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**REAL EXCHANGE RATE
ADJUSTMENT, WAGE-SETTING
INSTITUTIONS, AND FISCAL
STABILIZATION POLICY:
LESSONS OF THE EUROZONE'S
FIRST DECADE**

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Wendy Carlin, University College London and CEPR

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Centre for Economic Policy Research
77 Bastwick Street, London EC1V 3PZ, UK
Tel: (44 20) 7183 8801, Fax: (44 20) 7183 8820
Email: cepr@cepr.org, Website: www.cepr.org

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ABSTRACT

Real exchange rate adjustment, wage-setting institutions, and fiscal stabilization policy: Lessons of the Eurozone's first decade*

In terms of macroeconomic performance, the Eurozone's first decade is a story of successful inflation-targeting by the ECB for the common currency area as a whole combined with the persistence of real exchange rate and current account disequilibria at member country level. According to the standard New Keynesian model of a small member of a currency union, policy intervention at country level is not necessary to ensure adjustment to country-specific shocks. Self-stabilization of shocks takes place through the adjustment of prices and wages to ensure that the real exchange rate returns to equilibrium. That this did not happen in the Eurozone appears to be related to the presence of non-rational wage-setters in a number of member countries. A related second departure from the New Keynesian model was the transmission of nonrational inflation expectations to the real interest rate, propagating easy credit conditions in countries with inflation above target. Problems of real exchange rate misalignment among members were exacerbated by the ability of Germany's wagesetting institutions to deliver self-stabilization. The implications for policy focus on using fiscal policy to target the real exchange rate and / or on reforms to labour markets that deliver real exchange rate oriented wage-setting.

JEL Classification: E61, E62, E65, F41, O52

Keywords: Eurozone, fiscal policy, New Keynesian model, real exchange rate, wage-setting

Wendy Carlin
Department of Economics
University College London
Gower Street
London
WC1E 6BT

Email: w.carlin@ucl.ac.uk

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1. Introduction

The Eurozone's first decade (to the eve of the global financial crisis) was marked by satisfactory performance at the level of the currency area as a whole combined with divergent performance of members (Lane, 2006). It has become clear that the persistent inflation differentials and rising current account imbalances that characterized Eurozone members in the first decade did not solely reflect benign catch-up of the Balassa-Samuelson type or efficient adjustment to the risk-sharing opportunities provided by a common currency area (de Haan, 2010). Rather, the growing imbalances resembled disequilibrium outcomes. This raises the question of the role played by national policy-making and by national institutions in a common currency area.

In the standard New Keynesian macro model of a small country in a common currency area, adjustment to shocks occurs automatically through rational forward-looking private sector behaviour, which changes the real exchange rate as required. There is no need for a stabilizing policy rule. By contrast, in a small *flexible* exchange rate New Keynesian economy, it is necessary to have a policy rule at national level incorporating the Taylor principle to ensure the economy returns to the inflation target. This paper argues that the New Keynesian model is not a good fit for understanding how the Eurozone worked in its first decade. In particular, the kind of private sector behaviour envisaged in the model appears to deliver counter-factual predictions for the responses observed in a number of countries. For example, in a country that experiences a positive inflation shock, the NK model predicts a negative output gap and a period with inflation below the common currency area inflation target. Contrary to these predictions, a number of Eurozone members had persistently high relative inflation rates, positive output gaps and diverging rather than converging real exchange rates and current account balances.

We shall see that in a currency area where there are member countries with non-rational wage-setters and where the so-called Walters' critique real interest rate channel operates, there is a role for stabilization policy at national level. By rational wage-setting, we mean that wages are set so as to deliver the real exchange rate consistent with the economy at equilibrium output and with inflation at the common currency area inflation target. We focus on wage-setting because it is in wage-setting that important cross-country differences prevail in the Eurozone, which appear relevant to the operation of the common currency area. With inflation persistence and in the absence of rational expectations, a destabilizing real interest rate channel can operate through which loose credit conditions are propagated. This mechanism requires that the real interest rate relevant to investment decisions, including in housing, is affected by inflation persistence and was highlighted in the famous 'Walters' critique' in which Alan Walters used it to argue against UK membership of the European Monetary System (e.g. Walters, 1992).

It is shown that in a setting with non-rational wage-setters and where the real interest rate channel operates, fiscal policy can in principle achieve stabilization but that the task is more demanding than is the case for the monetary policy-maker in an economy with flexible exchange rates. This is because price level rather than inflation targeting is required. It follows from this argument that countries with rational (real exchange rate-oriented) wage-setters do not need to use fiscal policy for stabilization. Moreover, if large wage-setters play a key role in the institutional arrangements that deliver real-exchange rate oriented wage-setting, their incentive to exercise restraint in bargaining is increased by a balanced budget type fiscal rule. The implication is that in a common currency area where there is a variety of national wage-setting arrangements, different countries have different needs in terms of their fiscal policy framework.

By exploring the interrelation of fiscal policy rules and national differences in wage-setting, light is thrown both on aspects of the functioning of the Eurozone in its first decade and on the design of future reforms and policy. A stylized description of the Eurozone is that northern members and most importantly Germany are characterized by wage-setting that is coordinated by large wage-setters and oriented toward a real exchange rate target. Such countries also favour balanced budget fiscal rules, which reinforce the wage restraint of the large wage-setters. By contrast many southern members have non-rational wage setters where backward-looking behaviour (e.g. indexation) is important. Entry to the Eurozone can be modelled as an inflation shock for countries that began with inflation above the 2% target. Some countries (Spain and Ireland) experienced destabilization through the Walters' critique real interest rate channel along with real appreciation. These countries did not use fiscal policy to target the real exchange rate during the Eurozone's first decade. In others (e.g. Italy, Portugal) real exchange rates appreciated but growth was weak, suggesting that the dominant effect of inflation persistence was to dampen aggregate demand through the real exchange rate channel. The New Keynesian adjustment mechanism was absent in both groups of peripheral economies: higher inflation did not lead to negative output gaps and the unwinding of disequilibria through a period with inflation below the CCA inflation target. By contrast, Germany's behaviour can be understood as one in which rational large wage-setters responded to the *earlier* inflation shock associated with reunification: negative output gaps prevailed through most of the Eurozone's first decade, inflation was below the ECB target and the real exchange rate depreciated. Restrained fiscal policy reinforced the pressure on private agents to adjust.

When a CCA is made up of some countries with and some without rational wage-setters and the latter do not implement stabilizing fiscal policy, the effects of shocks cumulate in misaligned real exchange rates and in current account imbalances. Such problems arise even in the absence of fiscally irresponsible behaviour and of

spillovers from national fiscal policy to the union level, which have been the focus of much of the existing literature.²

The implication of this analysis is to highlight the difficulties that can arise in a common currency area when the automatic adjustment mechanisms envisaged by the New Keynesian model do not operate. Substituting these by the use of stabilizing fiscal policy is extremely difficult for several reasons. Lags in fiscal policy decision-making and implementation mean it is a less flexible policy instrument than monetary policy. Moreover the inherently political nature of tax and spending decisions makes delegation to an independent fiscal policy council along the lines of a monetary policy council impossible (Calmfors and Wren-Lewis, 2011). This renders the problem of ‘deficit bias’ more difficult to solve via delegation than its monetary policy parallel of ‘inflation bias’. The alternative is to implement reforms that reduce the vulnerability of the economy to Walters’ critique type instability and that orient wage-setters toward the real exchange rate. Some Eurozone members like Germany have institutions that are better suited to private sector adjustment to shocks. Germany’s large weight in the Eurozone, makes the need for institutional adjustment in the southern countries both more urgent and more difficult.

The paper proceeds as follows. Section 2 provides a brief empirical motivation for the focus on stabilization policy and inflation persistence by noting the stylized facts of performance in the Eurozone before the global financial crisis. In Section 3, we highlight the two key deviations from the standard adjustment mechanism in New Keynesian models related to wage behaviour and the real interest rate. First, with non-rational wage-setters, the real exchange rate channel may not be strong enough to ensure stabilization (this can never happen in an NK model since price adjustment is exogenously driven by Calvo pricing) and second, there is a destabilizing real interest rate channel if expectations are not sufficiently anchored (unlike in a rational expectations world). We use a very simple graphical model to illustrate the stabilizing real exchange rate channel of adjustment with rational wage-setters and the destabilizing real interest rate channel without rational wage-setters. In the second step, we use the same simple model to illustrate the nature of a fiscal policy rule that can produce stability when wage-setters are non-rational. Section 4 looks at the implications for the Eurozone. Section 5 concludes by suggesting that a joint focus on fiscal stabilization policy and wage-setting institutions in a CCA helps bring out an important structural challenge that has to be faced for a common currency area to succeed.

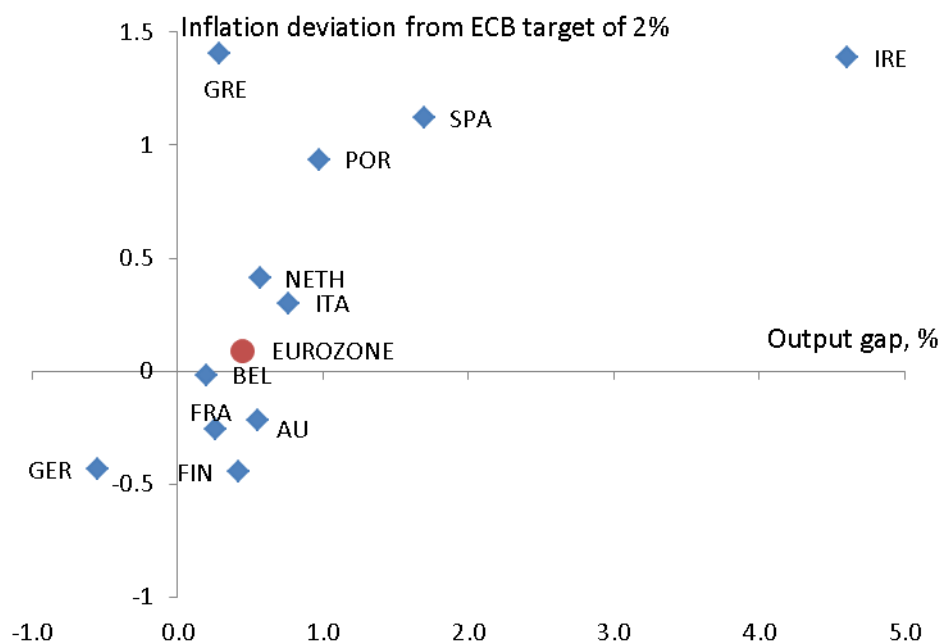
2. Empirical motivation

The performance of member countries in the Eurozone can be shown in terms of the elements of the policy-maker’s loss function familiar from inflation targeting namely, the deviation of inflation from target – in this case, from the ECB’s target – and the output gap. Fig. 1 illustrates the average deviation of inflation from the ECB’s target

² For a recent survey, see Beetsma and Giuliodori (2010).

of 2% and the average output gap for Eurozone countries and for the euro area as a whole in the period before the global financial crisis. The ECB's success in keeping Eurozone inflation close to target with a small output gap is clear. The chart illustrates the heterogeneity in performance of the members. The presence of inflation differentials in a CCA can reflect benign adjustment to shocks or catch-up such as the Balassa-Samuelson effect, where rapid productivity convergence in tradeables boosts wage inflation, which is transmitted to the non-tradeable sector pushing up the rate of unit labour cost growth in the economy as a whole. De Haan assesses the state of the evidence for the Balassa-Samuelson and other equilibrating mechanisms and concludes that although they may have played some role, they do not convincingly account for persistent inflation differentials in the Eurozone's first decade (de Haan, 2010). The evidence suggests that stabilization achieved at the level of the Eurozone as a whole was accompanied by persistent deviations from stability among members.

Figure 1. Inflation (HICP) and output deviations for Eurozone countries and the Euro area, 1999-2007 (average per cent per annum)



Source: OECD Economic Outlook No. 90 Database (2011).

Notes: Inflation is consumer price index, harmonised, quarterly sa, year-on-year; Output gap is for total economy. Data for Greece is from year of entry, 2001.

Table 1 summarizes a number of indicators for Eurozone members over the period before the global financial crisis. Countries are ranked in the table according to the size of the interest rate spread over the German 10-year Bund rate in the first phase of the Eurozone crisis (2010Q1 to 2011Q2) in the first column. The current account balance during the pre-crisis period has the same split of countries as characterizes the interest rate spread: the countries that had current account deficits on average from 1999-2007 are also the ones with an average spread of more than a hundred basis

points in the period from the first quarter of 2010 to the second quarter of 2011. With the exception of the Netherlands, these are also the countries that were on average furthest from stability as defined by inflation of 2% and a zero output gap in Fig. 1.

In Ireland and Spain, where the governments ran surpluses (Col. 3), a strong real interest rate channel (Col. 8) driving domestic private sector booms (Col. 4 & 9) appear to have been dominant (Lane, 2011, IMF, 2011). In Ireland, the scale of the domestic boom and the limited extent to which higher inflation affected competitiveness (Col. 5 & 6) are reflected in the contrast between its continued success in export markets and the behaviour of the current account, which deteriorated from a small surplus in 1999 to a deficit of 5.3% of GDP in 2007 (Col. 2 and 7). The indicator of export market performance in column 7 is the change from the previous year in the ratio between export volumes and export markets for total goods and services. In Greece, serious weakness in the tradeables sector and failure of wages and prices to adjust meant the economy was supported by a large government deficit (Col. 3). Portugal and Italy shared some common features: weak performance of tradeables and persistent government deficits (Col. 3 & 7). However, whilst access to cheap credit appears to have allowed private sector demand to remain relatively buoyant in Portugal, the Italian private sector was on average in financial surplus over this period (Col. 4). The Eurozone as a whole remained close to target in spite of the outcomes in the periphery because inflation was persistently below target in Germany where the output gap was negative. Like the other non-crisis members, Germany had current account and private sector financial surpluses on average. Germany's real exchange rate depreciation, strong export market performance and declining house prices stand out (Col. 5-7, 9).

Fiscal policy is normally assessed according to its pro- or countercyclicality. Although a well-known early study (Gali and Perotti, 2003) reported a shift from pro to counter-cyclicality when comparing the periods 1980-1991 and 1992-2002, more recent work has found either no change or a more pro-cyclical stance after the formation of the Eurozone (Fatas and Mihov, 2009). There is no indication that member governments systematically assessed country-level inflation in terms of whether it reflected benign processes or instability. For example, a post-mortem on the performance of the Irish Finance Ministry concluded that:

[T]he public and policy makers were insufficiently sensitive to the effects of extraordinarily expansive monetary conditions at the time, and to the fact that fiscal policy was the key potential counterbalance to this pressure. (Wright, 2010, p.23)

A typical example from the appendix to the Wright Report underlines the fact that external observers were also not focused on stability problems. The focus on solvency and not stabilization is reflected in this quote (typical of many) from the IMF 2005 Article IV Consultations: "the conduct of Ireland's fiscal policy had been laudable over the years and, while an enhanced public debate could help, many Directors did not see a case for a fiscal council."

Table 1. Summary indicators for the pre-crisis period, Eurozone members

	<i>Spread over German 10-year bond yields</i>	<i>Current account balance % GDP</i>	<i>General government balance % GDP</i>	<i>Private sector financial balance % GDP</i>	<i>RER, total economy</i>	<i>RER, manufacturing</i>	<i>Export market performance, % p.a. change</i>	<i>Real long term interest rate</i>	<i>House prices, % p.a. change</i>
	Average 2010Q1-2011Q2	Average 1999-2007	Average 1999-2007	Average 1999-2007	1999=100	1999=100	Average 1999-2007	Average 1999-2007	Average 1999-2007
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Greece	7.8	-8.1	-5.8	-2.3	107.6	129.9	-0.4	0.92**	6.7
Ireland	4.6	-1.6	1.6	-3.2	117.1	97.0	2.2	0.29	9.7
Portugal	3.6	-9.2	-3.6	-5.6	108.8	107.6	-1.7	1.23	..
Spain	1.7	-5.5	0.1	-5.5	112.3	123.0	-0.7	0.23	9.4
Italy	1.4	-1.1	-2.8	1.7	109.9	123.6	-3.8	1.96	5.5
Belgium*	0.7	3.6	-0.5	4.1	101.1	104.0	-1.6	2.39	5.8
Austria	0.5	1.3	-1.8	3.1	95.1	92.6	0.5	2.87	..
France	0.4	0.8	-2.6	3.4	102.3	98.7	-2.6	2.48	9.1
Finland	0.3	6.2	3.7	2.5	98.2	79.1	-0.3	3.09	3.8
Netherl	0.3	5.3	-0.5	5.8	107.5	101.1	-0.4	1.63	5.8
Germany	0.0	2.7	-2.1	4.8	84.7	85.1	1.1	3.54	-1.6

Sources: (1) OECD.stat long-term interest rates; (2), (3), (4) OECD Economic Outlook 89 Annex Tables 44, 51; (5), (6) Real effective exchange measures defined as unit labour costs vs rest of EA16, European Commission (2011) Economic and Financial Affairs - Economic Databases and Indicators - Price and Cost Competitiveness; (7) Export performance defined as change in ratio of export volumes to export market for goods and services, OECD Economic Outlook 89 Annex Table 27; (8) Long term interest rate deflated by GDP deflator OECD (2010), 'Quarterly National Accounts', *OECD National Accounts Statistics* (database); (9) OECD Economic Outlook 89 Annex Table 59.

Notes: * RER measures are for BLUE; ** Data available only from 2001; .. not available.

The stylized facts discussed in this section suggest that for the periphery countries, EMU membership was associated with net capital inflows and the operation of the de-stabilizing real interest rate channel. Inflation did not drop immediately to the ECB's inflation target and positive output gaps persisted. By contrast, in Germany the initially overvalued real exchange rate reflected a prior inflation shock (associated with reunification) and in the Eurozone period output gaps were negative.

3. Modelling the stabilization problem in a CCA

3.1 New Keynesian models

Over the past two decades, a consensus understanding has emerged about the role of monetary policy in macroeconomic stabilization. Setting aside the case of the zero nominal bound, modern central banks are modelled as implementing – under discretion – an optimal monetary policy rule where they adjust the interest rate in response to deviations in output from equilibrium and in inflation from target. The presence of nominal rigidities prevents the economy from adjusting to a shock without consequences for inflation and output, and therefore provides the motivation for active intervention by the central bank to improve welfare.

There is no parallel consensus about whether stabilization policy is necessary and, if so, how it works for a country in a common currency area (see e.g. Allsopp and Vines, 2008). Gali and Monacelli's (2008) New Keynesian (NK) model of a small fixed exchange rate open economy is a useful benchmark. This is a standard forward-looking model with Calvo price-setting. They analyze equilibrium determinacy and recall the role played in pinning down the unique equilibrium in the closed economy model by the Taylor principle in the monetary rule equation. In the closed economy, an increase in inflation reduces the real interest rate unless the central bank raises the nominal interest rate more than one-for-one with changes in inflation (the Taylor principle). An important feature of the benchmark model for a small country in a CCA is that a policy rule incorporating the Taylor principle is not necessary at the country level. In a standard NK model all agents are forward-looking, inflation expectations are rational, and following a shock, prices adjust slowly back to ensure purchasing power parity holds. The reason that a policy rule is not necessary is because of the discipline imposed through the product market by virtue of common currency area membership. If the economy is affected by a one-off positive inflation shock then inflation goes up on impact and then jumps down below the currency union inflation rate the following period. The intuition behind the downward jump in inflation via the New Keynesian Phillips curve³ rests on the anticipated negative output gap, and a negative output gap is required to restore the real exchange rate to its initial level. Another way of putting this is that there is depressed activity in the short run because prices are not optimally readjusted and so output and consumption fall.

³ The New Keynesian Phillips curve can be written (ignoring discounting) as $\pi_t = E_t \pi_{t+1} + \alpha(y_t - y_e)$, where $(y_t - y_e)$ is the output gap.

Equilibrium determinacy is ensured by virtue of the assumptions about how the real exchange rate channel works. Since Calvo price-setters do not know if they will be able to adjust their price downwards in subsequent periods as they would optimally like to do when the output gap is negative, they bring forward the adjustment. This means inflation falls exactly far enough initially so as to ensure it is increasing on the path to equilibrium. This is the New Keynesian Phillips curve process. With the nominal interest rate constant at the CCA rate, the real interest rate will follow the path of expected inflation: expected inflation is below the union inflation rate and rising. Hence the real interest rate must be *above* its steady state value and falling along the adjustment path. The real interest rate channel therefore contributes to stabilization. With these assumptions, in the absence of policy intervention, a positive inflation shock is followed by a fall in inflation to below the CCA rate and a negative output gap. The real interest rate goes above equilibrium and there is an initially appreciated but depreciating real exchange rate (back to equilibrium).

Models in Kirsanova et al. (2007), Kuralbayeva (2007) and Allsopp and Vines (2008) show that introducing inflation persistence to an NK model modifies the real interest rate channel. Inflation persistence is built into the behaviour of agents by assuming there are rule of thumb price-setters. Whereas standard NK (Calvo) price-setters set the price to maximize expected profits but are prevented from doing so each period because of the existence of nominal rigidities, rule of thumb price setters use a simple rule like indexation, where they set the price (or price increase) to be the same as it was last period. Given their inability to adjust each period, Calvo price-setters incorporate their expectations of future inflation and output gaps into their current price adjustment. With backward-looking behaviour as the source of persistence, a cost-push shock raises inflation and via the presence of the rule of thumb price setters, expected inflation. This *reduces* the real interest rate and for the period during which inflation is rising, the real interest rate is below its steady state level and falling. However, just as in the benchmark model of Galí and Monacelli, there is a negative output gap, inflation falls below the union rate and the real exchange rate eventually returns to its initial steady state value unwinding the effect on competitiveness of the inflation shock. With a sufficiently large proportion of rule of thumb agents, and without policy intervention, the economy is characterized by damped cycles around the initial equilibrium. The larger the proportion of rule of thumb price setters, the stronger the cycles.

Kirsanova et al. (2007) show that by cutting government spending to bring forward the negative output gap, and then raising it above its steady state level (to prevent the cycling that arises from the real exchange rate channel in the presence of inflation persistence), welfare is enhanced. In the absence of rule of thumb price-setters, the only rationale for using stabilizing fiscal policy is its role in offsetting the temporary relative price distortions associated with the implications of the shock for the real exchange rate (Galí and Monacelli).

To summarize, with sticky prices and rational expectations, an inflation shock is automatically stabilized in a CCA – i.e. without the need for policy intervention – through the New Keynesian Phillips curve process. The mechanism is a fall in home's inflation and a negative output gap in anticipation of the required adjustment in the real exchange rate. Introducing rule-of-thumb price setters slows down the adjustment process because it introduces a period of rising inflation and a falling real interest rate and if the backward-lookingness is sufficiently strong, this produces damped cycles, which stabilizing fiscal policy can prevent. Abbritti and Mueller (2011) develop very interesting results showing how the presence of asymmetric labour market institutions in a 2-country dynamic New Keynesian model increases the volatility of inflation and unemployment differentials in response to shocks. Nevertheless even with the inclusion of rule-of-thumb price setters and a range of labour market institutions, the structure of the NK model ensures that the economy responds to inflation above the CCA level by a negative output gap and the restoration of the real exchange rate to equilibrium.

However, we need to question the automaticity of self-stabilization in New Keynesian models if we are to shed light on the behaviour of Eurozone countries in the first decade, where countries with higher than CCA inflation had persistently positive inflation gaps and appreciating real exchange rates. The contrast is with Germany. Taking account of the fact that the real exchange rate in Germany was overvalued prior to the formation of the CCA, German adjustment in EMU better matches the NK prediction: inflation fell below the union level and the output gap was negative. The economy was characterized by an initially appreciated but depreciating real exchange rate.

3.2 A simple graphical illustration – currency union members with and without rational wage-setters and anchored inflation expectations

A salient difference among Eurozone member countries relates to the institutional arrangements for wage-setting (Aidt and Tzannatos, 2008, du Caju et al., 2008, Johnston and Hancke, 2009, Traxler and Brandl, 2010). For this reason, we focus on wage- rather than price-setting behaviour in the graphical model. We choose two extreme assumptions about expectations formation in wage-setting in order to provide a sharp contrast between 'rational' and 'non-rational' cases. The simple graphical model helps make transparent the real interest rate and real exchange rate channels and allows for a direct comparison with the flexible exchange rate case.⁴

The inflation target of the central bank in the common currency area (CCA) pins down inflation in medium-run equilibrium. In the Eurozone, this is the ECB's inflation target. The simplest way of modelling rational wage-setting behaviour is to assume that inflation expectations in the home economy are firmly anchored to the CCA inflation target. Anchored expectations are a simple way of representing the

⁴ Recent work by Corsetti et al. (2011) further develops the contrast between the modern NK approach and a model in which the Walters critique effect operates.

commitment of the rational wage-setter to wage settlements that are consistent with the restoration of the real exchange rate to equilibrium. We model non-rational wage-setting by assuming a completely backward-looking rule for the formation of inflation expectations.

The equations of the model are as follows, where an asterisk is used to denote CCA variables.

Phillips curve:

$\pi_t = \pi_t^E + \alpha(y_t - y_e)$, where π_t^E is expected inflation and $(y_t - y_e)$ is the output gap.

$\pi_t^E = \pi_{t-1}$, where wage-setters are non-rational and

$\pi_t^E = \pi^*$, where wage-setters are rational.

Aggregate demand (reduced form IS curve):

$y_{t+1} = A - ar_t + bq_t$, where y is output, A is autonomous demand,

and a and b are positive constants.

We define the real exchange rate, Q , $Q \equiv P^*e/P$, where e is the nominal exchange rate, and denote $\log Q$ by q . In a common currency area, the nominal exchange rate is fixed and home's competitiveness improves (its real exchange rate depreciates) when home inflation is below CCA inflation and vice versa: $\Delta q = \pi^* - \pi$.

Fisher equation:

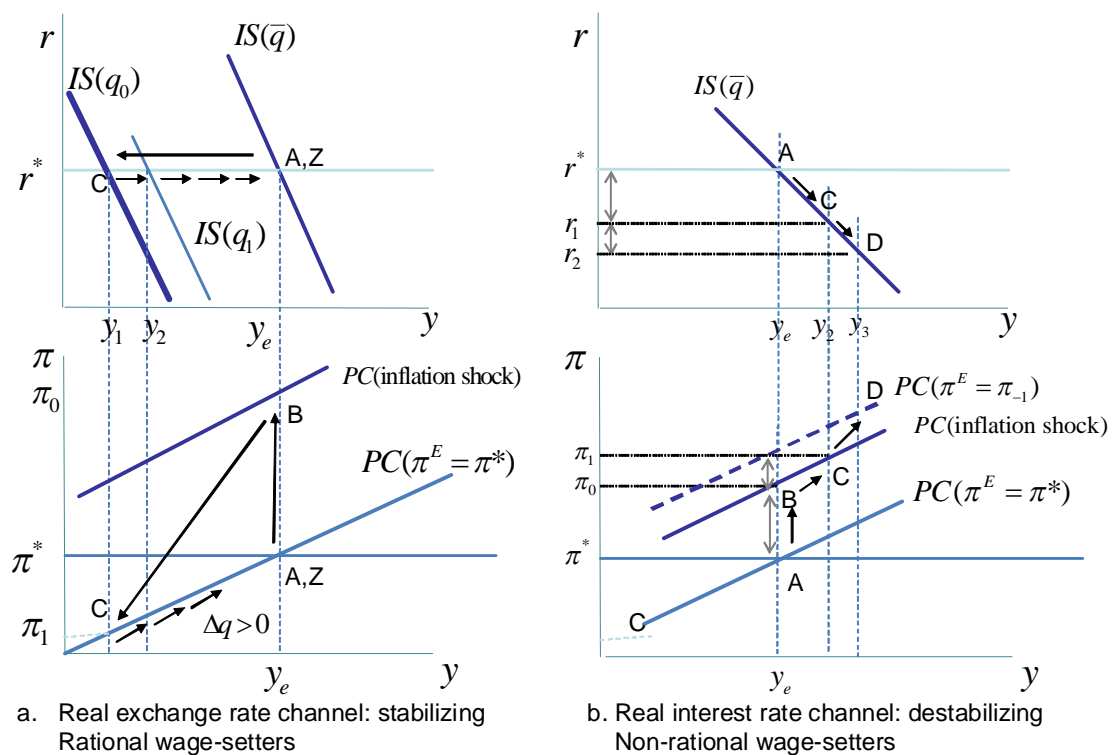
$$r_t = i_t - \pi_t^E$$

In this model, the real exchange rate channel operates through the *IS* equation when $\Delta q \neq 0$. The real interest rate channel operates through the *IS* equation via the Fisher equation. It is clear that by assumption a destabilizing real interest rate channel can only exist in the case of non-rational wage-setters. In the case of rational wage-setters, since the nominal interest rate, i , is set by the CCA central bank, then from the Fisher equation, the real interest rate, r , remains constant at the currency area interest rate throughout (i.e. $r = i - \pi^E = i^* - \pi^T = r^*$). With these assumptions, only the real exchange rate channel can come into play. In the initial equilibrium, inflation is at the CCA rate, output is at equilibrium, trade is balanced and there is primary fiscal balance.

In Fig. 2a, an inflation shock is represented by the upward shift in the Phillips curve in the lower panel. As a consequence of the impact of this in reducing home's competitiveness, the *IS* curve shifts to the left and the economy is at lower output (at point C where $r = r^*$ because of our assumption of anchored expectations, $\pi^E = \pi^*$). With inflation expectations firmly tied down to the CCA inflation rate, then in the period after the inflation shock, the Phillips curve reverts to the one indexed by π^* . A negative output gap will prevail until the effects of the inflation shock have been unwound. Eventually the economy returns to equilibrium with the initial real exchange rate and primary fiscal balance.

Let us now see what happens when inflation expectations that affect wage-setters and which operate through the *IS* equation are not firmly anchored to world inflation. In this case, the Fisher equation indicates that home's real interest rate can deviate from the world real interest rate. This opens the way for a destabilizing real interest rate channel. Fig. 2b illustrates how this channel works. To make the illustration of the real interest rate channel as clear as possible in the diagram, we shut down the real exchange rate channel by assuming the *IS* curve does not shift with a change in the real exchange rate. The inflation shock shifts the Phillips curve up as before (lower panel). This raises expected inflation, which reduces home's real interest rate (to r_1). This leads to a rise in output and inflation (point C). Inflation expectations are updated and the Phillips curve shifts up again. Output rises further, which is destabilizing. The economy goes from A to B to C to D etc. in Fig. 2b.

Figure 2. The stabilizing real exchange rate channel and the destabilizing real interest rate channel



If we relax the assumption in Fig 2b that there is no real exchange rate effect, the *IS* curve will shift to the left following the inflation shock. However unlike the case with rational wage-setters in Fig. 2a or in the NK model, there is nothing in the model with non-rational wage-setters to guarantee that the real exchange rate effect will be strong enough to produce an output gap sufficiently negative to reduce inflation below the CCA inflation rate and ensure the economy returns to equilibrium. The relative strength of the ‘coolant’ effect of the real exchange rate channel vis-à-vis the destabilizing real interest rate effect will be a function on the one hand of the speed

with which wage and price adjustments feed through into the tradeables sector and dampen net exports and on the other, of the speed with which an investment boom can take hold.⁵ This suggests that a stabilizing policy rule incorporating the equivalent of the Taylor principle is required. By contrast, with rational wage-setters, there is no such role for stabilizing fiscal policy.

3.3 A stabilizing fiscal policy rule

We now look at how fiscal policy could play a role when wage-setters are non-rational and the real interest rate channel prevails. Since stabilizing fiscal policy is not required when wage setters are rational, we assume throughout this section that wage-setters are non-rational. The first step is to assume there is a benevolent fiscal policy maker in the CCA member country and that this policy-maker adopts the same approach to optimal stabilization as does an independent central bank (e.g. Clarida et al. 1999). We begin with the familiar loss function of a central bank that seeks to minimize the (squared) deviations of inflation from target and output from equilibrium, and adapt it to a national policy maker inside a common currency area. In this case, the policy maker is concerned to minimize the deviation of inflation from the common currency area's inflation target. The analysis is simpler if we assume that the policy maker's objective in each case is defined in terms of domestic rather than CPI inflation.

This produces the following optimization problem and policy rule:

$$\begin{aligned} \text{Min } L_t &= (y_t - y_e)^2 + \beta(\pi_t - \pi^*)^2 \quad \text{s.t.} \quad \pi_t = \pi_{t-1} + \alpha(y_t - y_e) \\ &\quad \text{National policy-maker's loss function} \qquad \qquad \qquad \text{Phillips Curve} \\ \rightarrow (y_t - y_e) &= -\alpha\beta(\pi_t - \pi^*), \\ &\quad \text{Optimal output gap; Policy Rule} \end{aligned}$$

where y_t and π_t are respectively, output and inflation at time t , y_e is equilibrium output, π^* is the CCA's inflation target, β is the weight on inflation in the policy-maker's loss function and α is the slope of the backward-looking Phillips curve.

The optimal output gap tells the policy maker how to respond (using its stabilization policy instrument) to the observed inflation deviation if it is to guide the economy back to equilibrium output at target inflation. By writing the policy rule in terms of the output gap, it is clear that in principle, implementation can take place through either fiscal or monetary policy.

In the CCA case, the national policymaker chooses the output gap using fiscal policy in response to its observation of the deviation of home's inflation from the CCA inflation target. Although under normal conditions, fiscal policy is not used to choose the optimal output gap when monetary policy is available, this is a way modelling

⁵ In the Eurozone, the housing boom was fuelled not only by low real interest rates but also by incentives for banks to increase their leverage. As the data for Ireland in Table 1 highlight, the real exchange rate effect was muted there by the concentration of high unit labour cost increases in the non-tradeable sector.

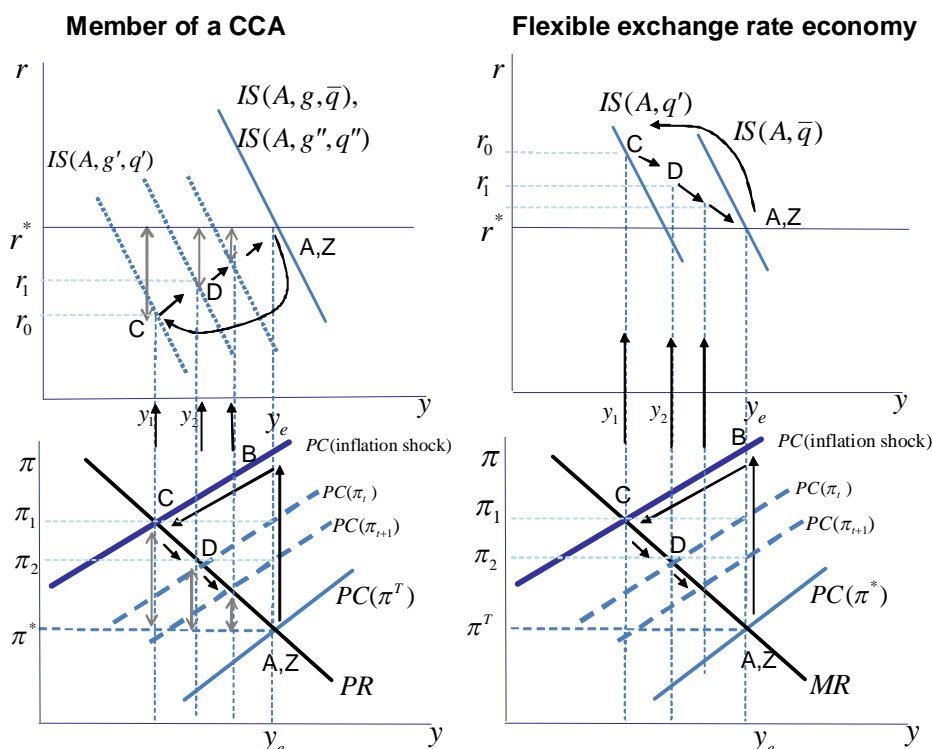
fiscal stimulus packages in the aftermath of the global financial crisis when monetary policy was constrained by the zero nominal bound. This context has revived the debate about the effectiveness of fiscal policy (Blinder, 2004, Beetsma, 2008, Ramey, 2011, Taylor, 2011, Parker, 2011). New evidence from the UK (Cloyne, 2011) confirms the results of Romer and Romer (2010) that tax changes have a marked and persistent effect on output. Noting the many caveats about efficacy and timing, we shall nevertheless assume that discretionary fiscal policy can be used to select the optimal output gap.

In the NK benchmark model and in the graphical model with rational wage-setters, an inflation shock is followed by a period in which inflation is *below* the CCA inflation rate. This suggests that if the fiscal authority simply takes over the optimal Taylor Rule and guides the economy back down to the CCA inflation rate, it will not achieve the same outcome as under rational wage-setting. It is obvious that as compared with adjustment under rational wage-setting, the home country's price level will be higher in the new constant inflation equilibrium: it will have an appreciated real exchange rate. As we shall see, this will be accompanied by a deteriorated primary fiscal balance in the new equilibrium.

Maintaining the assumption that wage-setters are non-rational, we now compare the outcomes in the case where *fiscal* policy is used (by a country inside a CCA) and where *monetary* policy is used to stabilize (a country has an independent central bank). We take the experiment of a temporary country-specific inflation shock in Fig. 3. Our assumptions about the policy-maker's loss function and the Phillips curve mean that the bottom panel in both parts of Fig. 3 are virtually identical. The only differences are in the labelling of the policy rule curve (called *PR* in the CCA and *MR* for monetary rule in the flexible exchange rate case), and the fact that at equilibrium, inflation is equal to CCA inflation in the CCA case and equal to target inflation in the flexible rate economy.

The lower panels show that using the assumptions we have made so far, the policy maker in each type of economy chooses the same sequence of output gaps on the path back to equilibrium. However, how policy is used to implement those output gaps differs.

Figure 3. Optimizing policy for stabilization in a CCA and under flexible exchange rates: temporary inflation shock



In a CCA, the fiscal policy rule says the government will decide on its initial fiscal policy stance, g' , (to achieve the output gap at point C) taking into account the fact that higher expected inflation reduces the real interest rate to r_0 and higher actual inflation reduces competitiveness to q' . The policy maker then manages the adjustment process along the policy rule curve until the economy is back at equilibrium. The point to note is that once the country in the CCA is back at equilibrium with inflation at target, home's real exchange rate will have appreciated. The reason is clear from the left hand lower panel of Fig. 4: home's inflation is above the CCA's throughout the inflation shock episode. Hence, home's price level will have risen relative to the CCA's and therefore its real exchange rate will have appreciated. The appreciated real exchange rate (q'') at equilibrium in the CCA economy means that net exports are lower and therefore, for the level of demand to be sufficient to sustain output of y_e , fiscal policy must be looser (g''). Consumption and investment are unchanged since the real interest rate is pinned down by the CCA nominal interest rate and by home's inflation rate, which in equilibrium is equal to the CCA inflation target. In short, the primary fiscal balance must have deteriorated.

This is not the case in the flexible rate economy, where the real exchange rate returns to the initial level \bar{q} and government expenditure remains unchanged. The logic of the flexible exchange rate case can be summarized as follows. For a small open economy with flexible exchange rates and non-rational wage-setters, the central bank and the foreign exchange market have rational expectations and forecast the output

contraction required to get the economy back to target inflation (see Appendix for a summary of the derivation of the results from Carlin and Soskice, 2010). The forecasting exercise incorporates the requirement that the uncovered interest parity condition holds in real terms throughout the adjustment process. The central bank tightens policy by raising the interest rate and the nominal exchange rate appreciates. This puts the economy on the path to return to equilibrium with target inflation. In the new equilibrium, output, the real exchange rate, the government's primary deficit and trade balance are back at their initial levels. Home's price level is higher but this is exactly offset by the depreciated nominal exchange rate. The dynamic adjustment process described above is illustrated graphically in the right hand panel of Fig. 4: the inflation shock shifts the Phillips curve up and the central bank optimizes by choosing its best output-inflation pair on the MR curve at point C in the lower panel. Monetary policy is tightened (to r_0) and the real exchange rate appreciates (to q') to deliver the optimal output gap at y_1 . The presence of a forward-looking foreign exchange market with rational expectations means that (in contrast to the closed economy) some of the stabilization is achieved via nominal (and real) appreciation.

Our example illustrates that fiscal imbalance can arise in a CCA not only as a result of 'profligacy' or deficit bias on the part of the national government. It can also arise as an unintended consequence of the use of the same 'optimal' policy rule to stabilize the economy in the face of a temporary inflation shock as chosen by an inflation-targeting central bank in a flexible exchange rate regime. This implies that to leave the primary fiscal balance and real exchange rate unchanged following the adjustment to a temporary inflation shock, the *price level* must return to its initial position. In contrast to the situation under flexible exchange rates, it is not sufficient for the *inflation rate* to return to target.⁶

Although in a closed economy price-level targeting is not necessary for stability it delivers higher welfare than does inflation targeting because it eliminates stabilization bias. However, it requires commitment since it is time inconsistent (Woodford, 2003, Gali, 2008). In the absence of mechanisms to ensure commitment, policy makers have adopted inflation-targeting. Membership of a common currency area delivers commitment but the results of this section suggest that unless commitment also delivers rational wage-setting and rules out the Walters' critique channel, another policy instrument is needed to deal with shocks. In principle, active fiscal policy can be used to do this. If fiscal policy does not ensure that the cumulative effects on the real exchange rate arising from country-specific shocks are offset, there will be lasting implications for the real exchange rate and for government indebtedness. There are many reasons why fiscal policy may not fulfil its stabilization role. If we drop the assumption of a benevolent policy maker with access to timely and effective fiscal

⁶ An inflation shock is the simplest to model because the real exchange rate is unchanged in the new equilibrium under flexible exchange rates. Similar issues arise in the more complicated cases of an aggregate demand or productivity shock.

policy instruments, it may, for example, be hampered by inside and outside policy lags or have a deficit bias.

4. Implications for the Eurozone

Section 3 suggests that even with a benevolent national fiscal policy maker, the task of stabilizing country-specific shocks in a small member of a CCA when wage-setters are non-rational is a difficult one. It is important to emphasize that the Eurozone's problems in 2010-2011 were by no means solely due to the consequences of the issues surrounding stabilization policy discussed in the previous section. In some countries like Greece, the assumption of a benevolent policy-maker is misplaced. Elsewhere, just as Taylor Rule-based monetary policy was not able to bear the full burden of controlling the leverage cycle that built up in the 2000s in countries with inflation-targeting central banks, the same would likely have been true of fiscal policy in a CCA had it been used to 'lean against the wind'. Given the potential for a Walters' critique propagation channel to fuel housing booms in a CCA, it is essential to reform banking regulation to prevent the build-up of excessive leverage in households and banks. Nevertheless, the mechanisms discussed in Section 3 appear to capture aspects of the structural background to the crisis and to clarify important differences in the genesis of the crises of the peripheral Eurozone economies from those of countries outside. They highlight the challenge faced by countries with non-rational wage-setters in achieving stabilization. And they direct attention to disequilibria in real exchange rates that can arise from the presence in a currency union of a mixture of countries with rational and non-rational wage-setters.

To this point, rational wage-setters were modelled as those with inflation expectations anchored to the CCA's inflation target. This assumption captures the commitment of the rational wage-setter to wage settlements consistent with the economy's return to equilibrium at the equilibrium real exchange rate. In an extended model in which demand and supply shocks as well as inflation shocks are included, rational wage-setters also adjust their wage claims to ensure that the real exchange rate is consistent with the new equilibrium. This 'stabilizing' real exchange rate is the counterpart in the open economy of the Wicksellian or neutral real interest rate in the closed economy.

The industrial relations literature provides evidence on the orientation of wage-setting toward the maintenance of exposed sector competitiveness (which happens automatically in the New Keynesian model via the PPP assumption). Traxler and Brandl (2010) classify wage-setting systems and highlight the way in which pattern bargaining led by the exposed sector can deliver the stabilizing real exchange rate. Although not all Eurozone countries are included in their study (Greece and Ireland are missing), there is a clear split between Germany and Austria on the one side, which have pattern bargaining led by the exposed sector and on the other, Italy, Portugal and Spain, which are characterized by wage-setting referred to as 'peak coordination / low governability'. Peak coordination refers to the ability of the median

union in the confederation of unions to coordinate aggregate pay increases and to make recommendations over wage increases for lower tier (industry or firm-level) bargaining. Low governability refers to the latter being non-binding. In contrast to pattern bargaining led by the export sector, the outcome of this structure will be contingent not only on the response of the lower tier units in their bargaining but also on the relative strength of the different unions in the sheltered and exposed sectors of the economy.⁷ There is no mechanism to produce wage increases consistent with the stabilizing real exchange rate.

Recent research in economics on wage behaviour has come out of the ECB's Wage Dynamics Network. Of particular relevance for the argument of this paper is the work of Knell and Stiglbauer (2009) on the importance of reference norms in wage-setting for inflation persistence. Using detailed data for Austria on 100 wage-setting units covering virtually the entire labour force for the period 1980 to 2006, they construct a set of different reference norms to capture a variety of wage-setting hypotheses. These include examples of non-rational wage-setting such as the use of a habit norm (using the previous increase in the wage in the sector) and a standard of living norm (as in the Section 3 example of non-rational wage setting), as well as a leadership norm in which firms in other sectors follow the wage increase set in the engineering sector. Their findings for Austria are consistent with a model of wage-leadership via large wage-setters in which the engineering sector sets wages taking account of the forecast output gap and inflation (which corresponds to a form of rational wage-setting), and other sectors use the engineering sector settlement as their reference norm. This is the pattern bargaining referred to in the industrial relations literature. It produces less persistence than one in which there is a symmetric structure of reference norms. They conclude that detailed knowledge of the micro-structure of wage-setting, including the differences in wage norms across sectors, is essential for an understanding of the sources and cross-country differences in inflation persistence.

A related paper by Knell (2010) uses data from the Wage Dynamics Network surveys to show that simple measures of nominal rigidity such as the frequency at which wages and prices are set (which can be fitted into standard NK models with Calvo price-setting or with Taylor staggered wage contracts) do not do well in accounting for the cross-country variation in real wage rigidity and *pari passu* in inflation persistence. Adding variables that capture important features of wage-setting in Europe such as the average size of sectors, the share of workers with flexible wage contracts and the coverage of wage-indexation improves the fit. However, the paper finds that the practice of wage-setting relevant for inflation persistence varies much more than is reflected even in the extended set of indicators collected in the wage dynamics surveys. For example, details of collective bargaining such as the key role of wage leadership established for the Austrian case above are not captured by these

⁷ Belgium, Finland and the Netherlands are classified as 'peak coordination with high governability', which suggests their wage-setting systems lie between those of Austria and Germany on the one side and the southern countries on the other.

indicators (Traxler and Brandl, 2010). In their study using micro data on wage changes, Holden and Wulfsberg (2011) document evidence of downward nominal wage rigidity persisting in the southern European countries (Italy, Greece, Portugal and Spain) in the 2000s, noting that for Eurozone members, DNWR ‘would make it difficult to escape from a position of weak international competitiveness’ (2011, p. 27).

An earlier literature on models of wage-setting and equilibrium unemployment also highlights the variation in wage-setting institutions. The Scandinavian (Aukrust/EFO) model of inflation was an early example of a two-sector model where the wage-setters in the export sector have incentives to behave in such a way that price and non-price competitiveness (i.e. the real exchange rate) are maintained (Aukrust, 1970, 1977, Edgren et al, 1973). The role of wage-setting institutions in explaining the heterogeneity of European unemployment performance has been explored at length (e.g. Calmfors and Driffill, 1988, Driffill, 2006). Robust results in the literature using aggregate data are rare (Howell et al. 2007, Heckman, 2007) but measures of wage coordination are usually found to be negative and both economically and statistically significant in explaining medium-run unemployment (Howell et al. Table 3).

In the Eurozone, Germany, like some other northern members (and some EU countries outside the Eurozone like Sweden and Denmark), has wage-setting institutions that facilitate the coordination of nominal wage growth (Traxler and Brandl, 2010). Germany is the largest Eurozone member and the implications of its institutional characteristics for wage-setting pose particular difficulties for some other members. From a macroeconomic perspective, many countries were attracted to joining a common currency area with Germany at its core because it offered a way of acquiring a credible commitment to low inflation. However, as noted above, one outcome has been divergent real exchange rates because inflation rates did not converge on entry to the ECB’s target of 2% per annum.⁸ As shown in Fig. 1 above, Germany’s inflation rate was persistently below 2% and the lowest in the Eurozone. From 2000, Germany was able to achieve a substantial real depreciation within the Eurozone through a combination of restraint in nominal wage growth and more rapid productivity growth than many other member countries (reflected in the real exchange rate indicators in Table 1, Col. 5 & 6). It demonstrates the country has wage-setting institutions that can mimic the self-stabilization predicted by the New Keynesian model by engineering a real depreciation inside the Eurozone when required.

The wage coordination mechanism in Germany is centred in the private sector and on wage leadership by the engineering industry. During the euro’s first decade, works councils and employers in large German companies, and unions and employers’ associations agreed to modest nominal wage increases in multi-year deals, and works councils in large companies negotiated over wage and hours flexibility in exchange

⁸ The dangers arising from this possibility in EMU were highlighted in the contribution of Carlin and Glyn to the UK’s Treasury’s EMU enquiry (Carlin and Glyn, 2003).

for investment by firms in fixed capital and training (e.g. Carlin and Soskice, 2008). Similar to the Austrian case discussed above unions play a key role in limiting the bargaining power of skilled workers in the core export sector of the German economy and in maintaining the exposed sector (engineering) as the wage leader. The Aukrust model highlights the different incentives faced by wage-setters in the sheltered and exposed sectors and this is reflected in the leader-follower pattern bargaining observed in Germany.

Real exchange rate oriented wage-setting via pattern bargaining at industry and company level is a method of delivering the results associated with rational wage-setters in the models of Section 3.2. As we have seen, having rational wage setters substitutes for the price-level targeting fiscal policy rule described in Section 3.3. In the simple example of an inflation shock, to model the German response, we would assume that wage-setters' inflation expectations are set by the CCA inflation target. With fully anchored inflation expectations, the response to the inflation shock is the one shown in Fig. 2a.

Countries in a CCA without access to real exchange rate-oriented wage-setting (or otherwise to rational wage-setting through a sufficiently flexible labour market as assumed in the NK models) must rely on a price-level targeting fiscal policy rule for stabilization, with the attendant difficulties that have been discussed. For countries with large rational wage-setters it has been argued that it is important to limit the use of discretionary fiscal policy for stabilization since it weakens the incentive of large wage-setters to exercise restraint (Carlin and Soskice, 2008). Soskice and Iversen (2000) model the interaction between large wage setters, monetary policy and equilibrium unemployment in a closed economy and the same logic can be applied to fiscal policy in a CCA. This makes the adoption of a balanced budget or 'debt brake' rule a natural complement to rational wage setting when wage setters are large.

Table 2 summarizes how the case of large wage-setters fits into the overall discussion of the use of fiscal policy rules for stabilization. The columns are divided between non-rational and rational wage-setters; with the latter in turn divided between small and large ones. The case of small, rational wage-setters matches the baseline NK model. As reported in Section 3.1, fiscal stabilization is not required in the NK model so this is shown in the cell corresponding to 'No Fiscal Policy Rule' and 'Rational, small wage-setters'. However, welfare is improved by a fiscal policy that undoes the temporary relative price distortions associated with the shock.

Table 2. Summary of fiscal policy stabilization rules (FPR) and wage-setting institutions (example of a temporary country-specific inflation shock)

Fiscal policy rule for stabilization	Wage-setting behaviour		
	Non-rational wage-setters *	Rational wage-setters	
		Small	Large
No FPR	Possible instability (real interest rate channel dominates) <i>Some Eurozone countries in 2000s</i>	Stable and fiscally neutral but sub-optimal <i>NK model</i>	Stable and fiscally neutral <i>Germany</i>
Fiscal policy rule (FPR)			
• inflation-targeting	Stable but fiscal imbalance <i>Some Eurozone countries in 2000s</i>		
• price-level targeting	Stable and fiscally neutral but output gaps may be large		
• to target temporary distortions		Optimal <i>NK model</i>	

* A simple representation is backward-looking inflation expectations.

The discussion of German wage-setting suggests it fits into the cell with ‘No FPR’ and large rational wage setters. A fiscal policy rule for *stabilization* is not necessary and a debt brake rule complements the stabilization achieved via large rational wage-setters. Whereas a country with large wage-setters needs constraints on fiscal discretion to incentivize large wage-setters to exercise restraint, from the stabilization perspective, this argument has no weight in the absence of large wage-setters. On the contrary, where the wage-setting system cannot be relied on to ensure that the real exchange rate is appropriately adjusted, and in the absence either of rapid adjustment by decentralized wage- and price-setters (i.e. the flex-price rational expectations solution) or jumps in inflation due to the forward-looking behaviour of Calvo price-setters (i.e. the sticky price rational expectations solution), active fiscal policy has to be used to create the necessary output gap to put the economy on the path to the CCA inflation rate. A benevolent fiscal council would, in principle, be one method of delivering this.

Spain and Ireland in the 2000s fit in the box for ‘No FPR’ and non-rational wage-setters. They experienced instability through the real interest rate channel, and an

appreciating real exchange rate. What was missing for these countries was fiscal policy directed at stabilization. It is important to note that a balanced budget or debt brake rule would have been non-binding in these cases. As the data in Table 1 make clear, both Ireland and Spain were running fiscal surpluses in the years before the crisis and their debt to GDP ratios were falling rapidly. Yet fiscal policy did not lean sufficiently against the wind to produce the negative output gaps that were necessary to pull inflation below 2%. The transmission of non-rational inflation expectations to the forward-looking real interest rate helped propagate loose credit conditions through very low real rates. Given the problems with using fiscal policy to stabilize, policy reform should also focus on creating automatic stabilizers (e.g. in the structure of property or capital gains taxes) to counter house price bubbles.

In some other cases, such as Italy, fiscal policy makers may have been mindful of the objective of getting inflation down to the 2% target ('Inflation-targeting FPR') but a sufficiently tight fiscal policy to bring inflation *below* the CCA level was not implemented. The result was that persistently higher inflation produced cumulative real exchange rate appreciation and fiscal imbalance. The analysis in this section highlighted how specific institutional arrangements for wage-setting can allow countries to achieve price-level targeting and avoid the need for stabilizing fiscal policy. For a small economy in the Eurozone, this would be of interest but would not be especially significant for the Eurozone as a whole. However, the fact that Germany is the largest Eurozone member makes its institutional arrangements of wider importance. Over the Eurozone's first decade, coordinated wage-setting resulted in a substantial real depreciation in Germany vis-à-vis other members. Looking to the future, given its weight in the currency union, Germany's characteristics mean that other member countries that do not have rational wage-setters (via either German-type coordination mechanisms or via a deregulated labour market) risk experiencing an appreciating real exchange rate. The only way to unwind this is through a period of slow growth and high unemployment as the standard (old) Phillips curve mechanism operates to reduce wage inflation below Germany's. The problem with the latter is that it is likely to impose a lengthy period of slow growth in the Eurozone. Given its fiscal rules and the consistency between those and its wage-setting structure, Germany is an unlikely locomotive for the Eurozone.

5. Conclusions

At the core of New Keynesian models of members of a CCA is self-stabilization through the adjustment of real exchange rates. Whilst this fits with the German case of wage coordination, it is not a good match for the periphery countries during the Eurozone's first decade. The policy implications are that if wage-setters in a member country are non-rational, stabilizing fiscal policy, where the fiscal policy rule targets the *price level*, is necessary in order to prevent destabilization through the real interest rate channel (Walters' critique) and to deliver the equilibrium real exchange rate. Even if we make the heroic assumption that there is a benevolent policy maker such

as a fiscal policy council with access to effective fiscal policy instruments, a price level targeting rule is more demanding than an inflation targeting one since it requires the policy maker to achieve an output gap that brings inflation below the CCA rate. With rational wage-setters, a stabilization role for fiscal policy is unnecessary. A balanced budget rule, i.e. one that is not oriented toward an active role in stabilization, also makes sense in a setting in which rational wage-setters are large because it helps induce the required wage restraint. However in countries with non-rational wage-setters, active stabilizing fiscal policy is needed because a balanced budget rule does not ensure adjustment to the stabilizing real exchange rate or prevent destabilization through the real interest rate channel.

In Ireland, the successful use of wage accords to achieve wage restraint in the 1980s and 1990s (Honohan and Walsh, 2002) disappeared during the first decade of the Eurozone at the economy-wide level. However, wage discipline continued to characterize the tradeables sector as reflected in the contrasting performance of the real exchange rate in the total economy and in manufacturing shown in Table 1. It is striking that Ireland stands out from the other crisis-ridden countries in the extent of nominal wage cuts achieved in 2010-2011. Previous experience with consensus wage adjustments and continuity of wage discipline in the export sector in the 2000s appear to have helped Ireland re-establish rational wage-setting more broadly.

The periphery countries without rational wage-setting would need sophisticated fiscal policy to stabilize idiosyncratic shocks. Germany has coordinated wage-setting via large wage-setters, which deliver the stabilizing real exchange rate and it therefore does not need stabilizing fiscal policy. Hence, the introduction of a balanced budget rule in Germany is consistent with its institutional arrangements and with the achievement of stability. It is interesting to note that federal nations such as the USA, Canada, Australia and Germany typically combine balanced budget rules at the sub-national level, substantial federal stabilization via taxes and transfers, and a federal fiscal redistribution scheme. There are much smaller differences in wage-setting systems across states or provinces than is the case across members of the Eurozone. This combination of institutional arrangements is very different from those in the Eurozone.

The introduction of the new fiscal pact in the Eurozone is narrowly focused on deficit bias, which we have argued was not at the root of the Eurozone crisis. Together with the new Macroeconomic Imbalance Procedure (and associated MIP scoreboard, European Commission (2011)), the fiscal compact does not connect macroeconomic imbalances (real exchange rates, current accounts and private sector imbalances) with the inter-relation of fiscal policy and wage-setting mechanisms in a common currency area.

The problems with implementing a sophisticated price-level targeting fiscal policy highlight the need for supply side reforms that can deliver rational wage setting in the

southern countries. Although the focus in this paper has been on the way in which pattern bargaining in Germany is able to deliver wage-setting oriented to the stabilizing real exchange rate, this could be delivered by an appropriately designed wage accord policy or via a deregulated labour market with behaviour like that assumed in the NK model. Any of these could avoid the need for stabilizing fiscal policy. It appears that membership of a CCA is not a sufficient condition for the implementation of such policies or reforms. De Haan (2010) summarizes the evidence that although the adoption of the euro was associated with the acceleration of product market reforms; this was not the case for labour market reforms. The kinds of supply-side reforms proposed in the wake of the Eurozone crisis have multiple targets, including boosting productivity to recover the losses in competitiveness during the 2000s, and reducing the unemployment costs of the necessary disinflation (operating through old Phillips curve mechanisms). Whether they will deliver the permanent changes relevant to stabilization in a common currency area remains to be seen. Unless member countries can establish real-exchange rate oriented wage-setting or are able to deploy fiscal policy effectively for stabilization, they may find it difficult to coexist in a common currency area with countries that can.

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Appendix

Equations for the flexible exchange rate open economy model (Fig. 4b) from Carlin and Soskice (2010).

The open economy *IS* curve is

$$y_{t+1} = A - ar_t + bq_t. \quad (1)$$

Medium-run equilibrium is defined by $y = \bar{y}$ and $r = r^*$. This pins down the equilibrium real exchange rate:

$$\bar{q} = \frac{1}{b}(\bar{y} - A + ar^*). \quad (2)$$

The medium run equilibrium is characterized by

$$y = \bar{y}; q = \bar{q}; r = r^* \text{ and } \pi = \pi^T.$$

We assume that home's inflation target is equal to world inflation, $\pi^T = \pi^*$.

(Phillips Curve, *PC*)
$$\pi_t = \pi_{t-1} + \alpha(y_t - \bar{y}). \quad (3)$$

(Monetary Rule, *MR*)
$$(y_t - \bar{y}) = -\alpha\beta(\pi_t - \pi^T). \quad (4)$$

From equations (3) and (4), the decline of the deviations of inflation from target and output from equilibrium is:

$$\begin{aligned} (\pi_t - \pi^T) &= (\pi_{t-1} - \pi^T) - \alpha^2\beta(\pi_t - \pi^T) \\ \rightarrow \frac{(\pi_t - \pi^T)}{(\pi_{t-1} - \pi^T)} &= \frac{1}{1 + \alpha^2\beta} \equiv \lambda = \frac{y_t - \bar{y}}{y_{t-1} - \bar{y}} \end{aligned} \quad (5)$$

Assuming that the central bank reduces the interest rate deviation linearly, we can show that it does this at the same rate as the output gap falls.⁹

We therefore have:

$$r_{t+1} - r^* = \lambda(r_t - r^*) \quad (6)$$

⁹ Let y , r and q be in deviation terms. Let $r_t = \rho r_{t-1}$ and $y_t = \lambda y_{t-1}$ along the optimal adjustment path. We will show $\rho = \lambda$.

$$\begin{aligned} y_{t+1} &= -ar_t + bq_t \\ -q_t &= \sum_{i=0}^{\infty} r_{t+i} = r_t[1 + \rho + \rho^2 + \dots] = \frac{r_t}{1 - \rho} \\ \rightarrow y_{t+1} &= -\left(a + \frac{b}{1 - \rho}\right)r_t \\ \rightarrow y_t &= -\left(a + \frac{b}{1 - \rho}\right)r_{t-1} \\ \rightarrow \frac{y_{t+1}}{y_t} &= \frac{r_t}{r_{t-1}} \\ \therefore \rho &= \lambda \end{aligned}$$

Hence the cumulative interest gain from holding home bonds during the adjustment process is

$$\sum_{t=0}^{\infty} (r_t - r^*) = (r_0 - r^*) [1 + \lambda + \lambda^2 + \dots] = (r_0 - r^*) / (1 - \lambda).$$

By the real *UIP* condition¹⁰, this must be equal to the expected real depreciation over the whole period of adjustment, $\bar{q} - q_0$, implying

$$\frac{r_0 - r^*}{1 - \lambda} = \bar{q} - q_0 \quad (7)$$

We substitute for $(q_0 - \bar{q})$ in the *IS* equation using equation (7) :

$$\begin{aligned} y_1 - \bar{y} &= -a(r_0 - r^*) + b(q_0 - \bar{q}) \\ &= -\left(a + \frac{b}{1 - \lambda}\right)(r_0 - r^*) \text{ and in general,} \\ y_t - \bar{y} &= -\left(a + \frac{b}{1 - \lambda}\right)(r_{t-1} - r^*). \end{aligned} \quad (8)$$

Equation (8) pins down the interest rate the central bank has to set to achieve its desired output gap in response to a shock, given the rational expectations behaviour of the foreign exchange market. In Fig 4b, this equation defines the path along which the economy moves from C to D to Z.

¹⁰ The *UIP* condition is that $i_t - i^* = e_{t+1}^E - e_t$ where e_{t+1}^E is the log of the nominal exchange rate expected in $t + 1$ and i is the nominal interest rate. Adding $-\pi_{t+1}^E + \pi_{t+1}^{*E}$ to both sides and rearranging the RHS implies the real *UIP* condition $r_t - r^* = q_{t+1}^E - q_t$. Summing both sides over the whole adjustment period, letting $N \rightarrow \infty$, and noting $q_N^E \rightarrow \bar{q}$, we have:

$$\lim_{N \rightarrow \infty} \sum_{t=0}^N (r_t - r^*) = \lim_{N \rightarrow \infty} (q_N^E - q_{N-1}^E) + (q_{N-1}^E - q_{N-2}^E) + \dots + (q_2^E - q_1^E) + (q_1^E - q_0) = \frac{r_0 - r^*}{1 - \lambda} = \bar{q} - q_0.$$