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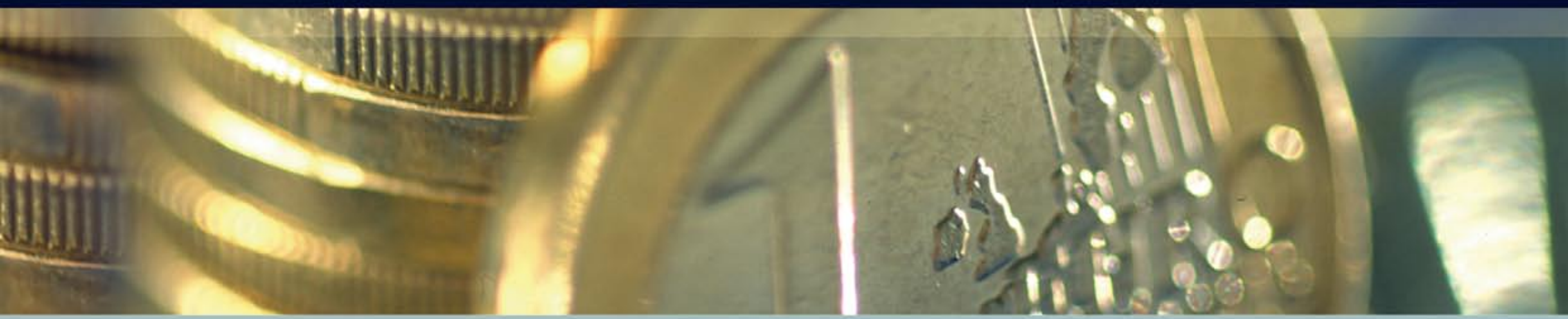

Fiscal Policy, Intercountry Adjustment and the Real Exchange Rate

Christopher Allsopp and David Vines

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In May 2008, it was ten years since the final decision to move to the third and final stage of Economic and Monetary Union (EMU), and the decision on which countries would be the first to introduce the euro. To mark this anniversary, the Commission is undertaking a strategic review of EMU. This paper constitutes part of the research that was either conducted or financed by the Commission as source material for the review.

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Fiscal Policy, Intercountry Adjustment and the Real Exchange Rate within Europe*

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Abstract

The paper argues that an improved fiscal policy process might result in improved macroeconomic performance within Europe. Within EMU, a country may have difficulty ensuring stability in the face of asymmetric shocks; the response may be unstable, or, even if not, the real exchange rate might overshoot. In this context, the rules of the SGP may interfere with the control of inflation control, with the short-run stabilisation of demand, and also with the longer term adjustment of intra-European real exchange rates. We recommend using fiscal policy to stabilise inflation and also to target the real exchange rate rather than deficits or debt. Such a policy would require a more active use of fiscal policy.

Key Words: Macroeconomic stability, European Monetary Union
JEL Reference Number: E52, E61, E63, F41

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1 Introduction

The establishment of the euro has been highly successful. Nevertheless, whilst some Member States have fully enjoyed the benefits of belonging to the currency union, notably by experiencing high growth rates, there have been large divergences in growth rates. One example of these differences in economic performance is the protracted period of slow growth and low inflation in Germany, from 2001 onwards, which contrasts with a prolonged period of high growth and more rapid inflation in Ireland and Spain. Such divergences partly reflect the process of economic catching up underway in certain euro-area members. But even within the latter group, there have been marked differences over an extended period. Most strikingly, since 1990 Ireland has achieved particularly rapid real convergence, which has led to living standards above the euro-area average since 1997. On the other hand, Portugal experienced a stalling of real convergence after 2000.

What factors lay behind such inter-EMU divergences? The conventional view is that they relate to long-standing issues about progress in enhancing the flexibility of markets. This leads to the conventional suggestion that to improve performance the emphasis should be on supply side flexibility – and on the Lisbon agenda.

However there is another possibility. This is that interactions between competitiveness, prices and fiscal positions within EMU might cause inter-country divergences to cumulate, even in the presence of supply-side flexibility.

Within EMU the adjustment process which brings national conditions back in line with the euro-area average works as follows. Within EMU, there is a single centralised monetary policy. A recession in one nation, caused, say, by competitiveness in that nation being less than in the rest of the union, will not lead to an EMU-wide a response in monetary policy, either if the country is small, or if there is a corresponding, offsetting, boom elsewhere. But it will lead to an reduction in inflation in that nation, and to a corresponding gain in competitiveness there, and this will moderate the recession. Similarly the reverse will occur if there is a boom in one nation, caused, say, by a gain in competitiveness there; inflation will rise there and so the competitiveness of that nation will worsen, damping the boom. The former kind of adjustment is what has been happening in Germany throughout the present decade. The conventional view is that this equilibrating process will work satisfactorily, so as to ensure inter-country adjustment within EMU. This conventional view is discussed in detail in Commission of the European Communities (2006).

It has long been believed that this adjustment process will be difficult within a monetary union. The speed of the process will necessarily depend on the *degree of price flexibility*; within a monetary union competitiveness cannot be rapidly adjusted by exchange rate change. If this price flexibility is low then the adjustment process will be prolonged. Hence the conventional beliefs, described above, about the need to promote supply-side flexibility.

In this paper we explore a new and different argument about the difficulty of adjustment, to do with the dynamics of the adjustment process. We show that difficulty depends not only on the degree of price flexibility but also on the *degree of forward-lookingness* in the economy. We show that in a monetary union in which (i) a sufficient number of price setters follow a backward-looking adjustment process and (ii) a sufficient number of consumers are indebted and credit constrained (and so cannot practice forward-looking consumption smoothing) there can be forces which offset the stabilising forces described above, and which can lead towards cumulative divergence between countries.

1.1 Analysis of the paper

The ECB sets a single nominal interest rate for all euro-zone countries. In countries experiencing a loss of competitiveness and so a recession, inflation will begin to fall gradually. (How gradually it falls will depend on the degree of forward-lookingness of price-setters.) The opposite is true in countries experiencing a boom. This means that in uncompetitive countries with a recession the real interest rate (the single common nominal rate minus domestic inflation) will begin to rise, and vice-versa in competitive countries experiencing a boom. But as the real interest rate gradually rises in countries with a recession, consumption will gradually fall (at least amongst credit constrained consumers). As a result there will be further downward pressures on domestic economic activity. This means that the rate of inflation will fall, the real interest rate will rise further, and consumption will fall further. Output may continue to fall, even although the country is becoming more competitive. The opposite is true in the countries with a boom. As a result, while aggregate inflation in the euro-zone may be on target, inflation rates across individual countries may not converge; the resulting real interest rate differences may diverge, and outputs may diverge cumulatively. This may happen, even although the relative competitive position of countries changes, in a direction which would promote convergence, in the conventional manner described above. The present paper analyses this adjustment difficulty using a formal model. The model will be used to examine how the possibility of cumulative divergence depends on the degree of forward-lookingness in both consumption and price-setting.

We will show that, within this model, a tendency towards divergence could not arise without *both* kinds of backward-lookingness. First, we will show that the problem of divergence could not arise if all price setting were forward-looking. In this case, the inflation rate would immediately jump down in the uncompetitive economy, and then gradually return to equilibrium in such a way as to return the competitiveness of the economy to its required level. The opposite would happen in the competitive economy. The forward-lookingness of price setters would ensure that the economies did not diverge. Second, we will show that divergence could not arise if all consumers were forward-looking. Even if inflation were entirely backward looking, and only adjusted gradually, forward-looking consumers in the uncompetitive country would immediately jump down their level of consumption, in response to a projected sequence of higher interest rates in the future, and, after this their consumption would gradually rise again. The recession in the economy would be removed over time, along with the economy's gradual improvement in competitiveness. The opposite would happen in the competitive economy. Forward-looking consumers would ensure that the economies did not diverge.[1]

The paper will also show that forward-lookingness in price setting and in consumption can substitute for each other in avoiding such cumulative divergence. Using a particular calibration of the model, we show that the larger the proportion of consumers who are liquidity constrained, the greater the proportion of forward-looking price setters has to be to avoid the possibility of cumulative divergence. Similarly, the smaller the proportion of price setters who are forward-looking, the greater the proportion of forward-looking proportion of consumers needs to be to avoid the possibility of cumulative divergence.

Going on from this, the paper also shows that, even if this adjustment process is stable, competitiveness can overshoot in this adjustment process, causing cyclical outcomes. Using the particular calibration of the model, we show that in the uncompetitive economy, the adjustment process can cause "too much" deflation, so that the price level overshoots too far in the downward direction. This is what appears to have been happening in Germany recently.

Finally, the paper shows that fiscal policy could contribute to this adjustment process, offsetting the way in which real interest rates effects push in the wrong direction. We show that fiscal policy could help to avoid a process of cumulative divergence, given the degree of backward-lookingness of consumption and of price-setting in the economy. Further we show that, even if cumulative divergence was avoided, fiscal policy could help to dampen any overshooting of competitiveness and cycles. We also show that tightly controlling debt, as required by the Stability and Growth Pact (SGP), can prevent fiscal policy having either of these effects. Our model thus suggests that, in a world in which there is a considerable degree of backward-lookingness, the SGP does not provide a framework which will facilitate inter-European adjustment. This may be the case, even although the SGP might provide a valuable framework in which the *aggregate* fiscal stability of the Euro area as a whole can be managed.

1.2 Plan of the paper

The paper is structured as follows. In the next section of the paper, we present some data which suggests that the difficulties which we have just described may be real difficulties within EMU. In Section 3 we sketch a very simple model which gives an analytical proof of the argument described above.

Then in Sections 4 and 5, we develop our argument using a microfounded macro model in which

[1] We will see that if consumers are forward-looking, but all price-setters are backward looking, the economy will only *just* be stable; it will cycle in an undamped manner. If some price setters are also forward-looking, then the resulting cycles will be damped.

the inflation process is partly forward-looking and partly backward-looking, and in which some consumers are forward-looking, and act as if they are infinitely lived, but in which other consumers are credit constrained. We examine a standard calibration of the model, and use it to perform the analysis described above.

Section 6 considers policy implications of this analysis. A final section concludes.

There already exist important papers on the subject of this paper, namely the conduct of fiscal policy in a monetary union in which there are nominal rigidities, in particular those by Gali and Monacelli (2005b) and Beetsma and Jensen (2005). The contribution of present paper it to show that the task for fiscal policy is more demanding if (a) the nominal rigidities arise from a partly forward-looking and partly backward-looking inflation process which gives rise to inflation persistence, and (b) not all consumers are forward-looking but there are also credit constrained consumers. The first of these features is contained in the model in Kirsanova et al. (2007), but the model in that paper contains no credit-constrained consumers. Both of these features are present in the model of Kirsanova et al. (2006); the model of the present paper is an extension of the model in that paper, obtained by adding a public sector to the model in that paper.

2 Inter-country differences

Figure 1 to 5 display some relevant recent developments in the Euro area. These figures show steady divergence.

The German economy entered EMU with high costs, in an uncompetitive position; Figure 1 shows a continuing relative gain in competitiveness for Germany since then. Similarly this figure shows a continuing loss of competitiveness for Spain and Portugal; which entered EMU with low costs, in a competitive position. This cumulative gain or loss is repeated, as a long and drawn-out process, in a number of countries including Italy. Wickens (2007) draws attention to this feature.

Figure 2 shows that real interest rates have been high, and have remained high, in the country, Germany, which entered EMU in an uncompetitive position, even although competitiveness has been continuing to improve, as a result of relatively low inflation. Similarly real interest rates have been low in Spain, even although its competitive position has been continuing to worsen, as a result of relatively high inflation. (The same is true for Portugal.) This position has been sustained not just for a short period, but over the full period since the creation of EMU, suggesting pronounced overshoot in response to the shock. Figure 3 shows that this has been a feature of long rates as well as short rates.

Figures 4 and 5 describe further aspects of the adjustment process. They show the German current account balance moving into a marked surplus, as the real exchange rate has become more competitive. Figure 4 suggests that this adjustment process may have gone far enough by 2004 or 2005, and that the continuing improvement in the German real exchange rate since then may have gone too far. It is apparent that German fiscal policy has not played a part in helping to bring the real exchange rate to a longer term equilibrium position. (The German fiscal figure for the year 2000 should be discounted because this was when German telephone licences were auctioned.) Such a policy might have required a more contractionary stance early in the period – to help bring the initial adjustment about more quickly - and a more expansive position more recently, to prevent the real exchange rate being driven down too far. The Spanish position also does not show fiscal policy moderating the recent private sector boom, a boom which has been assisted by a low real interest rate. This boom has continued to drive the Spanish real exchange rate in an uncompetitive direction. (In the case of Portugal an uncompetitive position has been sustained for nearly a decade, and the continuing fiscal deficit has not played a part in adjusting this position. Similarly, in Greece fiscal policy does not appear to have played a part in adjusting the external position.)

The models which follow in Sections 3 and 4 are designed to explain such cumulative divergence shown in these Figures.

3 A very simple model of a small member of a monetary union

We first demonstrate analytically that the kind of cumulative instability, discussed in the introduction to the paper, is possible; and we show how fiscal policy might prevent such instability. We do this assuming that the behaviour of both consumers and price setters is entirely backward looking. We then show that if either (a) all price-setters are forward-looking, or (b) all consumers are forward-looking, then this might be sufficient to remove such a tendency to cumulative instability. We are able to show this using a simple model in continuous time. A fuller model is developed in the next section in discrete time; in that model both consumption and price setting are determined by a mixture of forward-looking and backward-looking behaviour.

In both this section and next section we suppose that the country is small enough that developments in it do not influence the interest rate in the union as a whole.

3.1 A fully backward-looking model

We represent output as follows

$$y = c + \sigma s + g, \tag{1}$$

where y is output in the particular country, c is consumption in the country, s competitiveness of the country, where an increase in s denotes a depreciation in the real exchange rate of the country, and g is government spending. We suppose that consumers are credit constrained and indebted, so that a rise in the real interest rate causes a reduction in consumption; for simplicity we here model this effect in a static way. (In the full model in the next section consumption expenditure is derived from microfoundations and partly forward-looking and partly backward-looking, and so the relevant expression is more complicated.) Noting that the real interest rate r is affected negatively by the inflation rate, π, we write

$$c = \varsigma\pi. \tag{2}$$

We can represent fiscal feedback on inflation and on the real exchange rate as

$$g = -\theta\pi + \lambda s. \tag{3}$$

We can thus represent output in the economy by an equation in which the divergence in output in the country depends on inflation and on its real exchange rate relative to the rest of the monetary union

$$y = \delta\pi + \epsilon s, \tag{4}$$

where $\delta = (\varsigma - \theta)$. The sign of δ depends on fiscal feedback; $\delta > 0$ unless fiscal feedback is sufficiently strong. $\epsilon = (\sigma + \lambda)$ is necessarily positive because any fiscal feedback from the real exchange rate augments competitiveness effects.

We represent inflation as follows. In continuous time we can write a NAIRU Phillips curve with backward looking price setters as

$$\dot{\pi} = \gamma y, \tag{5}$$

where $\gamma > 0$.

Finally, in a monetary union, inflation in the country erodes its competitiveness relative to that in the rest of the union,

$$\dot{s} = -\pi. \tag{6}$$

We can thus represent the economy by two dynamic equations

$$\begin{bmatrix} \dot{\pi} \\ \dot{s} \end{bmatrix} = \begin{bmatrix} \gamma\delta & \gamma\epsilon \\ -1 & 0 \end{bmatrix} \begin{bmatrix} \pi \\ s \end{bmatrix}.$$

The eigenvalues of the system are $\frac{1}{2}\gamma\delta \pm \frac{1}{2}\sqrt{\gamma^2\delta^2 - 4\gamma\epsilon}$.

Here inflation is a predetermined variable, and, since competitiveness s is also predetermined, we need two negative roots if there is to be stability. But, in the absence of fiscal feedback $\delta = \varsigma > 0$, because of the effect of inflation on the real interest rate and so $\gamma\delta > 0$. Also $\sqrt{\gamma^2\delta^2 - 4\gamma\epsilon} < \gamma\delta$. As a result both of the roots are positive, and so no stable solution exists. This means that if for some reasons, the economy starts out of the steady state, for example it is uncompetitive and so that s is below equilibrium, inflation will fall without limit, consumption will collapse, and competitiveness will improve without limit.

There are two forces at work determining this unstable outcome. Consider a shock which makes the economy uncompetitive.[2] Output falls and so inflation begins to fall, which gradually causes the

[2] We could extend our analysis to a stochastic setting, since linear models are certainty equivalent.

competitive position to improve, and this of itself makes output increase. But the fall in inflation also causes the real interest rate to rise which causes consumption to fall, which of itself makes output decrease. Since, as here, all price setting is backward looking and so inflation only adjusts gradually, changes in the level of competitiveness are only gradual, and occur as the integral of the changes in inflation. By contrast, changes in the rate of inflation, and in the real interest rate, occur immediately once output falls. This is why these effects dominate, and go on dominating, cumulatively, offsetting the effects of improvements in competitiveness. The danger of this outcome became known as 'Walters' critique', stemming from the opposition of Sir Alan Walters to British membership of the Exchange Rate Mechanism of the European Monetary System (EMS), when he was advisor to Margaret Thatcher. This idea lies at the heart of the analysis in this paper.

This potential for instability in fixed exchange rate regimes is raised inKirsanova et al. (2006). Surprisingly it is not discussed in textbook accounts of fixed versus flexible exchange rate regimes, and does not feature in most official discussions of the advantages and disadvantages of monetary unions (Commission of the European Communities (1990), H.M.Treasury (2003)).

In the present simple model, such an unstable outcome can only be avoided if fiscal policy is sufficiently strong in its repose to inflation, so as to make $\delta = (\varsigma - \theta) < 0$. In that case both roots will be negative and stability obtains. In that case the reduction in inflation will cause both a gradual increase in competitiveness and an immediate increase in domestic expenditure, because – by construction – the positive effects of falling inflation on fiscal expenditure outweigh the negative effects on consumption coming from a rising real interest rate.

If fiscal policy ensures that $\delta = (\varsigma - \theta) < 0$ and so that the roots are negative and the system is stable, cycles in competitiveness may nevertheless occur. This will happen if the eigenvalues of the system are complex. By inspection, this will occur if ε is large enough, which will be the case if the effect of competitiveness on demand is large. To prevent such cycles, the fiscal feedback on inflation would need to be large enough not only to make δ positive but also to large enough to ensure that $\gamma^2\delta^2 - 4\gamma\epsilon$ is positive, and so prevent such cyclical behavior. Likewise if the fiscal feedback on the real exchange rate is large, so as to make ε larger and therefore speed up the adjustment of competitiveness, then δ would need to be even larger still to prevent cyclical overshoot.

3.2 Forward-looking price setting

We can represent a fully forward-looking, perfect-foresight, Phillips curve in continuous time as the limit, as the interval of time shrinks to zero, of an equation of the form $\pi_t = \phi y_t + \pi_{t+1}$. This may be written as

$$\dot{\pi} = \gamma y, \tag{7}$$

where now $\gamma < 0$.With this one change the model remains as before.[3]

Competitiveness is a predetermined variable, but we now suppose that inflation is a jump variable. We thus have one predetermined variable and one jump variable. Suppose that there is *no* fiscal intervention, so that now $\delta = \varsigma > 0$. As a result $\gamma\delta < 0$ and also $\sqrt{\gamma^2\delta^2 - 4\gamma\epsilon} > \gamma\delta$.This means that there is one negative eigenvalue and one positive eigenvalue. We suppose – in a conventional manner – that forward-looking price setters are capable of jumping the inflation rate so as to eliminate the unstable root and so putting the economy on a stable path. That is, we assume that they behave so as to ensure that the transversality condition – that the economy does not experience explosive behaviour – is satisfied.[4] As a result the model will be saddle-path stable.

Following an initial shock which causes competitiveness to fall below its equilibrium level, there will be no gradual, cumulative fall of inflation. Instead inflation will jump down, and gradually rise back to equilibrium again, during which time the disturbance to competitiveness will gradually be removed; competitiveness will gradually return to equilibrium. As it does this the real interest rate will immediately rise, causing consumption to fall, and so causing output to fall initially for a further reason, in addition to the effects of worsened competitiveness. But after its initial downward jump, inflation will be gradually rising again, and so the real interest rate will be gradually falling, and consumption will gradually be rising, back to equilibrium.

There will be no need for fiscal intervention in this case to ensure stability, since the behavior of the private sector in jumping the inflation rate will instead ensure this (given that we have assumed that forward-looking inflation will jump in such a way as to cancel out the unstable root in the system.) In such a setup, forward-lookingness can remove the problem of instability.

3.3 Forward-looking consumption

We can represent the behaviour of fully forward-looking, perfect-foresight, consumers in continuous time by means of an Euler equation, written as

$$\dot{c} = \varsigma r, \tag{8}$$

which, noting the dependence of the real interest rate on the inflation rate may be written as

$$\dot{c} = -\varsigma\pi. \tag{9}$$

With this change, and supposing that there is no fiscal intervention, the model may now be written as

$$\begin{bmatrix} \dot{c} \\ \dot{\pi} \\ \dot{s} \end{bmatrix} = \begin{bmatrix} 0 & -\varsigma & 0 \\ \gamma & 0 & -\gamma\epsilon \\ 0 & -1 & 0 \end{bmatrix} \begin{bmatrix} c \\ \pi \\ s \end{bmatrix} \tag{10}$$

[3] In the full model in the next section, we present a partly forward-looking and partly backward-looking Phillips curve; the forward looking component of that Phillips curve is New Keynesian, and so the Phillips curve in the full model does not have the NAIRU property.

[4] The system is solved using the Blanachard Kahn procedure.

As initially, we suppose that inflation is entirely backward-looking, and does not jump. Similarly competitiveness is predetermined. But we suppose that consumption is a jump variable. We thus have two predetermined variables and one jump variable. The eigenvalues of this system are $\lambda = 0$, and $\lambda = \pm\sqrt{-\gamma(\epsilon + \varsigma)}$. There is one zero root, and two pure imaginary roots. We suppose – in a conventional manner – that forward-looking consumers are capable of choosing the initial level of consumption so as to put the economy on a stable path. That is, we assume that they behave so as to avoid Ponzi-game outcomes.[5] As a result the model will be saddle-path stable.[6]

This system will not explode, but it will cycle in an undamped manner. Following an initial shock which causes competitiveness to fall below its equilibrium level, there will be a gradual fall of inflation. But at some stage competitiveness will improve enough, and output increase enough, so that inflation begins to rise again. Consumption will initially jump down and then begin to rise - in line with the behaviour of the real interest rate which gradually rises as inflation gradually falls. (The Euler equation shows that along the adjustment path consumption will be rising when the real interest rate is high.) This happens until the point where inflation stops falling; at this point consumption will start to fall again. The solution will lead to an undamped cycle in all of inflation, competitiveness and consumption.

It is possible to show that if there is any fiscal feedback on inflation, this will damp the resulting cycle and if fiscal policy is sufficiently strong this will ensure that there is no cycle. Thus, although forward-looking consumption can be sufficient to prevent instability, it will not, of itself eliminate a cyclical response. For this some fiscal policy is needed (or, as we shall see in the next section some forward-lookingness on the part of price-setters).

4 A microfounded model of a small member of a monetary union

In this section, we develop a microfounded model in which both inflation and consumption are forward looking and backward looking. This model enables us to explore the potential for instability, and the possibility of cycles, in more detail than has been done in the previous section, using a model with proper microfoundations. This model is too complex to allow us to derive analytic results; we will thus examine a standard calibration of the model.

The model which we develop is in the 'New Open Economy Macroeconomics' tradition; we take the model developed in Kirsanova et al. (2006) and modify it to include effects of fiscal policy. Our analytical framework is close to that of Beetsma and Jensen (2005), a setup which we generalise in three important respects. First, while that paper embodies nominal inertia in the form of Calvo contracts, we also, following, Kirsanova et al. (2007), allow for some additional backward-looking inflation inertia and so introduce inflation persistence, using a set up outlined in Steinsson (2003).

[5] The system is solved using the Blanachard Kahn procedure.

[6] Here this involves eliminating any effect of the zero root which would introduce a constant into the solution and prevent the economy returning to equilibrium.

(This is realistic, as suggested by Mankiw (2001) and Benigno and Lopez-Salido (2006) among many others.) Second, following Kirsanova et al. (2006), we the allow for some households to be credit constrained and so unable to implement an optimal consumption plan. As a result the consumption of this group is governed by its current budget constraint and so is backward-looking rather than forward-looking. (This is also realistic, as argued by Wright (2004).) Third, we introduce the government solvency constraint into the model. As a result, any short run stabilisation undertaken by the fiscal authorities is constrained, as it should be, by the long-run need to ensure debt stabilisation.

It is possible to study a monetary union with, say, two countries, each of which is big relative to the other, as in Kirsanova et al. (2006). Here the country we study is sufficiently small that developments in it have no effect on the nominal interest rate in the union, and, for simplicity, we abstract from the existence of other countries in the world. In this regard, the model similar to that in Gali and Monacelli (2005b).

We will use this model to study how the dynamic behaviour of the economy is influenced by the proportion of backward-looking and forward-looking behaviour, and by fiscal policy. We will describe the behaviour of the economy in response to a particular shock - a shock to the *level* of competitiveness rather than to the rate of inflation – since the discussion in Section 2 above has suggested that such shocks are important in a monetary union.

4.1 Households

There are two groups of consumers: those that are credit constrained, and those who are not. For both groups the aggregate consumption bundle is defined as

$$C = \frac{C_H^{1-\alpha} C_F^{\alpha}}{(1-\alpha)^{(1-\alpha)}\alpha^{\alpha}}, \tag{11}$$

where we drop time subscripts, since all variables are contemporaneous. C_H is a composite of domestically produced goods given by

$$C_H = \left(\int_0^1 C_H(z)^{\frac{\epsilon-1}{\epsilon}} dz \right)^{\frac{\epsilon}{\epsilon-1}}, \tag{12}$$

where z denotes the good's type or variety. The aggregate C_F is an aggregate of consumption across all other countries in the union i

$$C_F = \left(\int_0^1 C_i^{\frac{\eta-1}{\eta}} di \right)^{\frac{\eta}{\eta-1}}, \tag{13}$$

where C_i is an aggregate similar to (12). There is a public goods aggregate given by

$$G = \left(\int_0^1 G(z)^{\frac{\epsilon-1}{\epsilon}} dz \right)^{\frac{\epsilon}{\epsilon-1}}, \tag{14}$$

which implies that public goods are all domestically produced. The elasticity of substitution between varieties $\epsilon > 1$ is common across countries. The parameter α is (inversely) related to the degree of home bias in preferences, and is a natural measure of openness.

Optimisation of expenditure for any individual good implies the demand functions

$$C_H(z) = \left(\frac{P_H(z)}{P_H}\right)^{-\epsilon} C_H, \quad C_i(z) = \left(\frac{P_i(z)}{P_i}\right)^{-\epsilon} C_i, \tag{15}$$

where we have price indices given by

$$P_H = \left(\int_0^1 P_H(z)^{1-\epsilon} dz\right)^{\frac{1}{1-\epsilon}}, \quad P_i = \left(\int_0^1 P_i(z)^{1-\epsilon} dz\right)^{\frac{1}{1-\epsilon}}. \tag{16}$$

It follows that

$$\int_0^1 P_H(z) C_H(z) dz = P_H C_H, \quad \int_0^1 P_i(z) C_i(z) dj = P_i C_i. \tag{17}$$

Optimisation across imported goods by country implies

$$C_i = \left(\frac{P_i}{P_F}\right)^{-\eta} C_F, \tag{18}$$

where

$$P_F = \left(\int_0^1 P_i^{1-\eta} di\right)^{\frac{1}{1-\eta}}. \tag{19}$$

This allows us to write

$$\int_0^1 P_i C_i di = P_F C_F. \tag{20}$$

Optimisation between imported and domestically produced goods implies

$$P_H C_H = (1-\alpha) PC, \quad P_F C_F = \alpha PC, \tag{21}$$

where

$$P = P_H^{1-\alpha} P_F^{\alpha} \tag{22}$$

is the consumer price index (CPI).

The representative unconstrained consumer household maximises

$$E_0 \sum_{t=0}^{\infty} \beta^t (\ln C_t^u + \chi_t \ln G_t - \frac{(N_t^u)^{1+\varphi}}{1+\varphi}), \tag{23}$$

where N^u is labour supply for the unconstrained consumer. The budget constraint facing both constrained and unconstrained consumers is

$$\int_0^1 P_{H,t}(z) C_{H,t}(z) dz + \int_0^1 \int_0^1 P_{i,t}(z) C_{i,t}(z) dz di + E_t\{Q_{t,t+1} A_{t+1}\} \leq A_t + (1-\tau)(W_t N_t + \Pi_t), \tag{24}$$

where $P_{i,t}(z)$ is the price of variety z imported from country i expressed in home currency, D_{t+1} is the nominal payoff of the portfolio held at the end of period t, W are wages (the same wage rate is faced by constrained and unconstrained consumers), τ is an income tax rate and Π are profits. $Q_{t,t+1}$ is the stochastic discount factor for one period ahead payoffs. Using the definitions above, the budget constraint for either group of consumers can be rewritten as

$$P_t C_t + E_t\{Q_{t,t+1} A_{t+1}\} = A_t + (1-\tau_t)\left(W_t N_t + \Pi_t\right). \tag{25}$$

Unconstrained consumers are able to maximise

$$\mathcal{E}_t \sum_{v=t}^{\infty} \beta^{v-t}(\ln C_v^u + \xi_v \ln G_v - \frac{(N_v^u)^{1+\varphi}}{1+\varphi}) - \lambda \left(\sum_{v=t}^{\infty} \mathcal{E}_t(Q_{t,v} P_v C_v^u) - \mathcal{A}_t^u - \mathcal{E}_t \sum_{v=t}^{\infty} (Q_{t,v}\left((1-\tau)\left(W_v^u N_v^u + \Pi_v^u\right)\right)) \right),$$

because they face no constraints on their borrowing (or lending). This optimisation produces the standard first order conditions

$$\frac{\partial}{\partial C_s^u} : \beta^{s-t} \frac{1}{C_s^u} - \lambda Q_{t,s} P_s = 0,$$
$$\frac{\partial}{\partial N_s^u} : -\beta^{s-t} (N_s^u)^{\varphi} + (1-\tau)\lambda Q_{t,s} W_s^u = 0.$$

It follows that

$$\beta \frac{C_s^u}{C_{s+1}^u} \frac{P_s}{P_{s+1}} = Q_{s,s+1},$$
$$\frac{C_s^u (N_s^u)^{\varphi}}{(1-\tau)} = \frac{W_s^u}{P_s}.$$

Taking conditional expectations of the first equation and rearranging gives

$$\beta R_t E_t \left\{ \frac{C_t^u}{C_{t+1}^u} \frac{P_t}{P_{t+1}} \right\} = 1, \tag{26}$$

where $R_t = \frac{1}{E_t\{Q_{t,t+1}\}}$ is the gross return on a riskless one period bond paying off a unit of domestic currency in $t+1$.

Credit constrained households differ from unconstrained households in that they are unable to borrow all they require to implement their optimal consumption plan.[7] The reasons why consumers might face borrowing constraints are well understood: expectations about future labour income depend on knowledge of human capital which in many situations is likely to be imperfect and asymmetric, such that lenders may be unwilling to lend all that agents require to implement their optimal plan. (The classic reference here is Stiglitz and Weiss (1988).)[8] However it is unlikely that constrained consumers will be unable to borrow anything: we postulate that each member of this

[7] Ourmanalysis is similar to that in Wright (2004).

[8] Graham and Wright (2007) differentiate between constrained and unconstrained consumers by assuming that the former have a higher discount rate. Here we simply assume that the returns on some forms of human capital are easier to evaluate than others, and that those workers with more uncertain future earnings are credit constrained.

group faces an upper limit on their borrowing.[9] As a result, the consumption of this group will be governed by their budget constraint

$$C_t^c = \frac{(1-\tau)\left(W_t^c N_t^c + \Pi_t^c\right)}{P_t} + \bar{D}\frac{\mathcal{E}_t\left(Q_{t,t+1}P_t\right) - P_{t-1}}{P_t}, \tag{27}$$

where $\bar{D}$ is an upper limit on borrowing ($\bar{D} < 0$). [10]However, it is straightforward to show that the first order condition for labour supply will still hold for this group i.e.

$$\frac{C_t^c (N_t^c)^{\varphi}}{(1-\tau)} = \frac{W_t^c}{P_t}.$$

As constrained consumption is below desired levels, then for a given level of the wage these consumers will increase their labour supply in an effort to moderate the impact of the borrowing constraint.

4.2 Identities with PPP

The bilateral terms of trade with respect to country i in the union are the price of country i's goods relative to home goods prices. The effective terms of trade are given by aggregating across countries i

$$S = \frac{P_F}{P_H}. \tag{28}$$

The CPI and domestic price level are related as

$$P = P_H S^{\alpha}. \tag{29}$$

We also define the nominal relative price EX_i

$$EX_i = \frac{P_{H,i}}{P_H}.$$

4.3 Allocation of government spending

The allocation of government spending across goods is determined by minimising total costs. This implies

$$G(j) = \left(\frac{P_H(j)}{P_H}\right)^{-\epsilon} G. \tag{30}$$

[9] The justification for assuming a fixed nominal limit on borrowing, at least over the short term, is discussed in detail in Wright (2004).

[10] This constraint on nominal debt is what ensures, in Equation (50) below (which is the linearised equation for constrained consumption), that unconstrained consumption falls if inflation falls, because such a fall would raise the real rate of interest and so cause interest obligations on unconstrained consumers to rise. In the longer term, one would expect such a nominal constraint to be indexed to the price level.

4.4 Firms and Price Setting

Suppose the production function for firm j is

$$Y_t(j) = AN_t(j). \tag{31}$$

Both types of consumer supply labour of an identical type, so their is a uniform wage. (This assumption is not essential, but simplifies the exposition.)

Note that we can write the following expression for the wage

$$W_t = \frac{P_t C_t^c (N_t^c)^\varphi}{(1-\tau)} = \frac{P_t C_t^c (N_t - N_t^u)^\varphi}{(1-\tau)} = \frac{P_t C_t^c}{(1-\tau)} \left(N_t - \left(\frac{(1-\tau) W_t}{C_t^u P_t} \right)^{\frac{1}{\varphi}} \right)^\varphi ,$$

from where, using $N_t = \frac{1}{A} Y_t$ we obtain

$$\frac{(1-\tau)\, W_t}{P_t} = \left(\frac{1}{A} Y_t \right)^\varphi \left((C_t^c)^{-\frac{1}{\varphi}} + (C_t^u)^{-\frac{1}{\varphi}} \right)^{-\varphi} .$$

The formula for marginal cost then is

$$\begin{aligned} MC_t &= \frac{W_t}{A_t P_{Ht}} = \frac{P_t}{A_t P_{Ht}} \frac{W_t}{P_t} = \frac{P_t}{A_t \,(1-\tau)\, P_{Ht}} \left(\frac{Y_t}{A_t} \right)^\varphi \left((C_t^c)^{-\frac{1}{\varphi}} + (C_t^u)^{-\frac{1}{\varphi}} \right)^{-\varphi} \\ &= \frac{Y_t^\varphi S_t^\alpha}{A^{\varphi+1}\,(1-\tau)} \left((C_t^c)^{-\frac{1}{\varphi}} + (C_t^u)^{-\frac{1}{\varphi}} \right)^{-\varphi} , \end{aligned}$$

and the log-linearised marginal cost is given as

$$mc_t = \varphi y_t + \alpha s_t + \frac{\kappa^{\frac{1}{\varphi}}}{\kappa^{\frac{1}{\varphi}} + (1-\kappa)^{\frac{1}{\varphi}}} c_t^c + \frac{(1-\kappa)^{\frac{1}{\varphi}}}{\kappa^{\frac{1}{\varphi}} + (1-\kappa)^{\frac{1}{\varphi}}} c_t^u , \tag{32}$$

where lower case denotes log deviations from steady state. Here $\kappa = C^c/C$ in steady state, so κ represents the proportion of consumers who are credit constrained.

Price setting is based on an extension to Calvo contracting set out in Steinsson (2003).[11] Each period agents recalculate their prices with fixed probability $1-\gamma$. If prices are recalculated, then a proportion of agents ω use a backward looking rule of thumb to reset prices, while the remainder calculate the optimum price. If prices are not recalculated (with probability γ), they rise at the steady state rate of inflation.

We use an asterisk to denote those firms that do reset their price. Their average price set is a weighted average of forward and backward-looking components: $P_t^* = \left(P_t^F\right)^{1-\omega} \left(P_t^B\right)^\omega$. Backward-looking agents set their prices P_t^B according to the rule of thumb:

$$P_t^B = P_{t-1}^* \Pi_{t-1} \left(\frac{Y_{t-1}}{Y_{t-1}^n} \right)^\delta , \tag{33}$$

[11] Christiano et al. (2005) introduce inflation inertia by adapting Calvo in a different way: they assume that those firms that do not calculate the profit maximising price each period instead index their prices, rather than keeping them fixed as Calvo (1983) assumes. This results in a Phillips curve with inflation inertia that has the NAIRU property. The difference between these two formulations will not be important for the results in this paper.

where $\Pi_t = P_t/P_{t-1}$ and Y_t^n is the flexible-price equilibrium level of output (defined later). The forward-looking agents are able to solve the first order conditions for profit maximization and obtain an optimal solution P_t^F, see Rotemberg and Woodford (1997). For the rest of the sector the price will rise at the steady state rate of domestic inflation $\overline{\Pi} = 1$ with probability γ, $P_t = \overline{\Pi} P_{t-1}$. For the sector as a whole, the price equation can be written as:

$$P_t = \left[\gamma(\overline{\Pi}P_{t-1})^{1-\epsilon} + (1-\gamma)(1-\omega)(P_t^F)^{1-\epsilon} + (1-\gamma)\omega(P_t^B)^{1-\epsilon}\right]^{\frac{1}{1-\epsilon}}. \tag{34}$$

All optimising producers reset prices in period t according to the following approximate (log-linear) rule:

$$p_{Ht}^F = (\beta\theta)\, E_t p_{Ht+1}^F + (1-\beta\theta)\,(mc_t + p_{Ht})\,. \tag{35}$$

This is formula (B.2) in Steinsson (2003). The derivation is the same in our case, so we do not present it here.

Steinsson (2003) has shown that (formula (A.3))

$$p_{Ht}^B = (1-\omega)\left(p_{Ht-1}^F\right) + \omega\left(p_{Ht-1}^B\right) + \pi_{H,t-1} + \delta y_{t-1}, \tag{36}$$

and average inflation is defined as

$$\pi_{Ht} = \frac{(1-\gamma)}{\gamma}((1-\omega)p_{Ht}^F + \omega p_{Ht}^B - p_{Ht}). \tag{37}$$

Manipulations with formulae (35), (36) and (37) (see Steinsson (2003), formulae (A.5), (A.3) and (A.1)) lead to the following equation

$$\begin{aligned}\pi_{Ht} = {} & \frac{\gamma}{(\gamma + \omega\,(1-\gamma+\beta\gamma))}\beta\pi_{Ht+1} + \frac{\omega}{(\gamma + \omega\,(1-\gamma+\beta\gamma))}\pi_{Ht-1} \\ & + \frac{(1-\gamma)\omega\delta}{(\gamma + \omega\,(1-\gamma+\beta\gamma))}y_{t-1} - \frac{(1-\gamma)\gamma\beta\omega\delta}{(\gamma + \omega\,(1-\gamma+\beta\gamma))}y_t + \frac{(1-\beta\gamma)\,(1-\gamma)(1-\omega)}{(\gamma + \omega\,(1-\gamma+\beta\gamma))}mc_t.\end{aligned} \tag{38}$$

We can substitute mc_t from formula (32).

4.5 Capital markets

If we assumed that all consumers were unconstrained, and that capital markets were complete such that International Risk Sharing applied, then our model would be identical to Gali and Monacelli (2005a), apart from the addition of inflation inertia and credit constrained consumers. However, the assumption of international risk sharing would seem inappropriate for consumers who are rationed in credit markets, so we do not assume international risk sharing here. However, we do assume uncovered interest parity holds, which implies under fixed exchange rates that the domestic nominal interest rate is fixed, and equal to overseas interest rates. As is well known, a consequence of this set up is that the steady state for the economy is not unique, but depends on the initial level of wealth held by unconstrained consumers. (A classic example is Obstfeld and Rogoff (1995)).[12]

[12] We would get very similar results to those described below if we assumed interest risk sharing applied only to unconstrained consumers.

4.6 Aggregate Demand

Goods market clearing requires

$$Y(j) = C_H(j) + \int_0^1 C^i(j)di + G(j). \tag{39}$$

Symmetrical preferences imply

$$C_H^i(j) = \alpha \left(\frac{P_H(j)}{P_H}\right)^{-\epsilon} \left(\frac{P_H}{EX_iP^i}\right)^{-1} C^i, \tag{40}$$

which allows us to write

$$Y(j) = \left(\frac{P_H(j)}{P_H}\right)^{-\epsilon} \left[(1-\alpha)\frac{PC}{P_H} + \alpha \int_0^1 \frac{EX_iP^iC^i}{P_H}di + G\right]. \tag{41}$$

Defining aggregate output as

$$Y = [\int_0^1 Y(j)^{\frac{\epsilon-1}{\epsilon}} dj]^{\frac{\epsilon}{\epsilon-1}} \tag{42}$$

allows us to write

$$Y = (1-\alpha)\frac{PC}{P_H} + \alpha \int_0^1 \frac{EX_iP^iC^i}{P_H}di + G = S^\alpha \left[(1-\alpha)C + \alpha \int_0^1 Q_iC_idi\right] + G = CS^\alpha + G. \tag{43}$$

4.7 Fiscal Constraint and Simple Rules for Fiscal Policy

The government buys goods (G_t), taxes income (with constant tax rate τ), raises lump-sum taxes, pays an employment subsidy and issues nominal debt $\mathcal{B}_t$. The evolution of the nominal debt stock can be written as:

$$\mathcal{B}_{t+1} = (1+i_t)(\mathcal{B}_t + P_{Ht}G_t - \tau P_{Ht}Y_t - T + \mu^w). \tag{44}$$

The employment subsidy (μ^w) and lump-sum taxes (T) are constant and cannot be used in stabilization. This equation can be linearized as follows (defining $B_t = \mathcal{B}_t/P_{t-1}$, denoting the steady state ratio of debt to output as ζ; here and everywhere below, for each variable X_t with steady state value X, we use the notation $x_t = \ln(X_t/X)$).

$$b_{t+1} = i_t + \frac{1}{\beta}\left(b_t - \pi_t + \frac{(1-\theta)}{\zeta}g_t - \frac{\tau}{\zeta}y_t\right). \tag{45}$$

where $\theta = C/Y$ in steady state.

We let government expenditure be the fiscal policy instrument. We postulate that out-of-steady-state government expenditure G_t is related to out-of-steady-state debt, and also to inflation and to the real exchange rate, according to the following simple feedback rule

$$\frac{G_t}{G} = \left(\frac{\Pi_{Ht}}{\Pi_H}\right)^{\phi_\pi} \left(\frac{S_t}{S}\right)^{\phi_s} \left(\frac{B_t}{B}\right)^{-\phi_b}, \tag{46}$$

where $\Pi_{Ht} = (1 + \pi_{Ht})$.Log-linearisation of this rules yields

$$g_t = \phi_\pi \pi_{Ht} + \phi_s s_t - \phi_b b_t. \tag{47}$$

In what follows we shall explore the implications of different values of fiscal feedback parameters. In all cases, we assume that there is at least a minimum fiscal feedback on debt, so there are no debt sustainability issues.

4.8 The Complete Model

Our system consists of equations (26), (25), (27), (43), (28), (38) and (44) and the equation for fiscal policy. Assuming a fixed exchange rate regime, and log linearising (for each variable X_t with steady state value X, using the notation $x_t = \ln(X_t/X)$,we obtain the following:

$$c_t^u = c_{t+1}^u + (1-\alpha)\,\pi_{Ht+1} + \alpha \pi_{Ht+1}^*, \tag{48}$$

$$a_{t+1}^u = \frac{1}{\beta}\left(a_t^u - (1-\alpha)\,\pi_{Ht} - \alpha\pi_{Ht}^* - \frac{(1-\kappa)\theta\bar{Y}}{\bar{A}-\bar{D}}c_t^u + \frac{(1-\rho)\,(1-\tau)\,\bar{Y}}{\bar{A}-\bar{D}}\,(y_t - \alpha s_t)\right), \tag{49}$$

$$c_t^c = \frac{(1-\tau)\,\rho}{\kappa\theta}\,(y_t - \alpha s_t) - \frac{\bar{D}}{\kappa\theta\bar{Y}}\,((1-\alpha)\,\pi_{Ht} + \alpha\pi_{Ht}^*)\,, \tag{50}$$

$$y_t = \theta\,(1-\alpha)\,((1-\kappa)\,c_s^u + \kappa c_s^c) + (1-\theta)\,g_t + 2\theta\eta\alpha\,(1-\alpha)\,s_{\,t} + \theta\alpha c_t^*, \tag{51}$$

$$s_t = \pi_{Ht}^* - \pi_{Ht} + s_{t-1}, \tag{52}$$

$$\pi_{Ht} = \chi^f \beta \mathcal{E}_t \pi_{Ht+1} + \chi^b \pi_{Ht-1} + \xi_c\,(\xi_{cc}c_t^c + \xi_{cu}c_t^u) + \xi_s s_t + \xi_{y0} y_t + \xi_{y1} y_{t-1}, \tag{53}$$

$$b_{t+1} = \frac{1}{\beta}\left(b_t - \pi_t + \frac{(1-\theta)}{\zeta}g_t - \frac{\tau}{\zeta}y_t\right), \tag{54}$$

$$g_t = \phi_\pi \pi_{Ht} + \phi_s s_t - \phi_b b_t, \tag{55}$$

where $\theta = C/Y$ in steady state and ρ is the share of output produced by workers who are borrowing constrained. Bars above variables are added to indicate steady state values. The derived parameters ξ χ^f and χ^f in the Phillips curve, and the value of ρ, are given in the Appendix.

How does this model compare with the stylised system outlined in Section 3? Equation (53) is a generalisation of the simple Phillips curve considered there, where we allow for a combination of forward and backward price setters. We can get the purely backward-looking, or purely forward-looking Phillips curves as special cases, although in the latter case expected future inflation is discounted. In addition, inflation depends on consumption and on the real exchange rate as well as on output, reflecting the interaction between marginal costs and labour supply.

The 'IS curve' in our microfounded model is clearly much more elaborate. However, in both cases output depends on the level of competitiveness, in this case acting through the terms of trade. The impact of inflation on output varies with the two types of consumer. For unconstrained consumers, inflation (working through real interest rates) influences the (expected) *change* in consumption, and consumption itself is a forward looking, 'jump' variable. For constrained consumers, inflation influences the *level* of consumption, and the consumption function is static. The stylised model of Section 3 can be thought of as a special case in which all consumers are credit constrained. As we show in the following section, this distinction between forward-looking consumers and backward-looking ones is critical for issues of stability when inflation contains a significant backward looking element.

5 Calibration

In our simple model in Section 3, we were able to analyse stability analytically. In our more complex model, the algebraic expressions for eigenvalues are intractable, so we need to examine a calibrated model. In this Section we describe a standard calibration, with particular discussion of credit constrained consumers.

Our 'base case' calibration of most of the parameters is taken from Rotemberg and Woodford (1997). One period is taken as equal to one quarter of a year. We set the one period discount factor of the private sector (and policy makers) to $\beta = 0.99$. We calibrate $\varphi = 2.0$. We assume that $\gamma = 0.75$, which corresponds to an average contract length of one year.

Our knowledge regarding inflation persistence is very insecure. All empirical studies are unanimous in concluding that an empirical Phillips curve has a significant backward-looking component. Estimates of the relative importance of backward-looking price setters differ widely. Gali and Gertler (1999) and Benigno and Lopez-Salido (2006) find a predominantly forward-looking specification, while Mehra (2004) finds an extremely backward-looking specification of the Phillips curve. Mankiw (2001) argues that stylised empirical facts are inconsistent with a predominantly forward-looking Phillips Curve. A figure of $\omega = 0.75$ corresponds to an equal weight on forward and backward inflation terms suggested by results in Fuhrer and Moore (1995). As a result of this uncertainty, we look at a range of alternative values between the two extreme cases of complete forward and backward looking behaviour.

Since the seminal paper by Hall (1978), empirical studies have rejected the simple Euler equation formulation implied by (26). Studies have also shown that consumption tracks income over the life-cycle, which is again inconsistent with our model in which all consumers are unconstrained. One of the most popular explanations for these empirical findings is that at least some consumers face binding credit constraints. A large number of papers have tried to estimate the proportion of consumers who are credit constrained, and many of these are surveyed in Grant (2003). That paper also suggests that 26-31% of US households are credit constrained. We assume a base value of 30% for κ, but we also look at the implications of varying this parameter.

The amount of gross debt as a proportion of annual GDP varies substantially between economies. (It is roughly equal to unity in the UK and Netherlands, for example, is a little lower for the US, but substantially lower for Italy.) We adopt a base figure for the constrained debt to annual GDP ratio of 1.0, but we also investigate the implications of alternative values. We assume that unconstrained consumers collectively hold a similar quantity of wealth, so that the net asset position of the country as a whole is zero. We assume a value of $\alpha = 0.3$, $\theta = 0.7$, and our demand curve parameters are $\epsilon = 5$ and $\eta = 1$ (as assumed in Gali and Monacelli (2005a)). However, as we show in Kirsanova et al. (2006), our basic result is robust to these and most other parameter values besides those associated with credit constrained consumers.

6 Analysis

We use this model to study the effects of an initial unexpected, one-off shock to competitiveness, which causes the economy to begin in an uncompetitive position. This could happen because the underlying competitiveness of the economy changes, so that an initial position, which was initially competitive, ceases to be so. We study the model's behavior in the absence of fiscal active policy, the only form of fiscal policy consists of a low feedback on debt, $\phi_b = 0.05$.We how this behaviour varies with the proportion of forward looking price setters and with the proportion of forward-looking consumers. In particular, we show that, in the absence of fiscal policy, stability is only assured if there is a sufficiently large proportion of forward looking prices setters and/or a sufficiently large proportion of forward-looking consumers. We also show that a fiscal policy which responds to the level of inflation lowers the degree of forward-lookingness which is necessary to ensure stability.

We then show how, even if the economy is forward-looking enough to respond to the shock in a stable manner, the competitiveness of the economy can overshoot, and the outcome can be a cyclical process of convergence to equilibrium. Such cycles are bound to impact on social welfare (see, for example, Kirsanova et al. (2007)).We also show how fiscal policy can moderate such cyclical behaviour.

It would be valuable to study the response of the economy to stochastic disturbances. We leave this as a study for further work, confining our attention here to analysis of this one shock.

6.1 Instability and the Walters Critique

We consider the combinations of credit-constrained consumers κ and backward looking price-setters ω, with no fiscal feedback present, for which stability is possible. See Figure 6.

In the special case when we have complete inflation persistence, $\omega = 1$, a negative shock to competitiveness will cause inflation to fall and this will lead real interest rates to rise. This is a violation of the Taylor principle. As in our simple model analysed in Section 3, when all price-setters are also backward-looking and there are no forward-looking consumers, so that also $\kappa = 1$, then the outcome will be unstable. That outcome is depicted at the top right hand corner of Figure 6. The country's falling inflation, caused by its lack of competitiveness, would cause its price level to gradually fall relative to that in the other country, and the country's real exchange rate would depreciate. This will cause a rise in net exports, and that would cause a stabilising rise in the demand for output. If also $\kappa = 1$ then, even although inflation is falling and competitiveness is improving, the continuing fall in inflation, and continuing rise in the real interest rate, would provoke a continuing fall in consumption. For reasons explained in Section 3.1, this second effect would dominate, and output would fall cumulatively in an unstable manner. As noted in Section 3, this is instability is what was identified in the 'Walters' critique' of the EMS.

If all price setters were all forward looking, but all consumers were backward-looking then we are at the top left hand corner of Figure 6. Assuming that forward-looking price setters are capable of jumping the inflation rate so as to ensure that the transversality conditions hold, they will put the economy on a stable saddle-path, in the Blanchard-Kahn manner. We have discussed in Section 3.2 what happens then. Following the initial downward shock to competitiveness, inflation will jump down, and gradually rise back to equilibrium again, during which time the disturbance to competitiveness will gradually be removed. Along the adjustment path, consumption will fall initially and then gradually rise again.

If all price setters were backward looking, but all consumers were forward-looking then we are at the bottom right hand corner of Figure 6; numerical analysis of the calibrated model shows this point to be exactly on the stability boundary. Assuming that forward-looking consumers are capable of placing the initial level of unconstrained consumption so as to avoid Ponzi-game outcomes, they will put the economy on a stable path in the Blanchard-Kahn manner. We have described in Section 3.3 what happens then. The system will not explode, but it will cycle in an undamped manner. Following the initial downwards shock to competitiveness, there will be a gradual fall of inflation. Consumption will initially jump down and then begin to rise - in line with an expectation of higher real interest rates in the future. (As noted in Section 3.3 the Euler equation shows that, along the adjustment trajectory, forward-looking consumption must be rising in the presence of a positive real interest rate.) But at some stage inflation will begin to rise again, so that competitiveness begins to worsen again; consumption will begin to fall again at this point. The solution gives rise to an undamped cycle in all of inflation, competitiveness and consumption.

In the presence of forward-looking consumers and price setters, the system described by our model involves two jump variables: forward-looking consumption and inflation. We suppose that forward-looking price-setters and consumers are together capable of ensuring that the economy does not experience explosive behaviour. This requires that they jump the initial level of both unconstrained consumption and the inflation rate so as to place the economy on a stable saddle-path, in the Blanchard-Kahn manner. Such an outcome requires that there be two eigenvalues outside the unit circle.[13] The solid line in Figure 6 shows the stability boundary for different proportions of credit-constrained consumers κ and backward looking price-setters ω, with no fiscal feedback present. Saddle-path stability occurs to the south-west of the boundary. The stability boundary shows that stability can be achieved, without fiscal intervention, even if neither consumption nor

[13]In addition there is a unit eigenvalue reflecting the unit root process for wealth, a feature not present in our simpler model.

price setting are entirely forward-looking. For example if $\omega = 0.75$, then stability is ensured if $\kappa < 0.55$. In that case, then, providing that forward-looking consumers and forward-looking price-setters are together capable of jumping consumption and the inflation rate so as to ensure that the economy is on a stable Blanchard-Kahn path, stability will be ensured.

The solid line in the first column of Figure 7 shows outcomes of this kind, when both price setting and consumption are partly forward-looking and partly backward-looking, in this case when $\omega = 0.75$ and $\kappa = 0.3$. Along these paths, backward-looking price setters gradually adjust inflation after the shock, and forward-looking price setters adjust inflation more rapidly than this. Overall the movement in inflation is gradual, not only because of the weight of 0.75 on backward-looking price setters, but also because, due to this weight, forward-looking price setters expect a gradual downward movement in overall inflation, and so jump forward-looking inflation down by less then they would have done if all price-setters had been forward-looking. Overall the movement of inflation is more rapid than it would have been if all price setters had been backward-looking. Similarly backward-looking consumers cut consumption by increasing amounts over the first few periods after the shock, as the rate of inflation falls and so the real rate of interest rises. But, in the light of this rise in the real interest rate, forward-looking consumers initially jump consumption downwards and then, after the first period, cause their consumption to rise again. This continuing rise in forward-looking consumption, along with the improvement in competitiveness caused by falling inflation, comes to stimulate demand and so gradually to arrest the fall in inflation. The resulting turnaround in inflation ensures stability.

The stability boundary shows that forward-looking consumption and forward-looking price setting can substitute for each other in ensuring stability; the figure shows that the larger the proportion of consumers who are liquidity constrained, the smaller the proportion of backward-looking price setters has to be in order to ensure stability. For example, if κ does not have the value of 0.3 assumed in Figure 7 but instead had a value of 1.0, then stability would not be possible if ω remained equal to 0.75, but would only be possible if ω instead had a lower value of 0.5. In this case the proportion of forward-looking price setters would be large enough to ensure that, even if there were no forward-looking consumers to moderate a continuing fall in consumption after an initial shock to competitiveness, the initial downward jump in the price level would be large enough to ensure that improvements in competitiveness were large enough to offset the effects of the continuing fall in consumption.

If the parameters of the economy are such that it lies to the right of the stability boundary in Figure 6 then a stable rational expectations equilibrium solution will not exist. For example, if $\omega = 0.75$, but $\kappa > 0.55$ then it would not be possible for forward-looking consumers and price setters to put the economy on a stable saddle-path trajectory. We can see why this is. Suppose that, for these values of ω and κ, forward-looking price setters expected a gradual downward movement of inflation of the kind shown in Figure 7, for reasons described above. Then, in the expectation of this, backward-looking consumers would cut their consumption by increasing amounts over the first few periods after the shock, as the rate of inflation fell and so the real rate of interest rose. Stability requires that this effect be counterbalanced by the behaviour of forward-looking consumers, in the way shown in Figure 7. But with a low value of κ, this proportion of forward-looking consumers is small. As a result, any hypothetical attempt by them to jump consumption downwards and then, after the first period, to cause consumption to rise again - in the manner described above - would not be sufficient to cause output to begin to rise again. As a result inflation would continue to fall over time, and the real the interest rate would continue to rise. That would increase the expectation by forward-looking consumers of higher interest rates in the future, requiring a larger initial downward jump in the value of forward-looking consumption than what has been supposed - a contradiction.

Figure 6 shows that fiscal feedback on inflation will raise the value of κ consistent with stability given any value for ω. This is consistent with the analysis for the backward-looking model presented in Section 3.1, but generalises that analysis. It is now the case that for a range of values of κ and ω, stability is possible without any fiscal feedback. But a fiscal feedback on inflation will increase the range of κ and ω for which stability is possible. This is because as inflation falls and the real interest rate rises, expansionary fiscal policy offsets the effects of these higher interest rates in causing backward-looking consumption to fall. This means that there do not need to be as many forward-looking consumers to offset this effect, or forward-looking price-setters do not need to cause inflation to fall so fast. Policymakers can thus use fiscal policy to ensure that not so much forward-lookingness is necessary to ensure stability.

If stability is ensured, there may still be a possibility of overshooting and cycles to which we now turn.

6.2 Overshooting of the Price Level

The solid line in the first column of Figure 7 shows that, even when stable, outcomes without fiscal policy intervention may give rise to overshooting and to cycles. In response to a temporary shock to competitiveness within a monetary union, the real exchange rate s must return to its initial level. The shock causes output - which depends negatively on competitiveness - to fall. This low level of output will cause inflation to become negative, so that competitiveness rises back towards equilibrium, as shown. There will come a time when the price level has fallen enough to remove the reduction in demand which resulted from the initial fall in competitiveness. But, at this point, as Figure 7 shows, the persistence of inflation means that the rate of inflation will be negative. Thus when equilibrium has been reached the price level will still be falling and the real exchange rate will still be appreciating; i.e. it will overshoot. If the overshoot is large enough, the behaviour of the real exchange rate will be oscillatory.

Given stability, the oscillatory behaviour will be damped, and the proportion of backward-looking price setters will determine how damped it is. The figure shows that the behavior of the economy is highly cyclical when $\kappa = 0.3$ and $\omega = 0.75$; oscillations are still marked after more than 50 periods. It can be shown that, when $\omega = 0.5$, the model's dynamic is still cyclical, although the cycles are much reduced in amplitude after 50 periods. If $\omega = 0.15$ cyclical movements are much less apparent, although overshooting still occurs in constrained consumption.

There is a contrast here with inflation-targeting systems. In such systems, if inflation were to rise above its target level, and then be brought down again by monetary policy, the price level will slip away from the level which it would have had if, instead, it had risen at a steady rate without the shock. Such slippages are not normally corrected in inflation-targeting regimes. In this EMU regime, however, such a slippage of the price level is not possible. In this system any rise in the price level causes loss of competitiveness of the kind studied here. Their level of competitiveness must be brought to the level at which full employment of resources can be regained by a high enough level of net exports.

The proportion of unconstrained forward-looking consumers (i.e. those who are not liquidity-constrained) helps to contribute to cyclicality (whereas it is the existence of liquidity-constrained consumers which gives rise to the possibility of instability). We can see this from Figure 7. Unconstrained consumption initially falls and then begins to rise. The Euler equation shows that it will not stop rising until inflation has risen back to zero (because only then will the real interest rate have risen back to zero). But as the figure shows, at that point unconstrained consumption is above equilibrium. (This is because it will be falling in the future because, with inflation persistence, inflation will be positive in the future and so the real interest rate will negative in the future). But this positive consumption will be adding to the demand pressure caused by the real exchange rate, which has over-depreciated at that point. Thus although an increase in the degree of forward-lookingness of consumption makes instability less likely, it does not help eliminate cyclicality. That depends on the forward-lookingness in price-setting.

6.3 Fiscal Policy Rules

If the economy is not forward-looking enough to ensure stability, or to moderate a process of cyclical response, then policy-makers may use fiscal policy to ensure that the economy behaves more nearly how it would if consumption and price-setting were forward-looking. Such fiscal policy will influence how quickly prices, competitiveness and output return to their original levels.

6.3.1 Responding to inflation

If the economy is uncompetitive after a shock then - given stability - inflation begins to fall. Fiscal policy can be expanded as this happens. The first column of Figure 7 shows the effects of doing this. Along the adjustment path, fiscal policy could cancel out at least some of the effects on consumption of the higher real interest rates – the consequence of relative disinflation – so that the demand–increasing effects of improved competitiveness can take hold. Kirsanova et al. (2007) show that such a policy could significantly improve welfare within EMU. The required policy described in Figure 7 would require a negative feedback from lower inflation, to a higher level of government expenditure – or a positive feedback to the tax rate. This is a fiscal feedback rule of the kind described in Westaway (2003).

In this case fiscal policy must also continue to stabilise debt, to ensure that there is no instability caused by, for example, the loss in tax revenues caused by a loss in output. But the feedback coefficient can be small, and is set equal to 0.05. This value is large enough to ensure that the government's debt stock reaches its steady state value, but otherwise small enough to give policy the freedom to also help stabilise inflation. The reason why very slow adjustment of debt may be optimal is explored extensively in Kirsanova and Wren-Lewis (2008).

Such a feedback rule would mean that fiscal policy would be compensating for the failure of the Taylor principle to hold in a fixed exchange rate system in response to asymmetric shocks, and helping to avoid cycles. And the more that such policy stabilised demand and inflation the less would the price level overshoot.

6.3.2 Responding to the real exchange rate

Adjustment of the real exchange rate in the face of a competitiveness shock will require that the country's nominal prices end up in a lower position, relative to the level of prices in the EMU area as a whole. If competitiveness begins below equilibrium, as studied here, then fiscal policy might take additional corrective action of a contractionary kind to help speed the adjustment process. This form of response is depicted in the second column of Figure 7. It can clearly help to speed the adjustment process. This would be a parallel to the circumstances in which the monetary-policy regime can choose the speed at which inflation is controlled in the face of an inflation shock in an inflation targeting regime. The simple model in Section 3 above has shown that such feedback from the real exchange rate, and higher speed of adjustment, would make cyclical overshoot of the real exchange rate more likely. This too is borne out by the pictures shown in the second column of Figure 7. To prevent such a cyclical response, the feedback on the real exchange rate would need to be coupled with a stronger response to inflation. A fiscal response to the level of the real exchange rate, as well as a response to inflation, could bring about more rapid convergence without cycles. Kirsanova et al. (2007) show that such more rapid, non-cycling, convergence could lead to a significant improvement in welfare.

6.3.3 Responding to debt: the stability and growth pact

It clear that this interventionist policy points in the opposite direction from the Stability and Growth Pact. The response shown in the third column of Figure 7 shows the affect of operating a policy more like the SGP, in which there is no fiscal feedback on inflation and in which spending is cut strongly in response to an increase in debt. The Figure shows how such a feedback on debt could lead to more cycles of larger amplitude than those which would occur with the value of the feedback on debt of $\phi_b = 0.05$. Under the operation of a policy of this kind, a low level of competitiveness would cause output to fall. But this would cause tax receipts to fall, causing an increase in debt. Under this policy, government spending would be cut, augmenting the downturn. That would cause tax revenues to fall, leading to an increase in debt, to a further cut in government spending, further augmenting the downturn. This is why such a policy can worsen cycles. It is possible to show that it can make saddle-path stability impossible, for values of the range of κ and ω which would otherwise make such stability possible.

As already noted above, it is clear that fiscal policy must stabilise debt, to ensure that there is no instability caused by, for example the loss in tax revenues caused by a loss in output. But as shown in Kirsanova and Wren-Lewis (2008) the optimal feedback coefficient is small, and this avoids the cycles shown in the third column. This is one of the reasons why it is optimal for the stabilisation of debt to be slow: it avoids such cycles. A relaxed version of the SGP would allow that, in each country, fiscal policy fixed tax rates and let the deficit run up, and debt increased, as output fell and tax revenues fell, only gradually reducing so as to bring debt under control.

7 Policy Implications

7.1 Difficulties with the Stability and Growth Pact

The above analysis suggests that the fiscal rules of the Stability and Growth Pact could be unhelpful in EMU in response to asymmetric shocks. They suggest that if the fiscal authorities tightly target fiscal sustainability (aiming, say, for a particular deficit or debt ratio) as in the SGP, this may cause the economy to cycle, or may even make stability difficult to achieve.

If a country were to follow the SGP, when adjusting to a downturn in competitiveness, the fiscal authorities would be unable to allow the in-built stabilisers to operate – i.e. they would need to cut government spending. Further this would prevent them from intervening so as to the compensate for the violation of the Taylor principle. As inflation fell and debt increased, government expenditure would need to fall, causing further falls in inflation. The level of competitiveness would be likely to overshoot, leading to cycles. Secondly the fall in inflation would, quite possibly, be undesirably rapid, possibility making stability difficult to achieve, as suggested by the Walters critique.

There may thus be interference between the fiscal arrangements of the SGP, and the need to adjust real exchange rates and competitiveness between countries within EMU. It appears that the constraints of the SGP – which – unlike the analysis here may apply asymmetrically to countries facing competitiveness difficulties – do interfere with the fiscal policy responses which may be desirable in such countries. Because of this, such countries may experience unnecessary and costly deflation, or instability, or cycles. Our general prescription is that there should be a greater delegation of fiscal freedom to those countries which are suffering from such sustained negative shocks to competitiveness.

Importantly, such policies, if adopted, must not lead to the postponement of necessary adjustments of the relative real exchange rate. The additional fiscal freedom should be used in such a way as to be consistent with the long run outcome. The analysis here does *not* suggest that there be fiscal expansion to prevent adjustment in these countries. Instead it suggests that fiscal policy could be used to speed adjustment - fiscal expenditures could be cut initially in countries suffering from a low level of competitiveness – as shown in column 2 of Figure 7. But fiscal policy would subsequently become expansionary to prevent adjustment going too far.

Our overall conclusion is that, such additional policy freedom is likely to improve the trade-offs in the country concerned, resulting in better adjustment to competitiveness shocks, without causing additional inflation.

7.2 A Proposal

We suggest that, for a good outcome, the choice for fiscal policy might need to involve

(i) only very gradual feedback from the level of debt to the fiscal position,

(ii) active fiscal policy feedback which becomes more stimulatory if inflation becomes low, to prevent unstable developments in the price level, and to prevent the price level overshooting, and

(ii) active feedback to fiscal policy from the future equilibrium value of the real exchange rate, being cut if the economy is uncompetitive but becoming more expansionary as the real exchange rate depreciates towards its equilibrium level, in order to help prevent the real exchange rate overshooting.

Thus we are suggesting that the fiscal authorities target the longer-term fiscal position in such a way that they steer the real exchange rate towards the appropriate position. Or alternatively, we suggest they might target (i.e. introduce feedback from) an appropriate future real exchange rate, where that target is chosen give a competitive position which would be consistent with full employment.

This course of action seems desirable because the debt ratio per se does not normally, of itself, have much weight in the authorities' objective function. The fiscal position needs to be sustainable, as we have seen, but otherwise debt should be allowed to act as a shock absorber, and has been discussed above. This point is discussed in detail in Kirsanova et al. (2005) and Kirsanova et al. (2007).

The appropriate real exchange rate would be that which ensured that, after any worsening of the external competitiveness position which was expected to be sustained, competitiveness was again returned to a position at which demand for domestic resources was restored. At this point the level of capacity utilisation would have returned to a normal position, and tax revenues would have been restored, rather than being low because output was below capacity. At that position the sustainability of the budgetary position would be assured.

The contrast between such a conduct of fiscal policy, and one directed to the control of deficit and debt, is as follows. Initially, once it became clear that the position was one of worsened external competitiveness, fiscal policy would be tightened, with the aim of putting downward pressure on wage and price settlements, so as to help speed the adjustment of the real exchange rate by "Phillips-curve pressure". But as the adjustment happened, fiscal policy would become looser again, to ensure that downward pressure on wages and prices did not continue to be exercised even after competitiveness had improved sufficiently relative to other countries within EMU.

What we are suggesting for fiscal policy involves a regime of 'constrained discretion'. The longer-term objective for fiscal policy, or the 'constraint', would remain that of 'sustainability'. This would be an objective just like that in the SGP, specified in accordance with a framework of 'sustainability pacts' (see Coeure and Pisani-Ferri (2005)). The difference of our approach from that in the SGP lies in the way in which 'discretion' would operate. The policy action which we suggest, in response to indications of 'unsustainability', would be different from what is now meant to happen within the SGP. At present, within the SGP, the required response to such a problem is a programme of budgetary cuts, even if the problem is caused by a loss of competitiveness, as in the thought experiment that we have been carrying out. What we are suggesting instead would be a policy directed towards achieving changes in the real exchange rate over time, towards a long run target. That target would be the one which was consistent with the sustainability objective. The required move of the economy towards this position would be assisted by fiscal restraint. But that restraint would be devised so as to help avoid cycles, as has been explained.

There is an additional reason that such a policy might be desirable, beyond that shown in our modelling simulations discussed above. That modelling work assumed that those setting prices in a forward-looking way would know by how much competitiveness would need to be improved when bringing down the inflation rate so as to improve competitiveness. In reality it may be difficult for the private sector to determine the degree of adjustment of competitiveness that is required. If fiscal policy were to target the level of competitiveness, in the way discussed here, that might make it easier for the private sector to form the appropriate expectations.

The policy framework which we are outlining is not a simple one. But adjustment of the real exchange rate, in a way consistent with fiscal sustainability in the longer term, is not a simple problem within a monetary union. It is clear that the computation of the appropriate real exchange rate would require significant modelling work. In the same way in which inflation targeting does not operate by the mechanical operation of a Taylor rule, this kind of fiscal policy would need to operate in a non-mechanical way. Such policy might be managed by a national fiscal policy committees, in the way advocated by Charles Wyplosz (Wyplosz (2005)), Jean Pisani-Ferri, and Simon Wren-Lewis.

8 Conclusion

Europe has been under-performing, not only in terms of productivity performance, but, also in terms of an apparently unfavourable trade-off between growth and inflation. The normal diagnosis of this problem has given macroeconomic policy a relatively clean bill of health, and has pointed instead to supply-side issues and the need for supply-side reform.

This paper presents an alternative argument which focuses on the process of inter-country adjustment, and on the connections between this adjustment process and fiscal policies within the euro area. We argue that fiscal policy and adjustment issues have, within EMU, interacted in unfavourable, and possibly destabilising, ways. Our analysis suggests that these problems arise in particular for countries which are needing to improve their relative international competitiveness, and which are also suffering from downturns in spending resulting from such poor international competitiveness. It is in countries in these circumstances that fiscal rules of the SGP bind most strongly.

In broad terms, this combination of adjustment problems and binding fiscal constraints can be seen as characterising the 'German problem'. We believe that the poor performance in Germany for some years, and some other large countries, has been caused by the problems described in this paper. We think that this could explain a large part of the euro area's poor performance in aggregate in the first part of this decade. Our argument suggests that restoring greater fiscal sovereignty to national governments could enable better performance to be achieved in countries such as Germany, without engendering inflation, since there is no reason why such policies should be inconsistent with the requirement that fiscal policy be sustainable in the longer run.

Our arguments do not suggest that supply side problems are not important or that they should not be addressed. It may be that important supply side reforms and adjustments would be easier to introduce with a better macroeconomic framework, and that greater confidence in euro area's growth potential would then be realised.

A Coefficients

Coefficients of the Phillips curve can be written as:

$$\chi^f = \frac{\gamma}{(\gamma + \omega(1-\gamma+\beta\gamma))}, \qquad \chi^b = \frac{\omega}{(\gamma + \omega(1-\gamma+\beta\gamma))},$$
$$\xi_{cc} = \frac{\kappa^{\frac{1}{\varphi}}}{\kappa^{\frac{1}{\varphi}} + (1-\kappa)^{\frac{1}{\varphi}}}, \qquad \xi_{cu} = \frac{(1-\kappa)^{\frac{1}{\varphi}}}{\kappa^{\frac{1}{\varphi}} + (1-\kappa)^{\frac{1}{\varphi}}},$$
$$\xi_c = \frac{(1-\beta\gamma)(1-\gamma)(1-\omega)}{(\gamma + \omega(1-\gamma+\beta\gamma))}, \qquad \xi_s = \alpha\xi_c,$$
$$\xi_{y0} = \frac{(1-\gamma)((1-\beta\gamma)(1-\omega)\varphi - \gamma\beta\omega\delta)}{(\gamma + \omega(1-\gamma+\beta\gamma))},$$
$$\xi_{y1} = \frac{(1-\gamma)\omega\delta}{(\gamma + \omega(1-\gamma+\beta\gamma))}, \delta =$$

From the two steady state relationships:

$$D = \frac{1}{\beta}(D + \rho((1-\tau)Y + T) - C^c),$$
$$A^u = \frac{1}{\beta}(A^u + (1-\rho)((1-\tau)Y + T) - C^u),$$

we obtain the steady state share of output produced by workers who are borrowing constrained (ρ) :

$$\rho = \frac{\left(\kappa - (1-\beta)\frac{D}{\theta}\right)}{\left(1 - (1-\beta)\frac{A^u+D}{\theta}\right)}.$$

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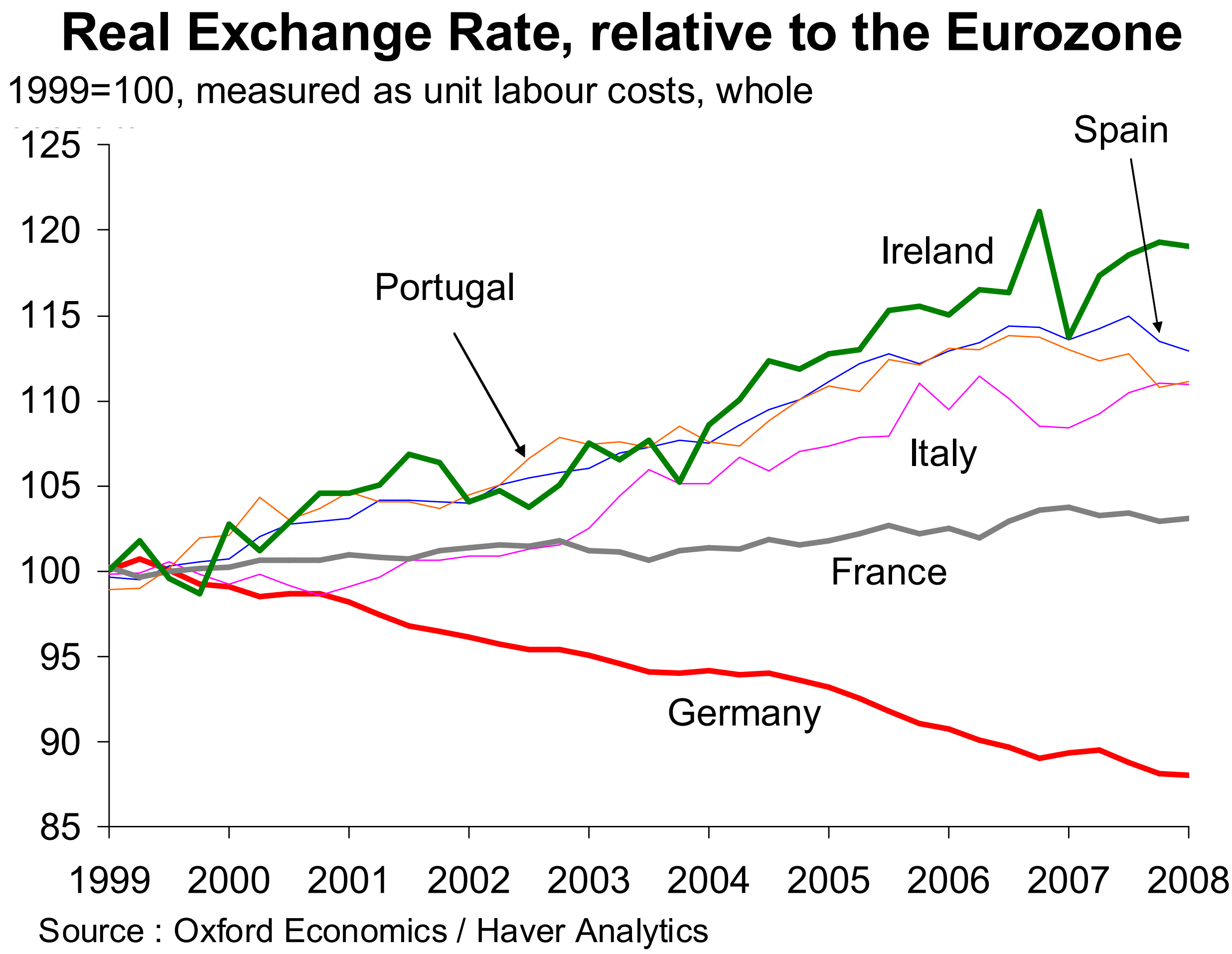

Figure 1: Real Exchange Rate

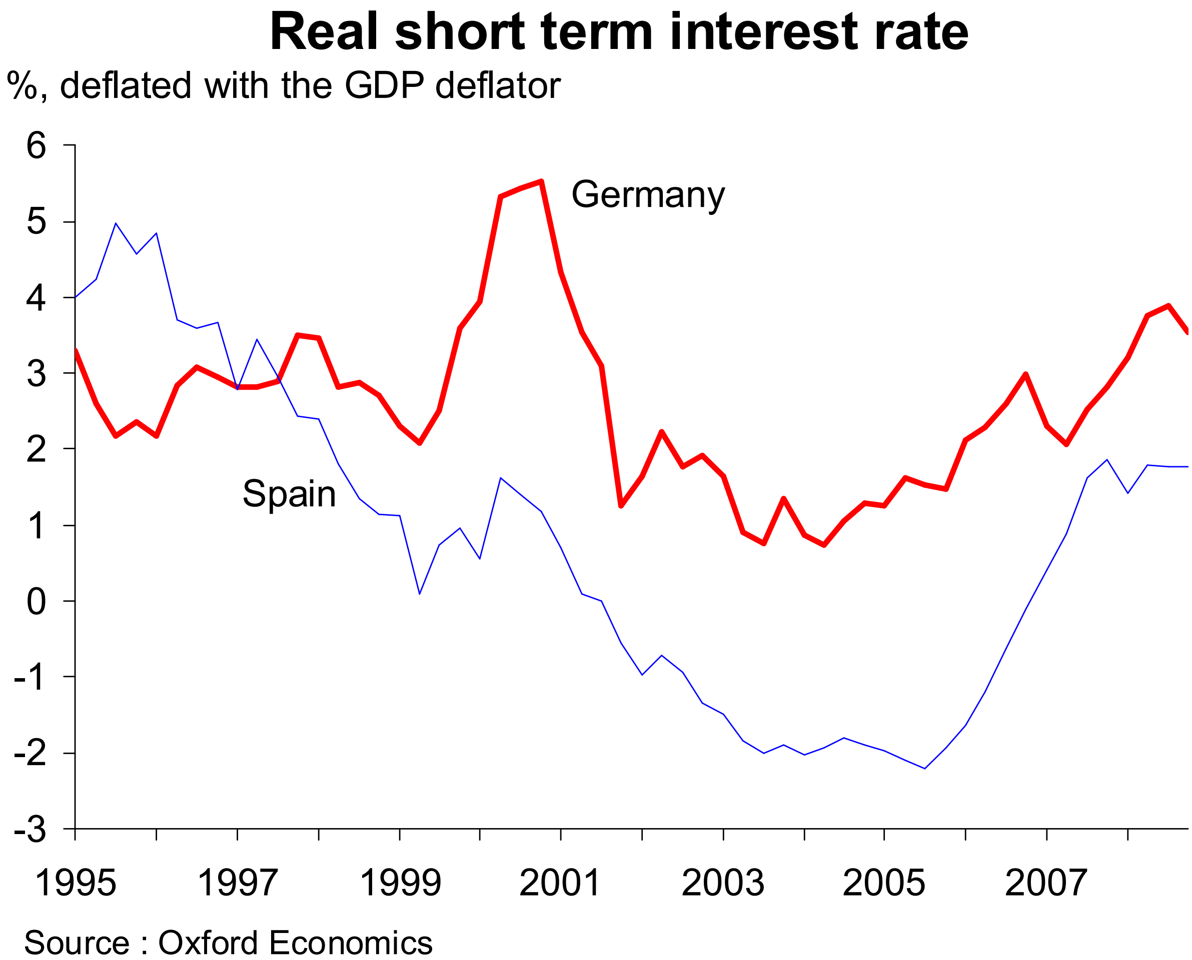

Figure 2: Real short term rate of interest

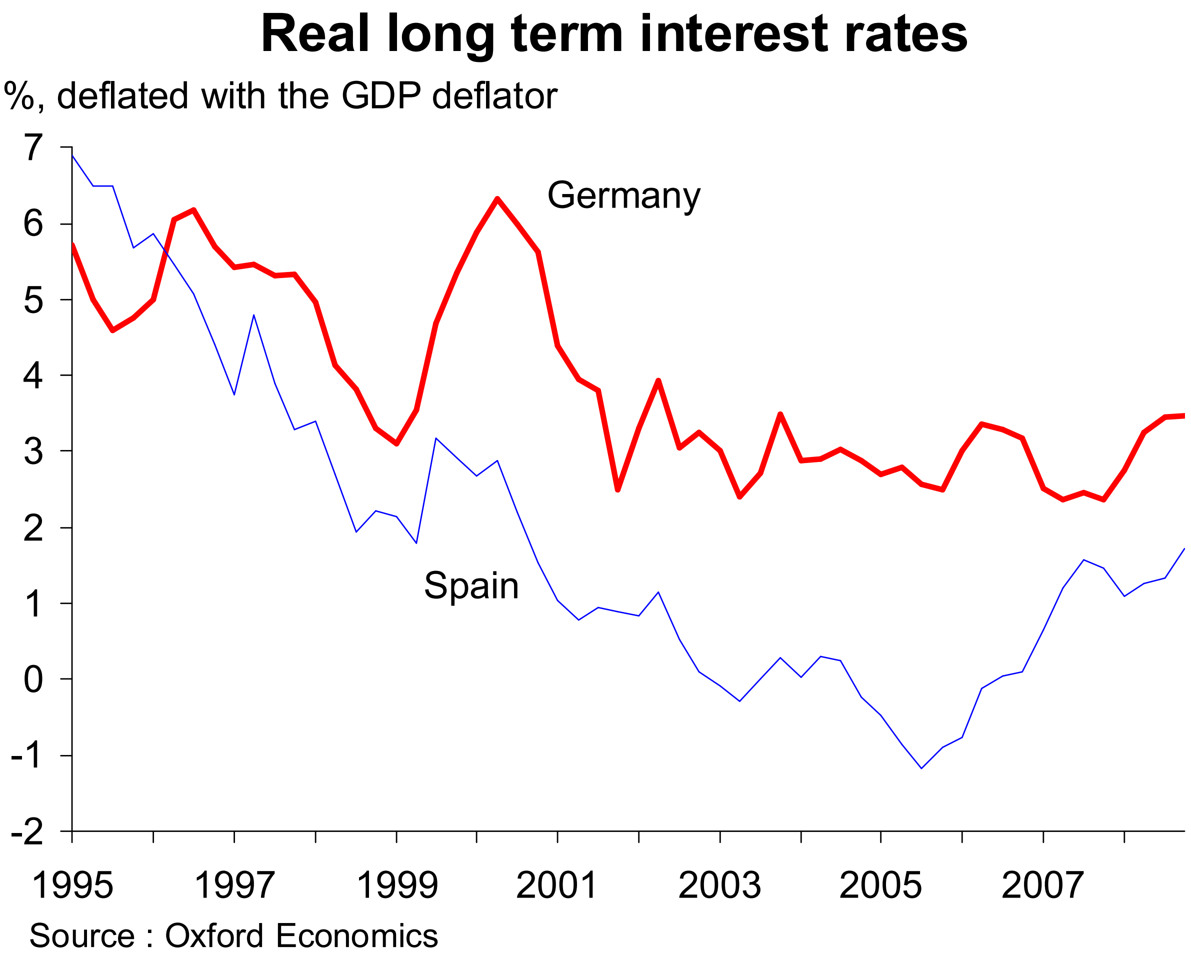

Figure 3: Real long term rate of interest

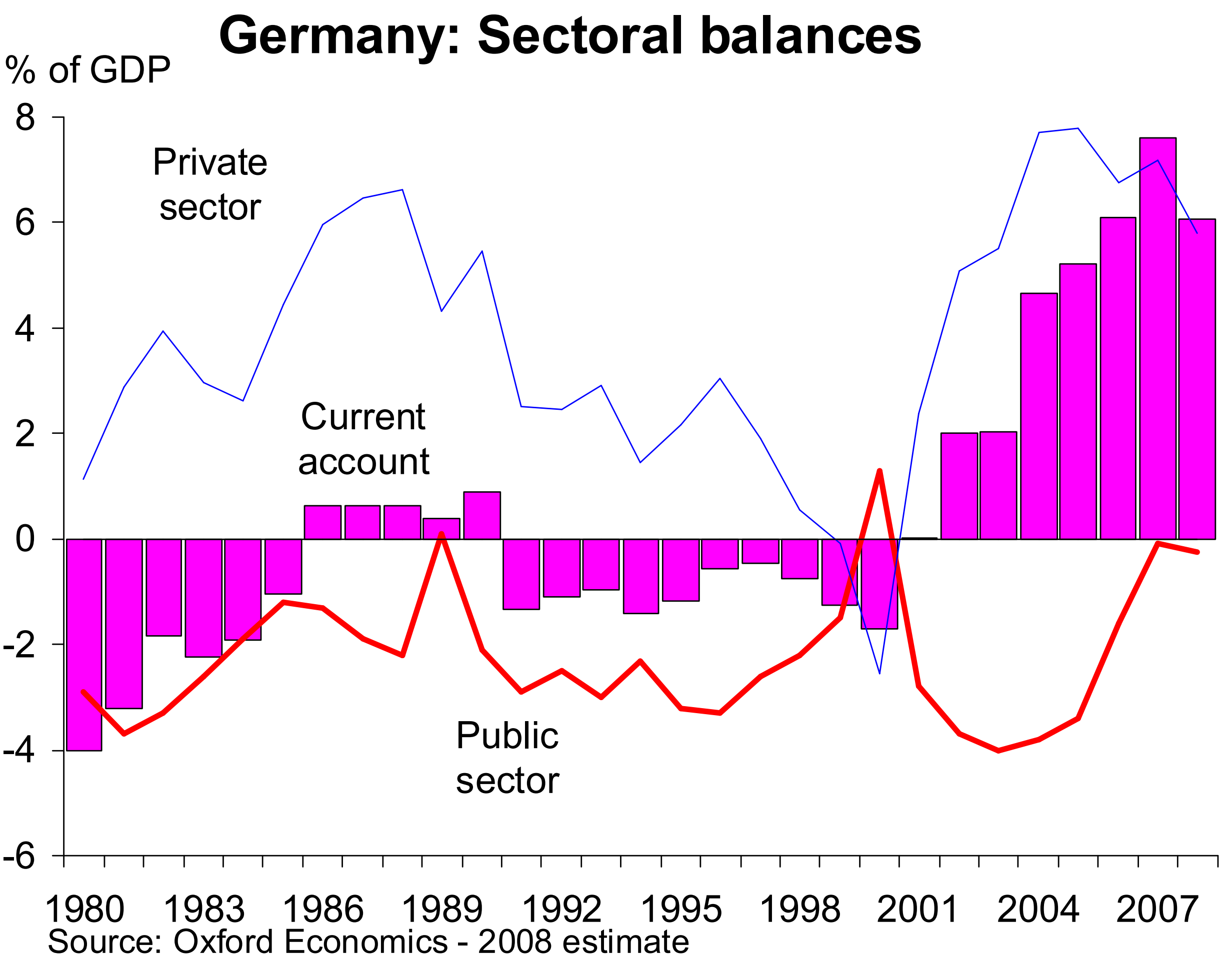

Figure 4: Sectoral balances for Germany

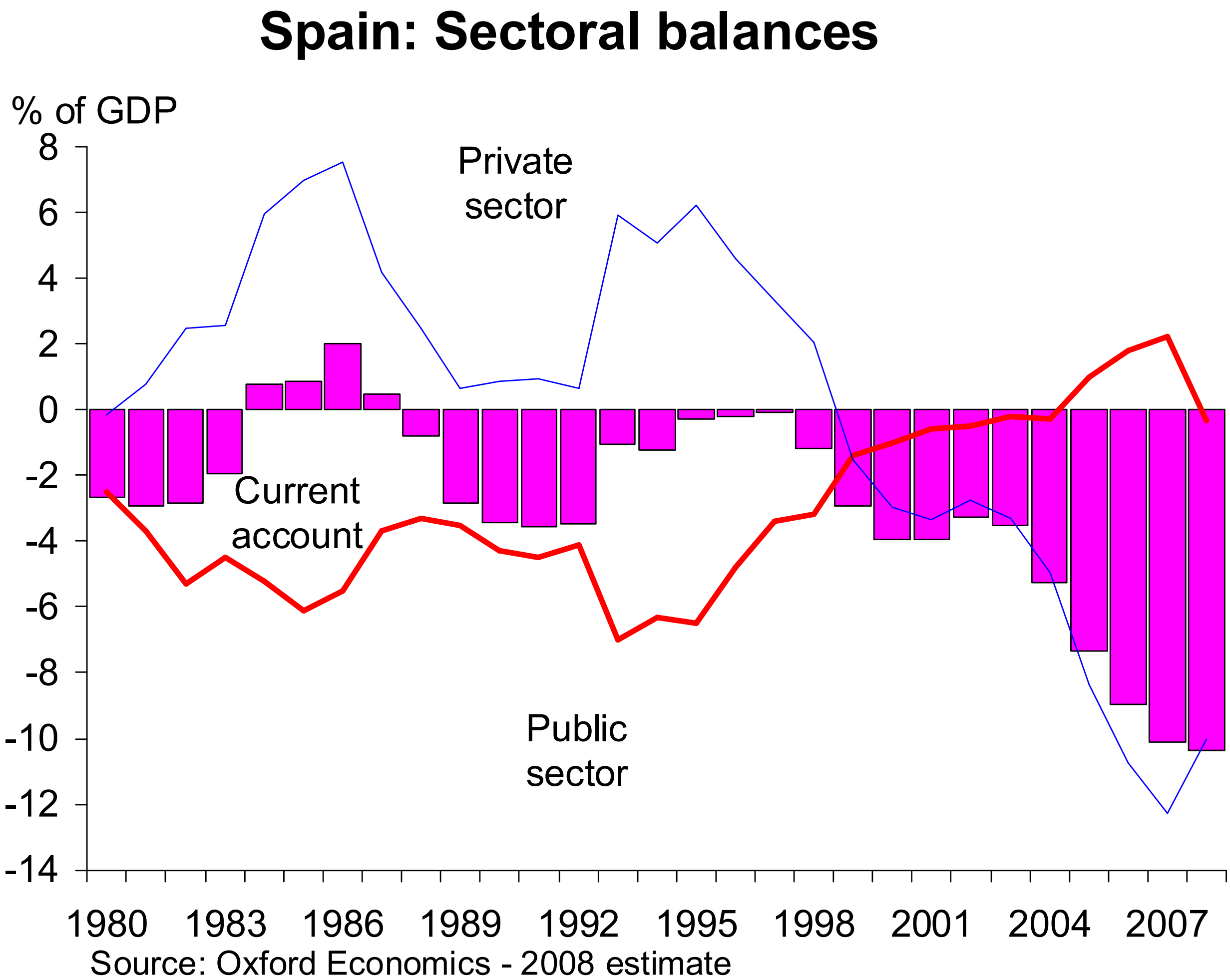

Figure 5: Sectoral Balances for Spain

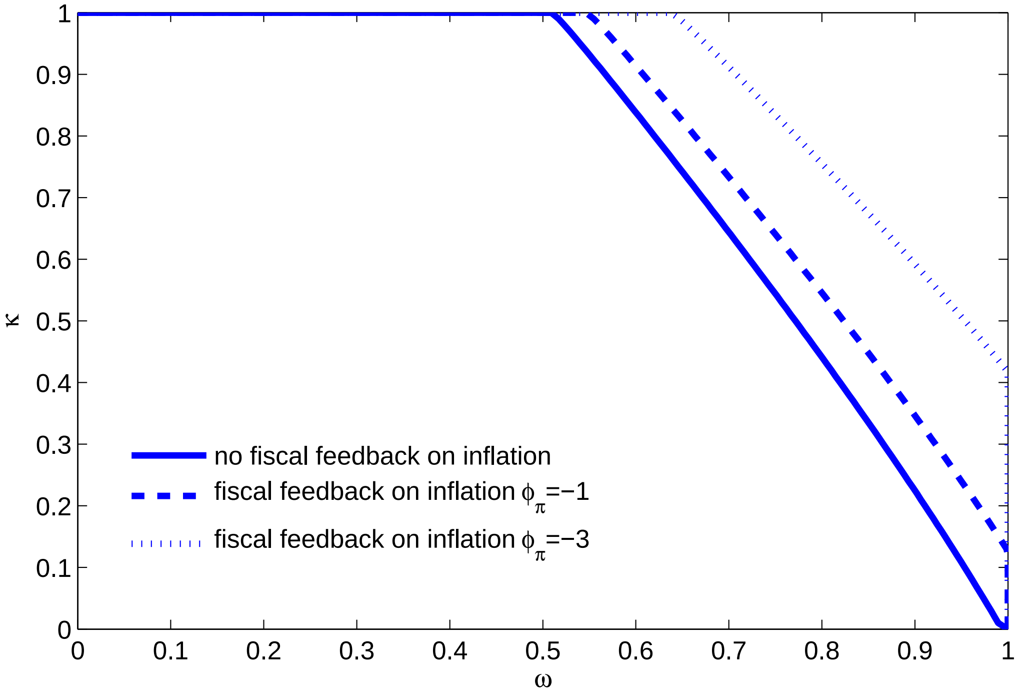

Figure 6: Stability boundary as a function of proportion of backward-looking price setters, ω, and proportion of credit constrained consumers, κ.

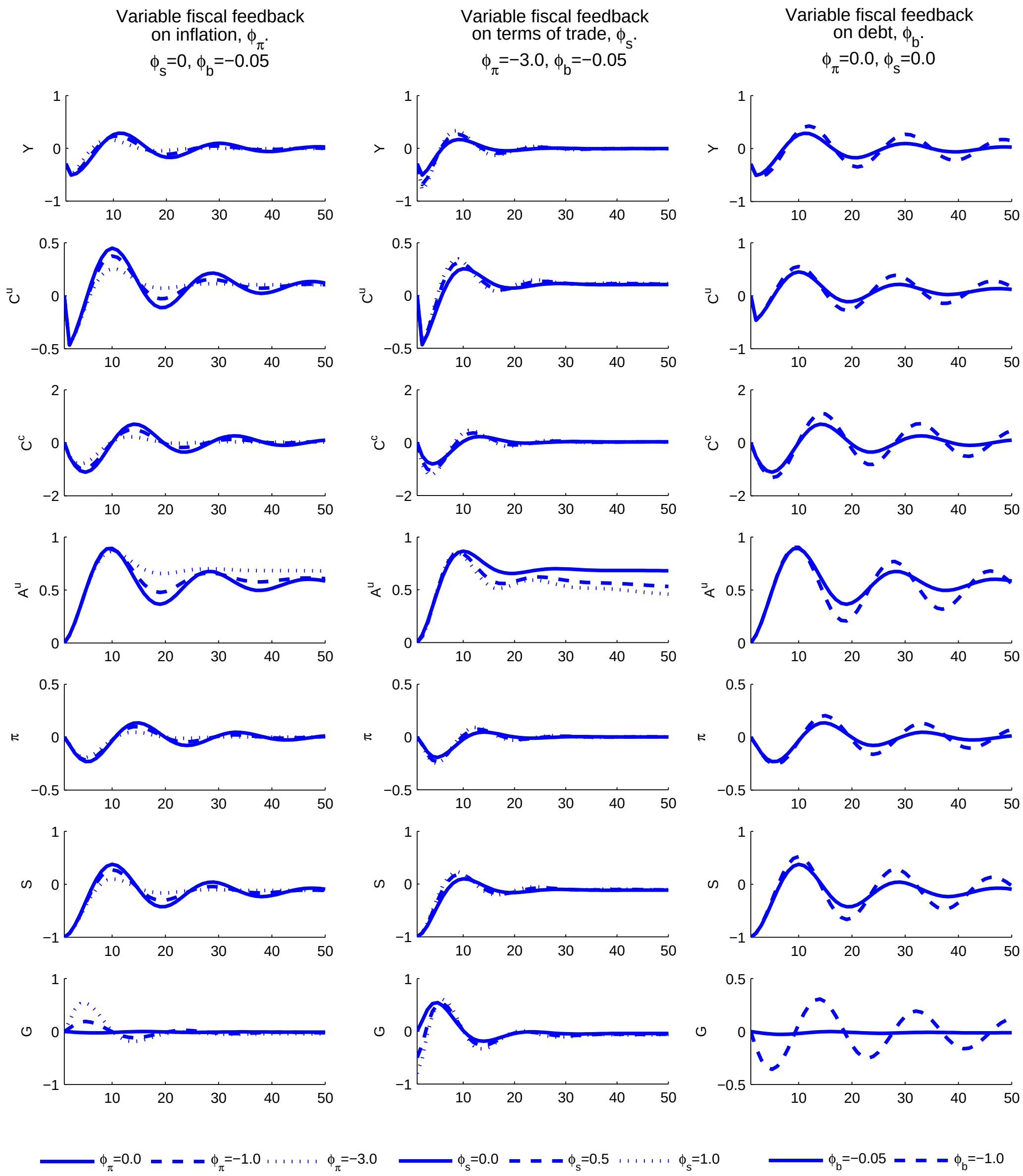

Figure 7: Response to a shock of -1 to competiveness, s. The figures assume that the proportion of backward-looking price setters ω is 0.75, and that the proportion of credit constrained consumers, κ is 0.3. They show the effects of different fiscal feedback parameters.