University of Rome III

From the SelectedWorks of Lilia Cavallari

2004

Inflationary performance in a monetary union with large wage-setters

Lilia Cavallari

Available at: https://works.bepress.com/lilia_cavallari/20/

12 Inflationary performance in a monetary union with large wage setters

Lilia Cavallari

1 Introduction

In the literature on international monetary policy games, the switch from uncoordinated national monetary policies to a monetary union is generally argued to lead to higher inflation. One reason why the formation of a monetary union is likely to raise inflation for a given level of employment is that the unified central bank's incentive to boost employment is no longer restrained by the cost of the exchange rate depreciation that follows unilateral monetary expansions (Rogoff 1985a). Higher inflation may then result as a consequence of rational agents anticipating the central bank's attempt to create surprise inflation.

A further channel leading to higher inflation has been recently stressed in the literature on strategic wage setting. Basically, it is argued that wage setters may be induced to behave more aggressively in a monetary union as they perceive an increase in their wages to have a smaller impact on the union-wide inflation rate relative to the one on their country-specific inflation rate.[1]

As the move to a monetary union alters the strategic environment faced by the central bank and labour unions, the incentives of *both* actors should be explicitly accounted for when analysing the macroeconomic impact of such a monetary policy regime shift.[2] In this chapter, we accomplish this task in a simple general-equilibrium setup in the tradition of the new open economy macroeconomics. Drawing on Cavallari (2001b), we model a two-region world

The present chapter benefited from comments by Lars Calmfors, Jürgen von Hagen and my discussant Fabrizio Coricelli. I would also like to thank participants in seminars at the Centre for European Integration Studies of the University of Bonn, the Institute for International Economic Studies of the University of Stockholm and at the conferences of the Royal Economic Society 2001 and 'EMU Macroeconomic Institutions'. Financial support from MURST is gratefully acknowledged.

[1] This point has been stressed by Zervoyanni (1997), Grüner and Hefeker (1999), Cukierman and Lippi (2001), Coricelli, Cukierman and Dalmazzo (2000b) and Soskice and Iversen (1998) among others.

[2] The impact of monetary unification on the nature of the game between monetary authorities and labour unions is analysed by among others, Carmignani, Muscatelli and Tirelli (2001) and Rantala (2001).

economy characterised by unionised labour markets and imperfect competition in both the factor and goods markets.

While moving to a monetary union unambiguously increases the central bank's temptation to inflate, the model in this chapter shows that such a monetary policy regime shift may either favour or inhibit wage discipline. Wage setters are found to behave less aggressively in the monetary union relative to a regime of independent monetary policies, provided there are monopoly distortions in the labour market.

For an intuitive account of this result, consider the unions' perception of the inflationary consequences of their wage claims in the two monetary policy regimes. Under sovereign monetary policies, each union understands that the increase in its own wage raises domestic inflation to an extent that is larger the bigger the union and the lower the central bank's inflation aversion. When switching to a monetary union, the impact of domestic wages on the union-wide inflation rate is diluted, thereby reducing unions' inflation awareness. This has two contrasting effects on wage behaviour. On the one side, wage setters expect less competition from other unions and may then be induced to demand higher wages. On the other side, however, they also perceive their wage claims to affect negatively the real wage and aggregate demand, favouring wage restraint.

Our analysis further shows that, when the establishment of a monetary union leads to higher employment, this generally comes at the cost of higher inflation unless wage setting is fully centralised in the monetary union. International coordination in wage setting makes international monetary policy cooperation effective in reducing wage inflation at no employment costs, in contrast to what is claimed in Rogoff (1985a).[3] In our setup, wage centralisation in the monetary union may lead the economy to the first-best allocation, namely to an equilibrium with zero inflation and competitive output. This happens provided the central bank is not ultra-liberal, i.e. provided the common central bank cares about inflation. It is worth stressing that it does not matter how conservative the central bank is, even a very small aversion towards inflation on the part of the central bank is sufficient for the optimal monetary policy to be time-consistent.

Since the contributions by Velasco and Guzzo (1999) and Cukierman and Lippi (1999), it is well known that monetary institutions may permanently affect the trade-off between inflation and unemployment by affecting strategic wage setting. The results in this chapter extend this insight to a particular monetary policy regime shift, by showing that the macroeconomic consequences of establishing a monetary union may depend in a non-linear way on wage bargaining institutions.[4]

[3] Unionisation and international monetary policy cooperation is discussed in Jensen (1997).

[4] The significance of unionised wage setting for the optimal design of central banking institutions in a closed economy is analysed by among others, Lawler (2000) and Soskice and Iversen (2000).

Strategic interactions between the central bank and wage setters as those analysed in this chapter may play a role in the macroeconomic performance in the EMU, as several European countries are characterised by intermediate to high centralisation in wage bargaining.[5] Our results stress the harmful consequences of establishing the anti-inflation credentials of the European Central Bank (ECB) through the standard way of reputation building when labour markets are unionised and imperfectly competitive. In these circumstances, in fact, wage restraint may be favoured in the monetary union without any need to appoint an ultra-conservative central banker at the ECB and imparting a 'deflationary bias' in the conduct of European monetary policy. This, besides the usual costs in terms of employment, may turn out to threaten the ECB's anti-inflationary credibility.[6]

The analysis in this chapter is closely related to a contribution by Cukierman and Lippi (2001) on the implications of monetary unification for strategic wage behaviour. Three main distinguishing features characterise our approach. Firstly, we explicitly derive demands for both labour and goods from profit and utility maximisation, while Cukierman and Lippi adopt a partial equilibrium approach. Secondly, our framework encompasses trade across the countries in the monetary union and considers optimal price setting by monopolistic firms. Finally, we make a first step towards a welfare-based analysis of the strategic interaction between central banks and wage setters by specifying preferences for unions and the central bank that are consistent with the behavioural analysis. Building on our micro-founded framework, we are able to show that monetary unification may induce a more or less aggressive wage behaviour, while only the former effect may appear in the Cukierman-Lippi model.

The chapter is structured as follows. Section 2 models the two-country world economy. Section 3 describes the one-shot, three-stage game between the central bank, unions and firms in the two monetary policy regimes. In section 4, the equilibrium outcomes under independent monetary policies and a monetary union are compared in the case of uncoordinated national wage setting as well as under international wage centralisation.

2 The world economy

We model a world economy that consists of two equally sized regions, Home and Foreign. Home is inhabited by a continuum of agents $j \in (0,1/2]$. Agents

[5] Calmfors (2001) provides a comprehensive survey of the literature on nominal wage bargaining within the EMU, focusing on the link between institutions and macroeconomic performance as well as on the likely effects of EMU on wage setting.

[6] This accords with the views expressed in Allsopp and Vines (1998) favouring the development of an appropriate reaction function rather than the establishment of a tough anti-inflationary reputation as the main task of the ECB. A similar conclusion is drawn by Bean (1998).

living in Foreign are indexed by $j \in [1/2,1)$. In our notation, foreign variables are denoted by an asterisk. Each country specialises in the production of a traded good that can be manufactured in a variety of brands indexed by $z \in (0,1)$. Labour is the only factor of production and is supplied in a variety of labour types defined in the interval (0,1).

Workers in the home country are organised in $n > 1$ labour unions, each of size $1/n$, while in the foreign country there are $n^* > 1$ union size $1/n^*$. In this setup, the degree of wage centralisation is proportional to union size and is higher the smaller the number of unions that bargain independently in the economy.

2.1 Technology

Home's production function exhibits decreasing returns to scale relative to the labour input

$$Y = \left[\int_0^1 \ell_i^{\frac{\phi-1}{\phi}} \mathrm{d}i\right]^{\frac{\alpha\phi}{\phi-1}}, \tag{12.1}$$

where Y is output of the home good, ℓ_i is labour of type $i, \alpha < 1$ and the parameter $\phi > 1$ captures the degree of substitutability among different labour types.

Let W_i represent the nominal wage of worker i. Then the price index for labour inputs is defined as the minimal nominal cost of producing a unit of output

$$W = \left[\int_0^1 W_i^{1-\phi)} \mathrm{d}i\right]^{\frac{1}{1-\phi}}. \tag{12.2}$$

Cost minimisation implies the following demand for each labour type i:

$$\ell_i = \left(\frac{W_i}{W}\right)^{-\phi} \left(\frac{W}{P\alpha}\right)^{-\frac{1}{1-\alpha}}. \tag{12.3}$$

2.2 Preferences of . . .

2.2.1 . . . consumers Agents in the world economy consume the same basket of goods and derive utility from consumption and leisure:

$$U_j = \ln C_j - \frac{\kappa}{2}(\ln \ell_j)^2, \tag{12.4}$$

where the real consumption index C aggregates consumption of the domestic good, C_H, and the foreign good, C_F:

$$C = C_H^{\frac{1}{2}} C_F^{\frac{1}{2}} \tag{12.5}$$

Each good can appear in an infinite variety of imperfectly substitutable brands (or types), all of which are consumed in the world economy. We define the

following consumption sub-indexes:

$$C_H = \left[\int_0^1 C_{Hz}^{(\frac{\theta-1}{\theta})}\mathrm{d}z\right]^{\frac{\theta}{\theta-1}}$$
$$C_F = \left[\int_0^1 C_{Fz}^{\left(\frac{\theta-1}{\theta}\right)}\mathrm{d}z\right]^{\frac{\theta}{\theta-1}}, \tag{12.6}$$

where $\theta > 1$ captures the elasticity of substitution among different brands of home and foreign goods, while the elasticity of substitution between the home and foreign type of good is equal to one according to (12.5).

Given additive separable preferences and Cobb–Douglas consumption indexes, it is easy to show that each firm faces a demand for the brand it produces that depends on its relative price and on world consumption

$$Y_z = \frac{1}{2}\left(\frac{P_{Hz}}{P_H}\right)^{-\theta}\left(C + C^*\right), \tag{12.7}$$

where P_{Hz} is the price for a home good of type z and $[\int_0^1 P_{ZH}^{(1-\theta)}\mathrm{d}z]^{\frac{1}{1-\theta}}$ is the price index of domestic goods.

2.2.2 . . . the central bank In the tradition of the literature on time inconsistency in monetary policy, we assume that the monetary authority dislikes inflation while caring about the real performance in the economy, which in our setup coincides with agents' utility. We consider two monetary regimes, namely a regime of independent, non-cooperative national monetary policies and a monetary union.

Under sovereign monetary policies, the domestic and foreign central banks aim at country-specific targets:

$$\Omega = 2\int_0^{\frac{1}{2}} U_j\mathrm{d}j - \frac{\beta}{2}\pi^2$$
$$\Omega^* = 2\int_{\frac{1}{2}}^1 U_{j^*}\mathrm{d}j^* - \frac{\beta}{2}\pi^{*2}, \tag{12.8}$$

where π and $\pi*$ are, respectively, the domestic and foreign inflation rates. The parameter β captures the weight of inflation relative to other policy targets and represents the central bank's degree of 'conservativeness' (Rogoff 1985b).

The common central bank similarly cares about the average utility of the agents in the monetary union while disliking union-wide inflation

$$\Omega^U = 2\left[\int_0^{\frac{1}{2}} U_j\mathrm{d}j + \int_{\frac{1}{2}}^1 U_j^*\mathrm{d}j^*\right] - \frac{\beta}{2}\pi^2, \tag{12.9}$$

where we have used the fact that with the consumer price index (12.13) and an irrevocably fixed nominal exchange rate the inflation rates are equalised across countries. In specifying the central bank's preferences (12.8) and (12.9), we assume that monetary conservativeness does not vary, so as to focus on inflation targeting as the sole difference across monetary regimes.

2.2.3 . . . unions In the theory of trade-union behaviour as surveyed by Oswald (1982), the unions' objective function depends on their sectorial interests, usually specified in terms of real wages and unemployment. In our micro-founded framework, this is equivalent to assuming that each domestic and foreign union is interested in the average utility of its own members

$$\Psi_i = n \int_{i-n^{-1}}^{i} U_j \mathrm{d}j$$

$$\Psi_i^* = n^* \int_{i-n^{*-1}}^{i} U_{j^*} \mathrm{d}j^*. \tag{12.10}$$

By relying on preferences that are consistent with the behavioural assumptions in the model, this specification provides a natural benchmark for welfare comparison across monetary regimes.

It is worth noticing that we abstract from inflation aversion on the part of unions so as to focus on the monetary policy regime shift as the sole incentive for wage restraint.[7]

2.3 Resource constraints

While markets are complete domestically (everyone owns an equal share of all domestic firms), there is no international equity trade. This assumption is benign since, given Cobb–Douglas preferences over domestic and foreign goods (12.5) and separable utility functions (12.4), international equity trade is redundant (Corsetti and Pesenti 2001).

Each agent in the economy needs cash in advance so as to pay for nominal expenses,

$$M_j \geqslant PC_j, \tag{12.11}$$

and faces the following budget constraint:

$$M_j + PC_j = M_j^0 + W\ell_j + D_j + T_j, \tag{12.12}$$

where M_j are money balances, D_j nominal aggregate profits, T_j nominal transfers from the government and P is the consumer price index. It is easy to show

[7] Soskice and Iversen (2001), Cukierman and Lippi (2001) and Grüner and Hefeker (1999) analyse the macroeconomic impact of monetary unification when unions are averse to inflation.

that:

$$P = P_H^{\frac{1}{2}} P_F^{\frac{1}{2}}, \tag{12.13}$$

where P_F is the domestic-currency price of the foreign good. It is worth stressing that the law of one price holds in our model, so that $P_F = \varepsilon P^*_{\mathrm{F}}$, where ε is the nominal exchange rate in home currency and P^*_F the foreign-currency price of the foreign good.

The home government is assumed to rebate all seignorage revenue in the form of lump-sum transfers to households

$$\int_0^{\frac{1}{2}} M_j - M_j^0 \mathrm{d}j = \int_0^{\frac{1}{2}} T_j \mathrm{d}j. \tag{12.14}$$

Finally, the domestic goods market clears when

$$Y \geqslant \left(\frac{P}{P_H}\right) \frac{1}{2}(C + C^*), \tag{12.15}$$

where the law of one price and purchasing power parity are used in deriving the aggregate resource constraint (12.15).

A representation parallel to (12.1)–(12.15) exists for the Foreign economy.

2.4 A useful reduced form

As a first step in solving our model, we derive the domestic and foreign current account by integrating the agents' budget constraints (12.12) in, respectively, the interval $(0, \frac{1}{2}]$ and $[\frac{1}{2}, 1)$. Using the domestic aggregate resource constraint (12.15), the government budget constraint (12.14) and their foreign analogues into the resulting expressions, it is immediate to show that consumption is equalised across countries:

$$C = C^*. \tag{12.16}$$

This is not surprising, as full international risk sharing is a standard result within this class of models (Corsetti and Pesenti 2001). As the equilibrium current account is always balanced, the nominal exchange rate is proportional to nominal spending and coincides with relative money supply:

$$\varepsilon = \frac{PC}{P^*C^*} = \frac{M}{M^*}. \tag{12.17}$$

It is worth stressing that equations (12.15), (12.11) and (12.16) imply that aggregate demand is proportional to money supply, as one would expect in a

framework with nominal rigidities:

$$Y = \frac{M}{P_H}$$
$$Y^* = \frac{M^*}{P_F^*}. \tag{12.18}$$

In each country, two reduced-form equations are needed in order to study the monetary policy game. The first is obtained by taking logarithms of labour demand (12.3), yielding

$$\ln \ell_i = -\phi (w_i - w) - \frac{1}{1-\alpha} (w - p), \tag{12.19}$$

where w_i is the growth of the nominal wage of labour of type i, w is the aggregate nominal wage growth and p is (the log of) the consumer price index.[8]

Finally, (the log of) domestic real consumption c_i is obtained by substituting labour demand (12.3) into the individual budget constraint (12.12) and taking logarithms:

$$c_i = (1-\phi)(w_i - w) - \frac{\alpha}{1-\alpha} (w - p). \tag{12.20}$$

Two equations parallel to (12.19)–(12.20) hold for the foreign country.

3 Strategic monetary policy

We consider a one-shot, three-stage game between firms, monetary authorities and labour unions in a monetary union, U, and in a regime of sovereign national monetary policies, N.

In the first stage, each union sets the rate of growth of the nominal wage of its members in an uncoordinated way relative to both foreign and other domestic unions. Unions are Stackelberg leaders vis-à-vis the central bank while playing Nash relative to other unions. These rules of the game reflect the presence of nominal rigidities in labour markets.[9]

After wages are set, the common central bank chooses the union-wide money supply in an attempt to control inflation in the monetary union and

[8] By normalising the previous period nominal wage to unity, the current nominal wage can be expressed as

$$W_i = 1 + w_i,$$

where w_i is the percentage increase in the nominal wage of worker i. In the text, the following approximations are used: $\ln(W_i/W) = w_i - w$ and $\ln(W/P) = w - p$.

[9] Jerger (2002) provides an example of strategic nominal wage bargaining where unions act non-cooperatively relative to both other unions and the central bank.

distributes money symmetrically across regions. Sovereign central banks, instead, choose the country-specific money supply in the uncoordinated monetary policy regime.

In the last stage, taking the general price level as given, each firm sets the price of its own brand so as to maximise profits.[10] The backward solution of the game provides the general equilibrium of the economy.

3.1 Price setting

Profit maximisation implies that the price for brand z of the domestic and foreign good is proportional to, respectively, domestic and foreign real wages and real money balances:

$$p_{Hz} - p_H = \frac{\alpha}{1+\theta-\alpha\theta}(w - p_H) + \frac{1-\alpha}{1+\theta-\alpha\theta}(m - p)$$
$$p^*_{Fz} - p^*_F = \frac{\alpha}{1+\theta-\alpha\theta}(w^* - p^*_F) + \frac{1-\alpha}{1+\theta-\alpha\theta}(m^* - p^*). \tag{12.21}$$

Each firm charges a higher price for its own brand following a rise in marginal costs or an increase in aggregate demand.

In a symmetric equilibrium, where $p_{Hz} = p_H$ and $P^*_{Fz} = p^*_F$ for all z, real money balances are negatively related to real aggregate wages:

$$m - p = \frac{-\alpha}{1-\alpha}(w - p_H)$$
$$m^* - p^* = \frac{-\alpha}{1-\alpha}(w^* - p^*_F). \tag{12.22}$$

Recalling the definition of the consumer price index (12.13), and using the nominal exchange rate (12.17), equations (12.22) imply that the general price level in each country can be written in terms of domestic and foreign wages and money supplies:

$$p = \pi = \frac{\alpha}{2}(w + w^*) + \frac{2-\alpha}{2}m - \frac{\alpha}{2}m^*$$
$$p^* = \pi^* = \frac{\alpha}{2}(w + w^*) + \frac{2-\alpha}{2}m^* - \frac{\alpha}{2}m, \tag{12.23}$$

where the first equalities follow after normalising the previous period price level to one.

[10] Coricelli, Cukierman and Dalmazzo (2000a) originally considered optimal price setting in the literature on nominal wage bargaining.

3.2 Optimal monetary policy

With independent monetary policy, the domestic central bank chooses domestic money supply so as to maximise (12.8) subject to (12.19) and (12.20) and taking into account optimal price setting by monopolistic firms (12.22) in the home country. This yields the reaction function

$$\frac{\alpha}{2} - \frac{(2-\alpha)}{(1-\alpha)}\kappa \int_0^{1/2} \ln \ell_j \mathrm{d}j - \beta\pi \left(1 - \frac{\alpha}{2}\right) = 0. \tag{12.24}$$

An equation similar to (12.24) describes the behaviour of the foreign central bank. Using reduced-form employment (12.19) in (12.24), it is apparent that monetary authorities will raise inflation in an attempt to boost output – which is suboptimally low owing to monopolistic distortions – up to the point where the marginal benefit of doing so (the first two terms on the left-hand side of (12.24)) equals the marginal cost.

The reaction functions of the domestic and foreign central banks are common knowledge for wage-setters, who can easily calculate the inflationary impact of an increase in their nominal wage growth

$$\begin{aligned} \frac{\partial \pi}{\partial w_j} &= \frac{\kappa}{n[\kappa + \beta (1-\alpha)^2]} \equiv s^N \in (0, 1) \\ \frac{\partial \pi^*}{\partial w_j^*} &= \frac{\kappa}{n^*[\kappa + \beta (1-\alpha)^2]} \equiv s^{*N} \in (0, 1)\,. \end{aligned} \tag{12.25}$$

Unions' perception of the inflationary impact of an increase in the nominal wage of their members is positively related to union size ($1/n$ in our specification) and negatively related to monetary conservativeness. A very conservative central bank may even counteract wage pressure by restricting money supply, while a liberal central bank always accommodates it. This can easily be seen by taking the partial derivative of money supply in the reaction function (12.24) relative to the domestic wage. In so doing, we obtain

$$sign\left(\frac{\partial m}{\partial w}\right) = sign\left(\frac{\kappa\,(1-\alpha/2)}{\alpha/2\,(1-\alpha)^2} - \beta\right),$$

where it is apparent that a sufficiently conservative central bank, i.e. when $\beta > \kappa\ (1-\alpha/2)\ /\alpha/2\ (1-\alpha)^2$, contracts money supply in the wake of an increase in nominal wages.

In the monetary union, the common central bank chooses the union-wide money supply so as to maximise the utility of all agents in the union, (12.9), subject to (12.19), (12.20) and their foreign analogues, as well as taking into account optimal price setting by monopolistic firms (12.22) at home and abroad.

The central bank's optimal strategy is:

$$\frac{\alpha}{2} - 2\kappa \int_0^{1/2} \ln \ell_j \mathrm{d}j - 2\kappa \int_{1/2}^{1} \ln \ell_j^* \mathrm{d}j^* - \pi \frac{(1-\alpha)\beta}{2} = 0. \tag{12.26}$$

As before, the common central bank balances marginal costs and benefits of raising union-wide inflation. However, while the marginal benefit of higher inflation (and output) does not change across monetary regimes, the cost of a 1% increase in union-wide inflation halves relative to the regime with sovereign monetary policies. This is due to the disappearance of exchange rate costs in the monetary union.

Building on (12.26), domestic and foreign unions calculate the union-wide inflationary impact of their wage claims

$$\begin{aligned} \frac{\partial \pi}{\partial w_j} &= \frac{\kappa}{n[2\kappa + \beta(1-\alpha)^2]} \equiv s^U \\ \frac{\partial \pi}{\partial w_j^*} &= \frac{\kappa}{n^*[2\kappa + \beta(1-\alpha)^2]} \equiv s^{*U}. \end{aligned} \tag{12.27}$$

Comparing (12.25) and (12.27), it appears that the move from sovereign monetary policies to the monetary union reduces the perception on the part of unions of the inflationary consequences of their wage claims. This is due to the weaker bargaining position of unions vis-à-vis the common central bank. It is worth stressing that unions' inflation awareness reduces in the monetary union despite the higher incentive to raise inflation and accommodate wage pressure of the common central bank relative to sovereign monetary authorities.

3.3 Wage setting

Under simultaneous bargaining, each union sets the rate of growth of the nominal wage of its members so as to maximise (12.10) subject to (12.19), (12.20), the central bank's reaction function in the appropriate monetary policy regime, i.e. (12.24) or (12.26), and taking as given the nominal wages set by other unions at home and abroad. The optimal non-cooperative strategy of the domestic union i is

$$\alpha(1 - s^r - \xi^r) + \xi^r \kappa \ln \ell_i = 0, \tag{12.28}$$

where ξ^r is the elasticity of labour demand to the nominal wage of union i in the monetary policy regime $r = U, N$:

$$\xi^r \equiv -\frac{\mathrm{d} \ln \ell_i}{\mathrm{d} \ln w_i} = \phi \left(1 - \frac{1}{n}\right) + \frac{1}{1-\alpha}\left(\frac{1}{n} - s^r\right). \tag{12.29}$$

An analogous equation describes the behaviour of the foreign union. A unitary increase in the nominal wage of union i has two contrasting effects on its members' utility. On one side, utility decreases since consumption reduces (this is captured by the term in brackets in (12.28)), while on the other side the increase in leisure raises utility.[11] Each union's optimal nominal wage is then set so as to balance these costs and benefits.

Drawing on the constant relation between increases in nominal and real relative wages, $\mathrm{d}w_i/\mathrm{d}\ln(W_i/P) = 1/(1-s^r)$, we can cast the first order condition (12.28) in terms of the real effects of the union's nominal wage, obtaining

$$\ln \ell_i = \frac{\alpha}{\kappa}\left(1 - \frac{1}{\eta^r}\right), \tag{12.30}$$

where $\eta^r \equiv \xi^r/(1-s^r)$ is the elasticity of the demand for labour of type i to the real relative wage in regime r. Using (12.29) and (12.25) or (12.27) when appropriate, the elasticity of labour demand to the real wage in the two monetary regimes can be easily expressed in terms of the model's parameters:

$$\begin{aligned}
\eta^N &= \frac{\phi\left(1-\frac{1}{n}\right) + \frac{1}{1-\alpha}\left(\frac{1}{n} - \frac{\kappa}{n\left[\kappa+\beta(1-\alpha)^2\right]}\right)}{1 - \frac{\kappa}{n\left[\kappa+\beta(1-\alpha)^2\right]}} \\
\eta^U &= \frac{\phi\left(1-\frac{1}{n}\right) + \frac{1}{1-\alpha}\left(\frac{1}{n} - \frac{\kappa}{n\left[2\kappa+\beta(1-\alpha)^2\right]}\right)}{1 - \frac{\kappa}{n\left[2\kappa+\beta(1-\alpha)^2\right]}}
\end{aligned} \tag{12.31}$$

Interpreting equation (12.30), it appears that unions are induced to raise nominal wages when they expect this to have small consequences for employment, namely when the elasticity of labour demand is low. The move from sovereign monetary policy to a monetary union may change the incentives for wage restraint by affecting the perception on the part of unions of the inflationary consequences of their wage hikes.

As discussed above, the monetary regime shift reduces unions' inflation awareness. This, in turn, has two opposing effects on strategic wage behaviour. On the one side, each union expects an increase in the nominal wage of its members to lead to a higher increase in the real aggregate wage and hence a larger contraction of aggregate demand. The employment consequences of wage aggressiveness are high in this case, favouring wage restraint.[12]

On the other side, however, when unions perceive the inflationary impact of their wages to be small, they also expect the real wage of other unions to

[11] The overall effect of the increase in the nominal wage of union i on consumption is negative, since the effect of the increase in the real wage $(1-s)$ is smaller than the reduction in labour demand (ξ).

[12] This is akin to the adverse output effect discussed in Lippi (1999).

decrease to a lesser extent, which in turn implies that the shift of labour demand towards cheaper labour types is small. The adverse competition effect favours wage aggressiveness.[13]

Which of these two contrasting effects prevails depends on monopoly distortions in labour markets. Comparing the elasticity of labour demand across monetary regimes, it appears that the move to a monetary union favours wage restraint whenever monopoly distortions are not too low. Using (12.31), it is easy to show that

$$\eta^U - \eta^N \geq 0 \text{ iff } \phi \leq \frac{1}{1-\alpha}.$$

4 Macroeconomic performance and the monetary policy regime

Under uncoordinated national monetary policies, the domestic and foreign inflation rates can be obtained by combining the respective unions' equilibrium strategies (12.28) in a symmetric equilibrium, $\ell_i = \ell$, with the central bank's reaction function (12.24), which yields the area-wide average inflation rate

$$\pi^N = \frac{\alpha}{2(1-\alpha)\beta}\left(\frac{1}{\eta^N} + \frac{1}{\eta^{*N}}\right). \tag{12.32}$$

For the well-known reason discussed in Kydland and Prescott (1977) and Barro and Gordon (1983), equilibrium inflation is suboptimally positive. Other than on central bank's inflation aversion, β, the economy's inflationary bias depends on labour market features as synthesised in the elasticities η^N and η^{*N}. Using (12.31) it is easy to verify that inflation is higher the less substitutable the different types of labour and the more decentralised the wage bargaining structure.[14]

A similar procedure that combines (12.28) and (12.26) yields the equilibrium inflation rate in the monetary union

$$\pi^U = \frac{\alpha}{(1-\alpha)\beta}\left(\frac{1}{\eta^U} + \frac{1}{\eta^{*U}}\right). \tag{12.33}$$

Employment in the two monetary regimes is given by equation (12.30) evaluated in a symmetric equilibrium where $\ell_i = \ell$

Comparing the macroeconomic performance in the two monetary regimes using equations (12.32), (12.33) and (12.30), it appears that in the absence of

[13] A lower incentive for wage restraint is a common result in the literature. Alternative mechanisms leading to wage aggressiveness in the monetary union are discussed, among others, by Grüner and Hefeker (1999), Cukierman and Lippi (2001), Soskice and Iversen (2001) and Coricelli, Cukierman and Dalmazzo (2000b).

[14] This accords with the analysis in Cubitt (1995) and Calmfors and Driffil (1998).

strategic effects – namely, when $\eta^U = \eta^N$ and $\eta^{*U} = \eta^{*N}$ – inflation under sovereign monetary policies is unambiguously lower than in a monetary union for a given level of employment. The reason the move to a monetary union raises inflation is the stronger incentive of the common central bank to resort to surprise inflation relative to national central banks (Rogoff 1985a).[15] This matches with the empirical regularity documented by Romer (1993) showing that open economies display lower inflation in a broad cross-section of countries.[16]

When wage setters are large, however, the move to a monetary union also affects wage behaviour and, as our analysis above shows, it does so in a way that crucially depends on monopoly distortions in labour markets. When labour types are poor substitutes for each other, i.e. when the adverse competition effect is low, the establishment of a monetary union favours wage restraint, the more so the more liberal is the central bank. In our setup, however, wage discipline is unable to compensate for the increase in the union-wide inflationary bias due to central bank behaviour. Higher employment can be obtained solely at the cost of higher inflation.

4.1 International wage coordination

It is useful to investigate in which circumstances wage restraint in the monetary union is sufficiently strong to reduce inflation at no employment cost. A natural candidate is the case of union-wide wage coordination, where wage discipline is at its best. Intuitively, a coordinated increase in nominal wages in the monetary union reduces union-wide aggregate demand, which in turn decreases union-wide employment. The perception of heavy employment consequences of wage pressure disciplines wage behaviour.[17]

A more formal argument in favour of international wage coordination in the monetary union can be provided by considering a supranational union that sets domestic and foreign nominal wages so as to maximise the utility of the population in the monetary union. In our setup, this is equivalent to assuming that there is a single monopoly union, namely that $n = n^* = 1$. It is worth noticing that regions in the monetary union are perfectly symmetric in this case, which in turn implies that in equilibrium domestic and foreign wages are equalised.

[15] As apparent in (12.24) and (12.26), the central bank's incentive to inflate is negatively related to the economy's degree of trade openness. In our setup, the degree of openness is 1/2 under independent monetary policies, while the monetary union is a closed economy.

[16] See also Lane (1997) and Campillo and Miron (1997), among others. Cavallari (2001a) investigates the link between inflation and openness when wage setters are large.

[17] As recently stressed in the literature on nominal wage bargaining, monetary unification is likely to alter the structure of wage setting across member countries. Calmfors (2001), for example, argues in favour of less centralisation in wage setting as a result of monetary unification. Holden (1999), instead, stresses the gains to wage centralisation in a monetary union.

Two features characterise the strategic behaviour of the supranational union relative to large non-coordinated unions. The first is the perception of the inflationary consequences of an increase in the union-wide nominal wage. Taking the partial derivative of inflation in the monetary reaction function (12.26) relative to the aggregate union-wide wage, we obtain

$$s^W = \frac{\kappa}{[\kappa + \beta (1 - \alpha)^2]}. \tag{12.34}$$

Comparing (12.25) and (12.34), it is easy to verify that the supranational union fully internalises the impact of wage claims on the union-wide inflation rate and perceives higher inflationary consequences of wage pressure relative to unions that act in a non-cooperative way. In contrast to the case with large but uncoordinated unions, however, inflation awareness unambiguously disciplines the behaviour of the monopoly union.

Secondly, the optimal choice of the union-wide wage is such that:

$$\kappa \int_0^1 \ln \ell_j \mathrm{d}j - \alpha = 0. \tag{12.35}$$

Evaluating (12.35) in a symmetric equilibrium, we obtain:

$$\ln \ell_i = \ln \ell = \frac{\alpha}{\kappa}. \tag{12.36}$$

The equation above says that the supranational union sets the union-wide nominal wage so as to restore the perfectly competitive level of employment, namely that which prevails when the elasticity of labour demand to the real wage is infinite.

Plugging (12.36) into the monetary reaction function in the monetary union (12.26) gives an equilibrium inflation rate equal to zero:

$$\beta (1 - \alpha) \pi = 0. \tag{12.37}$$

International wage coordination in the monetary union is able to restore the first-best allocation provided the common central bank cares about inflation, namely provided β is positive. It does not matter how conservative the central bank is, even a tiny aversion towards inflation on the part of the central bank is sufficient for the optimal monetary strategy to be time-consistent. This result is due to the symbiosis of wage and monetary policies when the supranational union and the common central bank have the same objectives.[18] Since both players are interested in the utility of the population in the monetary union, the competitive standard is the bliss point for both of them. In the absence of shocks, once the bliss level of employment is reached, the central bank has no incentive

[18] A similar result is achieved in the strategic interaction between monetary and fiscal policies (Dixit and Lambertini 2000).

to raise inflation and sets money supply so as to deliver zero inflation. Should the central bank be 'ultra-liberal', i.e. β is equal to zero, then the equilibrium inflation rate would be indeterminate.

Our results suggest that the union-wide macroeconomic performance may be improved in terms of *both* inflation and employment when wages are internationally coordinated. Provided the common central bank is not ultra-liberal, the first-best allocation can be attained with employment at the competitive standard and zero inflation.

REFERENCES

Allsopp, C. J. and D. Vines, 1998, 'The Assessment: Macroeconomic Policy after EMU', *Oxford Review of Economic Policy*, 14(3), 1–23.

Barro, R. and D. Gordon,1983, 'A Positive Theory of Monetary Policy in a Natural Rate Model', *Journal of Political Economy* 91, 589–610.

Bean, C. R., 1998, 'The New UK Monetary Arrangements: A View from the Literature', *Economic Journal* 108, 1795–809.

Calmfors, L., 2001, 'Wages and Wage Bargaining Institutions in EMU: A Survey', *Empirica* 28(4), 325–51.

Calmfors, L. and J. Driffill, 1998, 'Bargaining Structure, Corporativism and Macroeconomic Performance', *Economic Policy* 6, 14–61.

Campillo, M. and J. Miron, 1997, 'Why Does Inflation Differ Across Countries?' in C. Romer and D. Romer (eds.), *Reducing Inflation: Motivation and Strategy*, Chicago: Chicago University Press, pp. 335–570.

Carmignani, F., A. Muscatelli and P. Tirelli, 2001, 'Who's Afraid of the Big Bad Central Bank? Union-Firm-Central Bank Interactions and Inflation in a Monetary Union, mimeo, University of Milan La Bicocca.

Cavallari, L. 2001a, 'Inflation and Openness with Non-atomistic Wage-Setters', *Scottish Journal of Political Economy* 48(2), 210–25.

2001b, 'Macroeconomic Performance in a Monetary Union with Large Wage Setters', *Empirica* 28(4), 419–33.

Coricelli, F., A. Cukierman and A. Dalmazzo, 2000a, 'Monetary Institutions, Monopolistic Competition, Unionized Labor Markets and Economic Performance', CEPR Discussion Paper no. 2407.

2000b, 'Economic Performance and Stabilisation Policy in a Monetary Union with Imperfect Labor and Goods Markets', CEPR Discussion Paper no. 2745.

Corsetti, G. and P. Pesenti, 2001, 'Welfare and Macroeconomic Interdependence', *Quarterly Journal of Economics* 116(2), 421–46.

Cubitt, R. P., 1995, 'Corporativism, Monetary Policy and Macroeconomic Performance: A Simple Game Theoretic Analysis', *Scandinavian Journal of Economics* 97, 245–59.

Cukierman, A. and F. Lippi, 1999, 'Central Bank Independence, Centralisation of Wage Bargaining, Inflation and Unemployment: Theory and Some Evidence', *European Economic Review* 43, 1395–434.

2001, 'Labour Markets and Monetary Union: A Strategic Analysis', *Economic Journal* 111, 541–65.

Dixit, A. and L. Lambertini, 2000, 'Symbiosis of Monetary and Fiscal Policies in a Monetary Union', mimeo, University of California Los Angeles.

Grüner, H. P. and C. Hefeker, 1999, 'How Will EMU Affect Inflation and Unemployment in Europe?', *Scandinavian Journal of Economics* 101(1), 33–47.

Holden, S., 1999, 'Monetary Regimes and the Coordination of Wage Setting', mimeo, University of Oslo.

Jensen, H., 1997, 'Monetary Policy Cooperation May Not Be Counterproductive', *Scandinavian Journal of Economics* 99, 73–80.

Jerger, J., 2002, 'How Strong Is the Case for a Populist Central Banker: A Note', *European Economic Review* 46, 623–32.

Kydland, F. and E. Prescott, 1977, 'Rules Rather than Discretion: The Inconsistency of Optimal Plans', *Journal of Political Economy* 85, 473–92.

Lane, P., 1997, 'Inflation in Open Economics', *Journal of International Economics* 42, 327–47.

Lawler, P., 2000, 'Centralised Wage Setting, Inflation Contracts and the Optimal Choice of Central Banker', *Economic Journal* 110, 559–75.

Lippi, F., 1999, 'Strategic Monetary Policy with Non-atomistic Wage Setters: A Case for Non-neutrality', CEPR Discusion Paper no. 2218.

Obstfeld, M. and K. Rogoff, 1996, *Foundations of International Macroeconomics*, Cambridge, MA: MIT Press.

Oswald, A. J., 1982, 'The Microeconomic Theory of Trade Union', *Economic Journal* 92, 576–95.

Rantala, A., 2001, 'Does Monetary Union Reduce Employment?', mimeo, University of Helsinki.

Rogoff, K., 1985a, 'Can International Monetary Policy Cooperation Be Counterproductive?', *Journal of International Economics* 18, 199–217.

1985b, 'The Optimal Degree of Commitment to a Monetary Target', *Quarterly Journal of Economics* 100, 1169–90.

Romer, D., 1993, 'Openness and Inflation: Theory and Evidence', *Quarterly Journal of Economics* 108(4), 869–903.

Soskice, D. and T. Iversen, 1998, 'Multiple Wage-Bargaining Systems in the Single European Currency Area', *Oxford Review of Economic Policy* 14(3), 110–24.

2000, 'The Non-neutrality of Monetary Policy with Large Price or Wage Setters', *Quarterly Journal of Economics* 115, 265–84.

2001, 'Multiple Wage Bargaining Systems in the Single European Currency Area', *Empirica*, 28(4), 435–56.

Velasco, A. and V. Guzzo, 1999, 'The Case for a Populist Central Banker', *European Economic Review* 43, 1317–44.

Zervoyanni, A., 1997, 'Monetary Policy Games and Coalitions in a Two-Country Model with Unionized Wage-Setting', *Oxford Economic Papers* 49, 57–76.