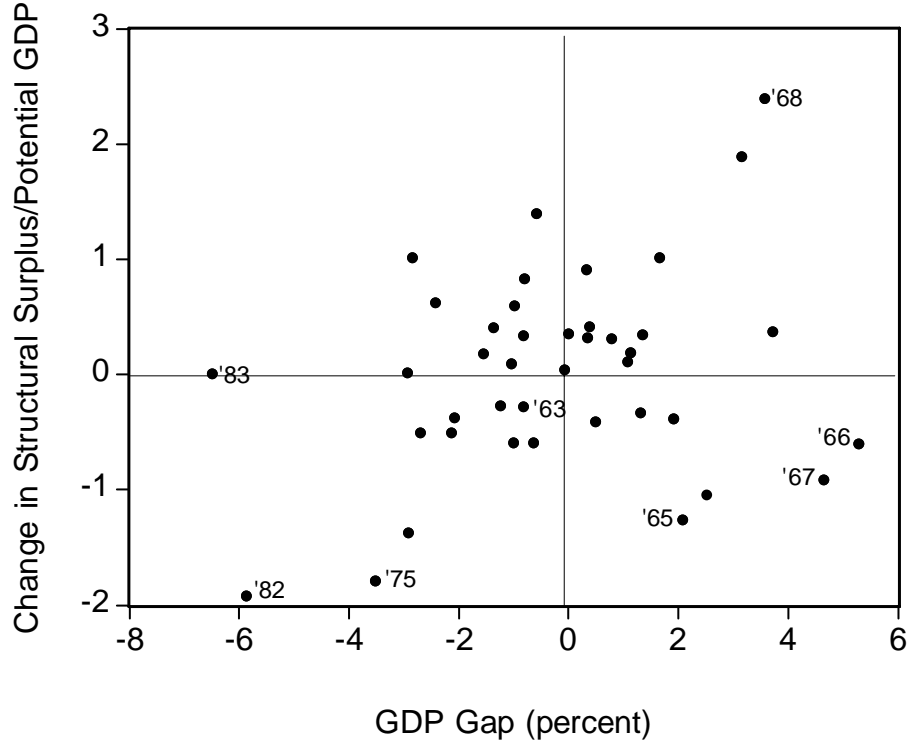


Figure 2: Inflation and Growth Differentials
1999-2004, Correlation = 0.69

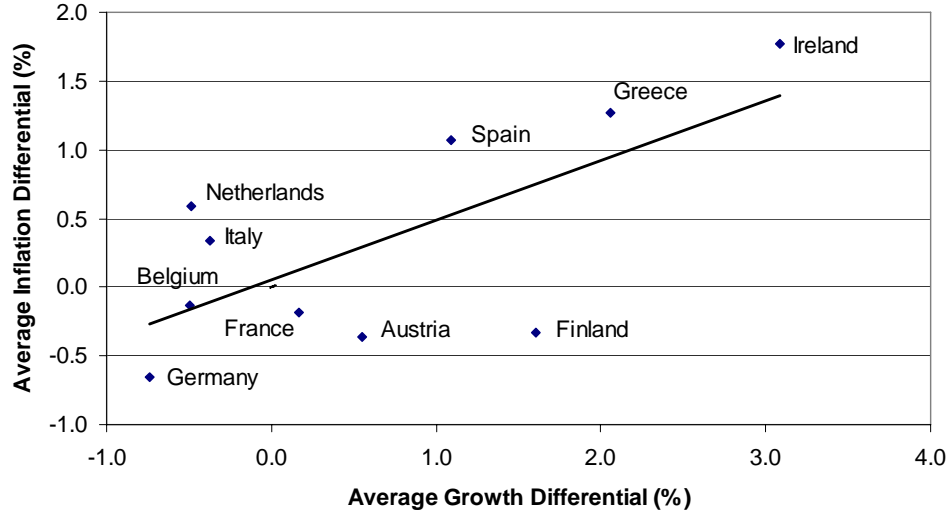
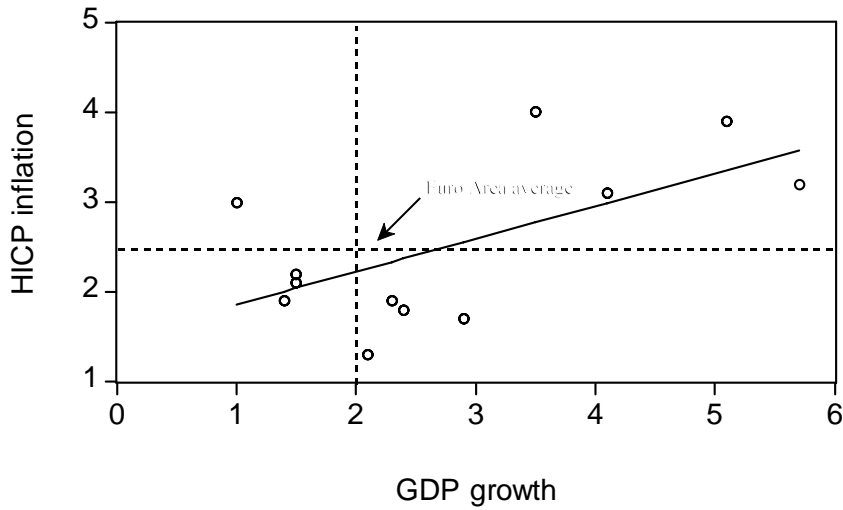


Figure 3: Current Inflation and Growth, Correlation = 0.62



Source: OECD Key Indicators, July, 2006

Figure 4: Own Effects of a Government Spending Shock in Ricardian Model

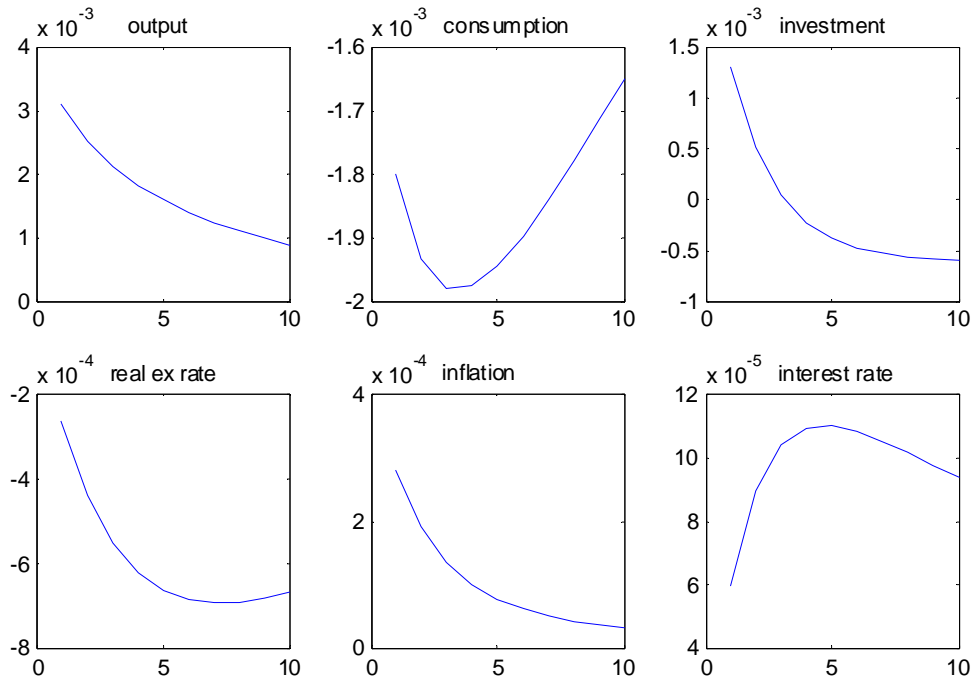
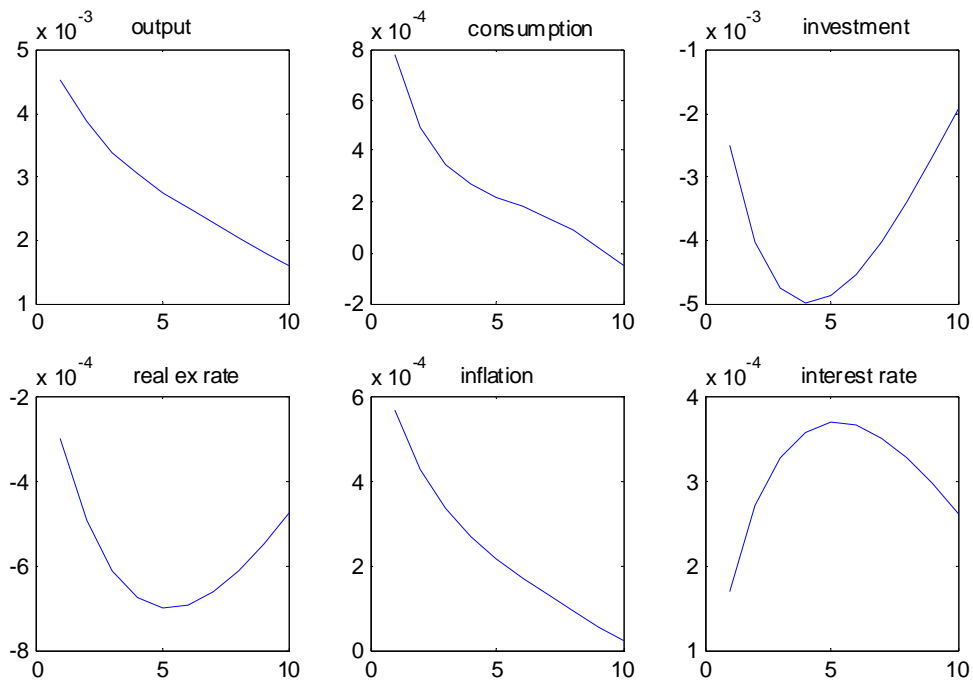


Figure 5: Own Effects of a Government Spending Shock in Non-Ricardian Model



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