Structural reform and transparency: Closed economy and monetary union analyses ♣

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Abstract

We model the impact of structural reform on macroeconomic developments when the government engages in strategic interaction with the central bank and wage setters. In a closed economy context, we use this underlying model to derive conditions under which it is better for policymakers to be transparent with the public (regarding structural reform). This qualifies the results from the commonly used, reduced form, "expectations augmented Phillips curve" model which favour opaque policies (in reference to central bank forecasts). Our approach attaches a game-theoretical interpretation (in terms of the degree of government transparency) to the Phillips curve shock. These closed economy results are obtained under the assumption that structural reform affects equilibrium unemployment. Our monetary union analysis allows structural reform to also enhance labour market flexibility. We show that, to a first-order approximation, an area-wide "expectations augmented Phillips curve" can be obtained in a model that extends Calmfors' (2001a) workhorse model by incorporating explicit wage bargaining and transparency imperfections. Finally, in a simplified case (a reduced form setup where transparency concerns central bank forecasts, and where we abstract from wage bargaining considerations), we find that transparency may induce more reform activity than opacity.

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Non-technical summary

Structural reforms are often seen as very conducive to an improved functioning of the economy, in particular favouring the adjustment of labour and product markets to unforeseen events. With regard to European countries, the discussions in this area have traditionally been linked to the prospects and/or reality of monetary union membership. Compared with other areas of economics, there has been little research about the role of transparency considerations in the choice and macroeconomic consequences of structural reform. The present paper aims at filling this gap by adopting various perspectives that are deemed relevant.

We model the impact of structural reform on macroeconomic developments when the government engages in strategic interaction with the central bank and wage setters. In a closed economy context, we use this underlying model to derive conditions under which it is better for policymakers to be transparent with the public (regarding structural reform). This qualifies the results from the commonly used, reduced form, "expectations augmented Phillips curve" model which favour opaque policies (in reference to central bank forecasts). Our approach attaches a game-theoretical interpretation (in terms of the degree of government transparency) to the Phillips curve shock. Formally, the same conclusion was reached by Laskar (2010), albeit with a very different interpretation about the underlying informational imperfection. For this author, the Phillips curve shock is a private sector, labour productivity-type disturbance that may be communicated to the public by the central bank as a forecast. Our closed economy analysis interprets the Phillips curve disturbance as a policy (structural reform) shock that may be publicly disclosed by the government. The derivation involves a game-theoretical setup where the government interacts with monetary policymakers and trade unions.

The closed economy results just described are obtained under the assumption that structural reform affects equilibrium unemployment. Our monetary union analysis allows structural reform to also enhance labour market flexibility. We show that, to a first-order approximation, an area-wide "expectations augmented Phillips curve" can be obtained in a model that extends Calmfors' (2001a) workhorse model by incorporating explicit wage bargaining and transparency imperfections. Finally, in a simplified case (a reduced form setup where transparency concerns central bank forecasts, and where we abstract from wage bargaining considerations), we find that transparency may induce more reform activity than opacity.

All of the results presented in this paper have been produced in terms of closed form solutions to linear (or linearised) systems of equations. Future work could consider the use of simulations in a non-linear context for both the more involved cases here considered and possible additional extensions of our analysis. In any case, the limitations of the current state of theoretical work in the field of reform and transparency in a monetary union signal the need for further development. Looking forward, studies in this area could benefit from ongoing interest in reform in EMU as well as the increasing interest in communication and transparency in the economics profession.

1. Introduction

Structural reforms are often seen as very conducive to an improved functioning of the economy, in particular favouring the adjustment of labour and product markets to unforeseen events. With regard to European countries, the discussions in this area have traditionally been linked to the prospects and/or reality of monetary union membership. For instance, the standard approach to optimal currency areas has advocated that labour market flexibility is a key prerequisite for currency union formation (see e.g. De Grauwe, 2003). The idea is that flexible labour markets (be it in terms of wage fluctuations or labour mobility) facilitate the adjustment to idiosyncratic disturbances, which is particularly beneficial after monetary autonomy is relinquished. In contrast with this view that "good" candidates to form an optimal currency union should satisfy some ex-ante criteria, the literature later advanced the principle that the optimality of monetary union participation may be fulfilled ex-post in light of the endogeneity of the suitability conditions. More concretely, it was argued that currency union membership – for instance, by implying deeper integration and possibly encouraging more structural reform – may improve market fundamentals (see e.g. Frankel and Rose, 1998; Calmfors, 2001a and 2001b). One important question about the optimality of currency unions has concerned the latter's implications for the likelihood of common as opposed to country-specific disturbances. By intensifying international trade among participating countries (Rose, 2000), a monetary union has been expected to make business cycles more synchronised among them However, this argument has been challenged because stronger trade integration might make disturbances less correlated across member states as it leads to specialisation and thus raises the likelihood of idiosyncratic shocks (Kalemli-Ozcan et al., 2001).[1] More importantly for this paper, with regard to structural reform it has been natural to think that it has the potential to deal with asymmetric shocks that a common monetary policy can no longer offset. In terms of a currency union's effect on reform incentives, there appears to be a consensus that, in the case of EMU, the pace of the reform process among euro area countries has been rather slow and/or uneven (Brandt et al., 2005; European Commission, 2008; Leiner-Killinger et al., 2007; McQuinn and Whelan, 2008).[2]

[1] Concerning the endogeneity of optimum currency areas in relation to financial integration, Schiavo (2008) reports the ambiguous theoretical channels for inducing more synchronicity as well as supportive evidence in the case of the euro area.

[2] It is not possible to argue that this has been the result of "reform fatigue" since the pace of structural reform in EMU has been deemed slow in the earlier years (1999-2004) following the launch of the Lisbon strategy (see e.g. van Poeck and Borghijs, 2001; IMF, 2004; Duval and Elmeskov, 2006; European Commission, 2008). Høj et al. (2006) finds that structural reform changes among OECD countries can be traced to both factors over which the governments have no leverage (such as economic crises, exposure to

In the recent analyses of structural reform mentioned thus far, informational asymmetries across the key economic agents play no role, which amounts to implicitly downplaying the relevance of communication considerations. Indeed, despite the fact that there have long been debates about the transparency of reformers,[3] over recent years the intensity of this discussion has paled in comparison with the research and policy interest attracted by transparency and accountability in some other areas of economics.[4] Although there have been discussions about how transparent governments should be in undertaking structural reform, this debate has arguably not been as prominent. The need to increase public sector accountability is generally acknowledged (e.g. World Bank, 2009). More generally speaking, incentive and coordination problems are known to arise in the implementation of structural policies among central and local authorities within a given country, as well as between different areas of reform (see e.g. Duval and Vogel, 2008, on the need to make product and labour market reforms compatible).[5] In the European Union case, coordination is also encouraged between countries and EU-policy making in areas of shared competencies (e.g. Berger and Danninger, 2007; Gelauff et al., 2008). The analysis, assessment and communication of structural reforms is certainly not constrained to the governments themselves, with central banks being in a position to contribute in this manner to reform implementation (for the ECB's role, see Leiner-Killinger et al., 2007).[6] At a more general international level, there is an understanding of the informational demands concerning benchmarking and collaboration among major institutions involved in policy reform (e.g. IMF and World Bank, 2004; OECD, 2009).

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foreign competition and government's duration in office) and others over which governments have some influence.

[3] On the theoretical front, reform transparency has been debated e.g. by Hirschmann (1968), Williamson and Haggard (1994), Pierson (1994, 1996), Rodrik (1996) and Arroyo (2008). This literature is not cast in relation to the standard macroeconomic models of reform and central banking. Empirically, Tompson and Dang (2010) find that effective reform communication is fruitful, especially in "normal" times – as opposed to emergency reform conditions – when government actions relate to an electoral mandate.

[4] This interest in particular reaches areas of government activity other than reform. Specific examples are the positive impact of official data announcements on the real economy (Oh and Waldman, 1990; Rodríguez Mora and Schulstald, 2007), and the – at least partially – favourable effect of transparency on fiscal performance (Gavazza and Lizzeri, 2009a, 2009b; Milesi-Ferreti, 2004; Shi and Svensson, 2006). The literature also refers to the more general considerations about public information (not specifically on reform), including the reputational incentives for disclosing/hiding information (Morris, 2001; Ottaviani and Sorensen, 2006) and the link between the dissemination of noisy public information and the use of private information (Morris and Shin,2002; Weill, 2008).

[5] The existence of complementarities between reform initiatives (see e.g. Bassanini and Duval, 2009) also raises the issue of coordination between them in order to reap the maximum overall benefit.

[6] Furthermore, a large number of ECB speeches address the issue of structural reform, in particular mentioning the communication role played by the ECB in connection to the economic reform process. See under http://www.ecb.europa.eu/press/key/date/2010/html/index.en.html.

Despite some interest shown in the link between structural reform and monetary policy, the number of studies in this area explicitly considering transparency imperfections has been scanty. For instance, Calmfors (2001a), which remains to this day the workhorse model for the reform/monetary policy nexus in a currency union context, assumes full transparency throughout the analysis. One paper relaxing this assumption in a euro area context is Hefeker (2006), who investigates the role of monetary policy uncertainty (about central bank preferences) on structural reform. In this paper, which considers both closed economy and monetary union setups, we introduce two novel dimensions for examining structural reform in connection with policymakers' transparency. First, we look at the macroeconomic impact of transparency in the communication of structural reform by governments. Second, we revisit the role of central bank transparency concerning central bank forecasts, which makes our treatment of reform in a monetary union substantially different from the above-mentioned study by Hefeker (2006), who instead addresses central bank transparency about its preferences (i.e. so-called "political" uncertainty).

The present paper pursues the general goal of addressing the role of transparency in the conduct of structural reform and the latter's impact on macroeconomic developments. We do so in the context of models where the government engages in strategic interaction with the central bank and wage setters. Our results proceed in three steps. The first part concerns closed economy results, which characterise when it is better for governments to be transparent with the public about structural reform. These results are obtained under the assumption that structural reform affects equilibrium unemployment. Before proceeding to an underlying game-theoretical examination, we start with a "reduced form" version of the "expectations augmented Phillips curve", i.e. an equation stating that economic activity depends on inflation surprises. The latter is often used in the theoretical literature on monetary policy, which normally reports results against central bank transparency in a context where the underlying behaviour of agents (other than the central bank) is not made explicit.[7] In connection with this, the present paper benefits from some recent developments in this area of monetary policy transparency. More specifically, Laskar (2010) shows that the standard approach to central bank forecast transparency is unsatisfactory because the Phillips curve used by the model actually depends on the degree of transparency on central bank forecasts, which turns out to bias the results obtained against transparency. We apply this logic to our study of structural reform, which allows us to provide a game-theoretical interpretation to the "expectations augmented Phillips curve" for

[7] This literature portrays the Phillips curve disturbance as a term that could be disclosed to the public (in a more or less transparent manner) by means of a central bank forecast (see Cukierman, 2001, and Geraats, 2007).

unemployment. The shock to the latter equation is thus derived from a transparency imperfection about how the government communicates structural reform to the public.

The second and third parts of this paper turn to monetary union analysis. The second part finds that, to a first-order approximation, an area-wide "expectations augmented Phillips curve" can be obtained in a model that extends Calmfors' (2001a) workhorse model by incorporating explicit wage bargaining and transparency imperfections. The third and last part uses a simplified reduced form setup for the interaction between monetary policy, the government(s) and the private sector. Here transparency concerns central bank forecasts and we abstract from explicit wage bargaining considerations. We derive conditions under which transparency induces more reform activity than opacity. It is worth stressing that we are aware of the link with our closed economy results. On the basis of our closed economy results, it makes sense to guess that a reduced form approach might bias the analysis against transparency for a given economy (be it under monetary autonomy or currency union participation). However, the focus here is not on the role of transparency for a given economy but on the effect it exerts on a country when the latter conducts monetary policy on its own compared to engaging in currency union membership. In the two parts of our monetary union examination, we allow structural reform to also enhance labour market flexibility, and not simply equilibrium unemployment. The justification for this is that, as demonstrated by Calmfors (2001a), the currency union arrangement may – under certain circumstances – elicit more reform activity than a national monetary policy regime only when reform enhances labour market flexibility.[8]

The rest of this paper is organised as follows. Section 2 starts by considering as a benchmark a "reduced form" model of the "expectations augmented Phillips curve", then turning to formulate an underlying model. The focus is on examining the macroeconomic consequences of government transparency about structural reform that reduces equilibrium unemployment. Sections 3 and 4 turn to a monetary union analysis, allowing structural reform to also enhance labour market flexibility. Section 3 uses an underlying game-theoretical model to provide an interpretation of the area-wide "expectations augmented Phillips curve" on the basis of government transparency imperfections. Section 4 turns to the role of transparency (this time, concerning central bank forecasts) on the

[8] As with Calmfors (2001a), Sibert and Sutherland (2000) distinguish between reform of factors that affect the inflation bias and reform of factors affecting labour market flexibility. Ultimately, the overall assessment is in both studies similarly ambiguous concerning the intensity of reform and welfare in a monetary union.

intensity of structural reform in the currency union relative to national monetary policy. Section 5 concludes.

2 Reduced form and underlying models of the "expectations augmented Phillips curve"

2.1 The reduced form model

We start by presenting a benchmark "reduced form" model of the expectations augmented Phillips curve, in which the central bank decides the value of the policy instrument (inflation). The "reduced form" specification for the Phillips curve for unemployment follows the most basic of Calmfors' (2001a) setups:[9]

$$u = u^* - \alpha\left(\pi - \pi^e\right) + \varepsilon \qquad (1)$$

where $\alpha>0$ and ε is a zero-mean shock. In (1), u is a decreasing function of inflation surprises, where π and π^e are actual inflation and private-sector inflation expectations, respectively. We assume that expectations are rational. It is worth mentioning that in this paper we shall also refer to a more advanced version of the Phillips curve, also developed by Calmfors (2001a) – one that allows both the slope and the error term in (1) to be dampened by flexibility-enhancing structural reform.[10] Despite their different degree of complexity, these two Calmfors' (2001a) versions of the Phillips curve are "reduced form". As such, they play a key role in the present subsection and later in section 4. Instead, the next subsection and section 3 go somewhat beyond "reduced form" approaches to the Phillips curve. More specifically, in those parts of the paper we provide game-theoretical interpretations for: i) the simpler of Calmfors' (2001a) Phillips curve in terms of a closed economy underlying model (in the next subsection), and ii) the more advanced of Calmfors' (2001a) Phillips curve in terms of an underlying monetary union model (in section 3).

The central bank loss function is

$$L = u^2 + \chi\pi^2 \qquad (2)$$

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[9] In (1), we allow for a positive "equilibrium unemployment" component, u^*. Since we are concerned only with the response of policies to disturbances, there is no need for, u^* to exceed zero. The latter would give rise to a systematic inflation bias because a higher u^* means that the central bank perceives a larger marginal gain of unemployment reductions through unanticipated inflation. Our results comparing transparency and opacity do not rely on this.

[10] Both versions of the Phillips curve are allowed to also have the intercept depend (negatively) on reform intensity, as we shall see from subsection 2.2 on.

where $\chi \geq 0$ is the weight of inflation aversion relative to unemployment stability.

The monetary policy literature has interpreted ε to be a (correct) forecast made by the central bank, which the latter can decide to communicate to the public.[11] The literature concludes that opacity is beneficial in such a model.[12] Here we also assume that the shock is known to the central bank, but that the way it is revealed to the public or not may not involve the central bank itself. The reason for this is that in subsection 2.2 we shall have the government, not the central bank, decide how much to reveal about the factor (structural reform) driving ε.

The central bank chooses π to minimise L in (2), taking the private-sector expectations π^e as given. The first order condition can be found to equal

$$u = \frac{\chi}{\alpha}\pi \tag{3}$$

Plugging u from (3) into (1), we obtain

$$\pi = \frac{\alpha}{\alpha^2 + \chi}\left(u^* + \alpha\pi^e + \varepsilon\right) \tag{4}$$

At the beginning of the period, the shock ε may or may not be revealed to the public. Under full transparency the private sector knows ε, that is, $\varepsilon_T^e = \varepsilon$. By taking expectations in, and subtracting from, (4) we obtain $\pi_T^e = \pi_T$, which, using (1), gives

$$u_T = u^* + \varepsilon \tag{5}$$

Under opacity the private sector ignores the disturbance ε. Thus, $\varepsilon_{op}^e = E\varepsilon = 0$. Taking expectations in (4) gives $\pi_{op}^e = \alpha u^* / \chi$, which, using (4), implies $\pi_{op} = \alpha u^* / \chi + [\alpha/(\alpha^2 + \chi)]\varepsilon$. Then, from (3) one obtains

[11] The relevance of the central bank forecast should in principle be in direct relation to its accuracy (Rhee and Turdaliev, 2010). There is evidence that central banks have an informational advantage over the private sector, which is rationalised in terms of the relative amount of resources being allocated to forecasting and/or the utilisation of superior projection methods (Athey et al., 2005; Kohn and Sack, 2004; Kurz, 2005; Romer and Romer, 2000).

[12] For the case of central bank forecasts, Cukierman (2001) shows that if the monetary authority possesses noisy information on ε this does not change the result that transparency is harmful.

$$u_{op} = u^* + \frac{\chi}{\alpha^2 + \chi}\varepsilon \tag{6}$$

From (2) and (3), the equilibrium loss is

$$L = \left(\frac{\alpha^2 + \chi}{\chi}\right)u^2 \tag{7}$$

Opacity is preferred to transparency when we have $L_{op} < L_T$, which occurs if and only if ${u_{op}}^2 < {u_T}^2$. Eqs. (5) and (6) imply that this is always true. That is, transparency is dominated by opacity, as the latter has the advantage of allowing for inflation surprises.

2.2. The underlying model

This section offers a game-theoretical interpretation of the expectations augmented Phillips curve (1) which relies on government transparency imperfections.

As with Laskar (2010), we postulate that there are a large number of atomistic trade unions and firms. Each union wants to stabilise both unemployment and the real wage, with a relative weight given by $\lambda \geq 0$, according to the loss function

$$\Omega = u^2 + \lambda(\omega - \pi)^2 \tag{8}$$

All unions are alike, with ω and u thus also measuring aggregate variables for the (log) nominal wage and unemployment, respectively. The previous-period price level (in logs) is normalised to zero, so $\omega - \pi$ is the (log) real wage. Parameter λ can be seen as (inversely) trading off unemployment concerns and inflation concerns, given that ω is under each union's control.[13] Once the nominal wage is set by the union, unemployment is given by firms' labour demand. Unemployment can be expressed as[14]

$$u = -\delta s + \beta(\omega - \pi) \tag{9}$$

[13] As we shall see, it really matters how well informed unions are about structural reform, as this will affect the responsiveness of wages to shocks (and thus in particular to inflation itself).

[14] Eq. (9) adds to the standard real wage effect the term $-\delta s$, as in Calmfors (2001a). We abstract from a constant or labour productivity shocks. The role of real wages in unemployment is in line with the literature on interaction between the central bank and wage setters (e.g. Cukierman and Lippi, 2001).

where $\beta>0$. Unemployment increases with the real wage and decreases with s, a structural reform variable that moves inversely with labour market distortions.

We assume that the government and the central bank share the loss function[15]

$$L^{CB} = L^{G} = u^2 + \chi\pi^2 + \gamma(s-\theta)^2 \tag{10}$$

which, in comparison with (2), also penalises structural reform deviations from its target, θ. The latter is stochastic, with the distribution $\theta \sim N\left(\bar{\theta}, \sigma_\theta^2\right)$ being common knowledge. The objective functions for both the government and the central bank in (10) broadly resemble those in Calmfors (2001a),[16] extended to allow for stochastic deviations of s from its target. Given that s is not under the control of the central bank, the results obtained here are logically consistent with subsection 2.1's "reduced form" model.[17]

The system of three equations (8), (9) and (10) defines our model. Concerning timing, each union first sets the nominal wage ω. Second, the government decides s. Third and last, the central bank determines the inflation rate π. The private sector has an informational disadvantage vis-à-vis the government as it does not observe the target θ. At the very start of the game, the government decides how transparent it is about structural reform. We allow for a continuum of intermediate options between full transparency and full opacity. More concretely, we assume that the private sector receives the public signal

$$\xi^\theta = \theta + \varsigma \tag{11}$$

where ς is an i.i.d. white noise capturing the government transparency imperfection. Its actual distribution, $\varsigma \sim N\left(0, \sigma_\varsigma^2\right)$, is assumed to be common knowledge. The degree of transparency associated with signal ξ^θ is described by

[15] By sticking to this assumption in Calmfors (2001a), we deviate from Jordahl and Laséen (2005).

[16] In Calmfors (2001a), s enters those loss functions additively rather than in a quadratic fashion. Our main results are not substantially affected by the linear specification, as long as government transparency imperfections are then applied to γ instead of θ. We shall adopt the latter approach in sections 3 and 4.

[17] Interestingly, Calmfors (2001a) proposes trade union behaviour as a possible alternative interpretation to his treatment of reform, whereas here we model wage bargaining and reform as separate decisions by different key players in the economy.

$$\tau^{\theta} \equiv \frac{\sigma_{\theta}^2}{\sigma_{\theta}^2 + \sigma_{\varsigma}^2}$$

where $0 \leq \tau^{\theta} \leq 1$. When $\sigma_{\varsigma}^2 = 0$, the signal ξ^{θ} transmits θ without any noise, in which case there is perfect transparency about the structural reform target.

Private-sector inflation expectations depend on perceptions regarding the structural reform target θ. Using public signal (11) and its accuracy, τ^{θ}, the private-sector rational expectation of θ amounts to $\theta^e = E\left[\theta \mid \xi^{\theta}\right] = \bar{\theta} + \tau^{\theta}\left(\theta - \bar{\theta}\right) + \tau^{\theta}\varsigma$.[18]

The three-stage game is solved by backward induction. In analogy to subsection 2.1, in stage 3 optimal monetary policy implies $u = (\chi / \beta)\pi$. Plugging this in (9) yields

$$\pi = \frac{\beta}{\beta^2 + \chi}\left(-\delta s + \beta\omega\right) \tag{12}$$

$$u = \frac{\chi}{\beta^2 + \chi}\left(-\delta s + \beta\omega\right) \tag{13}$$

In stage 2 the government chooses s to minimise L^G in (10), subject to (12)-(13), which leads to

$$s = \frac{\delta\beta\left(\omega - \pi\right) + \gamma\theta}{\gamma + \delta^2} \tag{14}$$

In stage 1 each atomistic union decides the nominal wage to minimise the expected value of Ω in (8), subject to (9), which holds for every union, and taking the values of s and π as given. Invoking certainty equivalence, we replace the variables u, π and s by their expected values u^e, π^e and s^e conditional on the union's information set. The first order condition yields $\beta\left[-\delta s^e + \beta\left(\omega - \pi^e\right)\right] + \lambda\left(\omega - \pi^e\right) = 0$ and ultimately[19]

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[18] We use the property that, if x and z are jointly normal, $\mathrm{E[x \mid z]} = \mathrm{E[x]} + \dfrac{\mathrm{Cov[x,z]}}{\mathrm{Var[z]}}\left(\mathrm{z - E[z]}\right)$.

[19] Eq. (15) uses the that, from (14), $s^e = \left[\delta\beta\left(\omega - \pi^e\right) + \gamma\left(1 - \tau^{\theta}\right)\bar{\theta} + \gamma\tau^{\theta}\left(\theta + \varsigma\right)\right] / \left(\gamma + \delta^2\right)$.

$$\omega = \pi^e + \frac{\delta\beta\gamma}{\beta^2\gamma + \lambda\left(\gamma + \delta^2\right)}\left[\left(1-\tau^\theta\right)\bar{\theta} + \tau^\theta\left(\theta + \varsigma\right)\right] \tag{15}$$

Plugging this expression of ω into (9), we get the expectations augmented Phillips curve (1), with $\alpha = \beta\gamma/\left(\gamma+\delta^2\right)$, $u^* = \gamma\lambda\tilde{u}/\left[\beta^2\gamma + \lambda\left(\gamma+\delta^2\right)\right]$ and

$$\varepsilon = \frac{\delta\gamma}{\gamma+\delta^2}\left[\frac{\beta^2\gamma}{\beta^2\gamma+\lambda\left(\gamma+\delta^2\right)}\tau^\theta - 1\right]\left(\theta - \bar{\theta}\right) + \frac{\delta\beta^2\gamma^2}{\left(\gamma+\delta^2\right)\left[\beta^2\gamma+\lambda\left(\gamma+\delta^2\right)\right]}\tau^\theta\varsigma \tag{16}$$

The shock ε is thus found to depend on two random variables, namely, the stochastic target (in deviation from its unconditional mean), $\theta - \bar{\theta}$, and the noise incurred in transmitting structural reform to the public, ς.[20] Since under transparency we have $\tau^\theta = 1$ and $\varsigma = 0$, and under opacity we have $\tau^\theta = 0$, we get

$$\varepsilon_T = -\frac{\delta\gamma\theta\lambda}{\beta^2\gamma+\lambda\left(\gamma+\delta^2\right)}; \quad \textit{and} \quad \varepsilon_{op} = -\frac{\delta\gamma\theta}{\gamma+\delta^2} \tag{17}$$

The disturbance is thus smaller in absolute value under transparency, helping the case for the latter (as we shall see).

In analogy to the derivation of (7), in equilibrium L^G from (11) can be rewritten as

$$L^G = \left[1 + \frac{\beta^2}{\chi} + \frac{\delta^2}{\gamma}\right]u^2 \tag{18}$$

The result that, in equilibrium, the only variable that seems to determine welfare is unemployment deserves justification. As we have seen, optimal monetary policy implies that inflation is proportional to unemployment, and so is also structural reform (in deviation from its target, θ).[21] In consequence, the government decides how transparent to be about s on the basis of

[20] Compared with (1), which simply assumes that ε is a zero-mean shock, (16) adds normality in light of θ and ς. This assumption would have been harmless in subsection 2.1. In practice, it also plays a small role (only for derivations) in subsection 2.2 due to our focus on the specific extremes of full transparency and full opacity.

[21] Indeed, (12)-(14) can be rearranged to yield $s - \theta = \delta u/\gamma$.

unemployment variability and the tradeoffs with the variability in other two goal variables (inflation and structural reform). These tradeoffs are reflected in the coefficients in the square bracket in (18).

From (18), the government finds transparency better than opacity if and only if $u_T{}^2 < u_{op}{}^2$. Replacing ε by ε_T in (5), and by ε_{op} in (6) (and also replacing α by $\beta/(1+\delta^2)$), we obtain

$$u_T = u^* - \frac{\delta\gamma\theta\lambda}{\beta^2\gamma + \lambda(\gamma+\delta^2)}; \quad \text{and} \quad u_{op} = u^* - \frac{\delta\gamma\theta\chi}{\beta^2\gamma + \chi(\gamma+\delta^2)}$$

From these equations, $u_T{}^2 < u_{op}{}^2$ is equivalent to $\lambda<\chi$. This leads to

Proposition 1. The government prefers full transparency when $\lambda<\chi$, and prefers full opacity when $\lambda>\chi$ (being indifferent between these two options when $\lambda=\chi$).

This result invalidates the standard "reduced form" result against transparency. We have reached this conclusion by explicitly modelling the interaction between the government, the central bank and the private sector.

Intuitively, the government prefers to disclose its reforms if and only if, in equilibrium, unemployment is more stabilised under transparency than under opacity. Under transparency, unemployment is not stabilised by policy because the latter is not able to generate surprises (concerning inflation and/or structural reform), but unions can adjust wages in reaction to the shock, thereby contributing to stabilise unemployment. As can be seen in (17), this effect amounts to dampening the Phillips curve shock ε under transparency.[22] In contrast, under opacity the lack of government information makes wages unresponsive to disturbances, with real wage stability being tied to price stability. In this case, macroeconomic stabilisation is left entirely to policymakers (i.e. the government and the central bank). Overall, the government will be indifferent between transparency and opacity when policymakers face the same tradeoff between unemployment and inflation concerns as the private sector (i.e. if and only if $\lambda=\chi$).

The balance between transparency and opacity is altered if and only if policymakers are faced with a different tradeoff between the variability in

[22] Laskar (2010) has revealed a comparable favourable response of the private sector to transparency. He contrasts this result to ordinary monetary policy analyses, which miss it because of considering a reduced form Phillips curve where the shock ε is given independently of whether there is transparency or opacity.

unemployment and inflation than wage setters. When we have $\lambda<\chi$, the private sector puts a larger weight to unemployment (relative to price stability) than policymakers. The government then senses that, by being transparent about structural reform, it enables the private sector to stabilise unemployment more effectively than policymakers would in an opaque environment. It is thus better to have government transparency. Under the alternative configuration $\lambda>\chi$, opacity instead prevails. The private sector displays smaller unemployment concerns (relative to inflation concerns) than policymakers, with unemployment being more effectively stabilised if the government maintains the public uninformed about structural reform. Policy surprises to the latter (by the government) and/or to inflation (by the central bank) then minimise macroeconomic fluctuations, benefiting from the fixity of nominal wages in the face of shocks.

3. Flexibility-enhancing reform and currency union: An underlying model

Here we show that an underlying model of the type presented in subsection 2.2 can be applied to the case of monetary union. As a result, we can provide a game-theoretical interpretation of the area-wide "expectations augmented Phillips curve" on the basis of government transparency imperfections. Although it would be simpler to assume that structural reform simply reduces equilibrium unemployment, from now on we assume that reform also enhances labour market flexibility.[23] We do so because, as shown by Calmfors (2001a), only when reform is also flexibility-enhancing may the currency union display more reform activity than in a regime of national monetary policy.[24] This section can be seen as an extension of Calmfors (2001a) to the case when wage setting is conducted by unions and structural reform may fail to be fully transparent. The use of an underlying approach involves some analytical complexities, thereby constraining us in the present section to the derivation of the area-wide "expectations augmented Phillips curve" – one that, in addition, holds to a linear approximation. We leave for section 4 an assessment of the role of transparency for structural reform in the currency union (in comparison with the national monetary policy case), which will only be possible to produce by resorting to a "reduced form" approach to the "expectations augmented Phillips curve".

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[23] Calmfors' (2001a) interpretation is that reform thus "affects not only equilibrium unemployment but also money-wage flexibility and, hence, the sensitivity of the economy to shocks".

[24] When reform only reduces equilibrium unemployment, in a currency union each national government is willing to undertake a lower reform effort since the latter contributes to reducing inflation volatility only in proportion to each country's size, while the political cost of implementing reform is paid in full (same as under monetary autonomy).

We start by assuming that the (national) government in country *i* has the loss function[25]

$$L_i^G = \frac{1}{2}\left(u_i^2 + \chi\pi^2\right) + \gamma s_i \tag{19}$$

which differs from that used in section 2 in that *s* enters linearly. The policy weight γ is stochastic, and its distribution $\gamma \sim N\left(\bar{\gamma}, \sigma_\gamma^2\right)$ is common knowledge.

The central bank operates at the currency union level, and it is labelled as the single monetary authority (SMA); it is concerned about the same variables as the government but only at the area-wide level (which we denote by suppressing the subindex *i*):

$$L^{SMA} = \frac{1}{2}\left(u^2 + \chi\pi^2\right) + \gamma s \tag{20}$$

Once more, we assume that the private sector is composed of a large number of trade unions and firms (in each country). Each union *j* in country *i* aims at stabilising both unemployment and the real wage, according to the loss function

$$\Omega_{ij} = \frac{1}{2}\left[u_{ij}^2 + \lambda\left(\omega_{ij} - \pi\right)^2\right] \tag{21}$$

In line with the change in the way structural reform enters the authorities' loss functions, we add a constant term ($\tilde{u}$) to the unemployment expression in (9):

$$u = \tilde{u} - \delta s + \beta\left(\omega - \pi\right) \tag{22}$$

Equilibrium unemployment otherwise continues to decrease with the intensity of structural reform (*s*), overall amounting to $u^* = \tilde{u} - \delta s$. At the level of each union, (22) unemployment can be written as

$$u_{ij} = \tilde{u} - \delta s_i + \beta\left(w_{ij} - \pi\right) \tag{23}$$

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[25] In the analysis of monetary union, we assume that the same goods are produced in all countries. As the exchange rates among member states are fixed, inflation is the same across individual countries. See Sánchez (2010) for a study relaxing this assumption.

The timing and informational asymmetries are analogous to subsection 2.2. Concerning government transparency, we assume that the private sector receives the public signal about the policy weight on structural reform

$$\xi^{\gamma} = \gamma + \varsigma \tag{24}$$

where ς behaves as in (11); we reutilise the same name for this noise term to save on notation. The corresponding degree of transparency is given by

$$\tau^{\gamma} \equiv \frac{\sigma_{\gamma}^2}{\sigma_{\gamma}^2 + \sigma_{\varsigma}^2} \tag{25}$$

where $0 \leq \tau^{\gamma} \leq 1$. Full transparency about government preferences is achieved when $\sigma_{\varsigma}^2 = 0$, in which case the signal ξ^{γ} transmits γ without any noise. The private-sector inflation rational expectation of γ equals $\gamma^e = E\left[\gamma \mid \xi^{\gamma}\right] = \bar{\gamma} + \tau^{\gamma}\left(\gamma - \bar{\gamma}\right) + \tau^{\gamma}\varsigma$.

Backward induction is used to solve the three-stage game. In stage 3, the SMA sets monetary policy such that

$$\pi = \frac{\beta(1-s)u^* + \beta^2(1-s)^2\omega}{\beta^2(1-s)^2 + \chi} \tag{26}$$

In stage 2 each national government chooses s_i to minimise L_i^G in (19). From now on, in order to simplify the algebra the number of member countries in the monetary union is assumed to be large. As a result, we get

$$s = \frac{\tilde{u} + \delta + \beta(\omega - \pi)}{\left[\delta + \beta(\omega - \pi)\right]^2}\beta(\omega - \pi) - \frac{\gamma - \delta\tilde{u}}{\left[\delta + \beta(\omega - \pi)\right]^2} \tag{27}$$

Finally, in stage 1 each union sets the nominal wage ω_{ij} to minimise the expected loss given by Ω_{ij} in (21), subject to (23), taking as given the values of s and π. In light of certainty equivalence, we replace the variables u and π by their expected values so as to obtain the following first order condition corresponding to the symmetric equilibrium:

$$\beta u^e + \lambda\left(\omega - \pi^e\right) = 0 \tag{28}$$

Given the nonlinear relation between structural reform and real wages involved in (27), we proceed to a linear approximation of (22), (27) and (28) around constant values for u, s and $\omega - \pi$, denoted by upper bars. These linearisations produce

$$\left(u - \bar{u}\right) = -\left(\delta + \beta\,\overline{\omega - \pi}\right)\left(s - \bar{s}\right) + \beta\left(1 - \bar{s}\right)\left(\omega - \pi - \overline{\omega - \pi}\right) \tag{22'}$$

$$\left(\delta + \beta\,\overline{\omega - \pi}\right)^2\left(s - \bar{s}\right) - \left[\beta\tilde{u} + \left(1 - 2\bar{s}\right)\delta\beta + 2\left(1 - \bar{s}\right)\beta^2\,\overline{\omega - \pi}\right]\left(\omega - \pi - \overline{\omega - \pi}\right) + \left(\gamma - \bar{\gamma}\right) = 0 \tag{27'}$$

$$\beta\left(u^e - \bar{u}\right) + \lambda\left(\omega - \pi^e - \overline{\omega - \pi}\right) = 0 \tag{28'}$$

Using (22'), (27') and (28'), and taking into account the way private-sector expectations are formed, we arrive at an expression formally identical to (1), i.e. Calmfors' (2001a) "reduced form" specification for the Phillips curve for unemployment, but that is here derived from an underlying model. The correspondence with (1) is attained for:

$$\alpha \equiv -\frac{\delta\beta\bar{s} - \left(1 - \bar{s}\right)\beta^2\,\overline{\omega - \pi} - \beta\tilde{u}}{\delta + \beta\,\overline{\omega - \pi}} > 0 \tag{29}$$

$$u^* \equiv \bar{u} \in (0,1) \tag{30}$$

$$\varepsilon = \left[\frac{1}{\delta + \beta\,\overline{\omega - \pi}} + \frac{\alpha\beta\tau^{\gamma}}{\lambda\left(\delta + 2\beta\,\overline{\omega - \pi}\right)}\right]\left(\gamma - \bar{\gamma}\right) + \frac{\alpha\beta\tau^{\gamma}\varsigma}{\lambda\left(\delta + 2\beta\,\overline{\omega - \pi}\right)} \tag{31}$$

where it can be shown (using the constant values derived in (32)-(34) below) that $\delta\beta\bar{s} - \left(1 - \bar{s}\right)\beta^2\,\overline{\omega - \pi} - \beta\tilde{u} < 0$, $\delta + \beta\,\overline{\omega - \pi} > 0$ and $\delta + 2\beta\,\overline{\omega - \pi} > 0$. For the range of u^* in (30), see the discussion of constant term $\bar{u}$ in (32) below. The disturbance ε is depends on two random variables, namely, the reform policy

weight (in deviation from its unconditional mean), $\gamma - \bar{\gamma}$, and the noise with which the government disseminates information to the private sector, ς.[26]

With regard to the constants around which we approximate, we find that:[27]

$$\bar{u} = \frac{\delta - \sqrt{\delta^2 - 4\beta^2 \bar{\gamma}/\lambda}}{2\beta^2/\lambda} \in (0,1) \tag{32}$$

$$\overline{\omega - \pi} = \frac{-\delta + \sqrt{\delta^2 - 4\beta^2 \bar{\gamma}/\lambda}}{2\beta} < 0 \tag{33}$$

$$\bar{s} = \frac{1}{\delta + \beta\,\overline{\omega - \pi}}\left[\left(\frac{\beta^2 + \lambda}{2\beta^2}\right)\left(-\delta + \sqrt{\delta^2 - 4\beta^2 \bar{\gamma}/\lambda}\right) + \tilde{u}\right] > 0 \tag{34}$$

For any of these three constants to be real numbers, we need $\delta \geq 2\beta\sqrt{\bar{\gamma}/\lambda}$. The range for $\bar{u}$ in (32) is chosen on the basis of different conditions depending on whether the latter inequality holds at equality or not. In the former case, we impose the constraint that $\delta < 2\beta^2/\lambda$, while in the latter we need $\delta > \beta^2/\lambda + \lambda^2\bar{\gamma}$ to rule out the existence of two plausible constant unemployment values. Moreover, for a positive value of $\bar{s}$ in (34) we impose the constraint $\bar{u} > \frac{\beta^2 + \lambda}{2\beta^2}\left[\delta - \sqrt{\delta^2 - 4\beta^2 \bar{\gamma}/\lambda}\right]$.

4. The role of transparency for flexibility-enhancing reform in a monetary union

This section shares with the previous one a monetary union focus, as well as the notion that structural reform does not just reduce equilibrium unemployment, but also enhances labour market flexibility. In order assess the role of transparency on reform intensity, here we revert to a "reduced form" Phillips curve approach. That is, instead of simultaneously deriving the expectations augmented Philips curve via government transparency imperfections, we content ourselves with assuming that the unpredictable component of the Philips curve captures the degree to which the central bank

[26] As mentioned in the last section, compared with (1) we add normality to the zero-mean property of shock ε.

[27] The constant values around which we approximate are below connected in a non-linear exact fashion (that is, without approximating) on the basis of equations (22), (27) and (28).

reveals its (accurate) unemployment forecasts prior to wage contracts being set. In light of the results from section 2, we shall keep in mind that this approach might bias the analysis against transparency. However, the focus here is not on the role of transparency for a given economy but on the effect that transparency exerts on a country when the latter conducts monetary policy on its own compared to currency union membership.

Lets us start the analysis with an extension of unemployment equation (1), namely:

$$u_i = u_i^* - (1 - s_i)\beta(\pi - \pi^e) + (1 - s_i)\varepsilon_i \qquad (35)$$

where $u_i^* = \tilde{u} - \delta s_i$ and i continues to denote each country possibly forming a monetary union. Equation (35) is a "surprise unemployment" equation for the representative economy – one where, as in the last section, reform affects both equilibrium unemployment (as given by term $-\delta s_i$) and also labour market flexibility, as given by the roles of s_i in dampening the impact of the last two terms (i.e. the inflation surprise and shock terms) in (35). Although flexibility-enhancing reform was allowed for in section 3, it is worth mentioning that the present treatment differs in the three following ways: i) equilibrium unemployment, u_i^*, is here postulated, as opposed to subject to a game-theoretical derivation; ii) the same applies to the nominal surprise term, $\pi - \pi^e$; and iii) in (35), reform is also assumed to affect the ability of authorities to directly dampen the consequences of the Phillips curve shock, ε_i.

The disturbance is assumed to equal $\varepsilon_i = v_i + \mu$, i.e it is split into two components: a country-specific, or asymmetric, part, v_i, and a common, or symmetric, term, μ, which is uniform across the countries in question.

Compared to the last section, the loss function for the government in a representative country remains given by (19). The government is here assumed to move first; then private sector inflation expectations are set; and finally monetary policy chooses the inflation rate. That is, instead of unions deciding before the government, we have the private sector set inflation expectations after the government decides policy and prior to the central bank decision. As we have said, the model here is "reduced form". The information asymmetry involved thus concerns central bank forecasts about ε_i (and its components v_i and μ) which are disseminated at the very start of the game. For convenience, we assume that not only the private sector but also the government(s) learn

about the shock from the central bank forecasts. Moreover, as mentioned in the last section, for the monetary union case we simplify the algebra by assuming that the number of member countries in the monetary union is large.

Concerning central bank preferences, the currency union regime continues to have the SMA loss function determined by (20), while in the autonomous policy regime the national central bank (denoted by *cb*) minimises a loss function identical to that of the domestic government, that is:

$$L_i^{cb} = \frac{1}{2}\left(u_i^2 + \chi\pi^2\right) + \gamma s_i \tag{36}$$

As regards transparency, we assume that the private sector and the government(s) receive the following public signals about the Phillips curve disturbance's components:

$$\xi_i^v = v_i + \varsigma_{v_i} \tag{37}$$

$$\xi^\mu = \mu + \varsigma_\mu \tag{38}$$

where ς_{v_i} and ς_μ are i.i.d. white noise terms capturing transparency imperfections about central bank unemployment forecasts. The actual distributions of these terms, $\varsigma_{v_i} \sim N\left(0, \sigma_{\varsigma_v}^2\right)$ and $\varsigma_\mu \sim N\left(0, \sigma_{\varsigma_\mu}^2\right)$, are assumed to be common knowledge. The degrees of transparency associated with ς_{v_i} and ς_μ are

$$\tau^v \equiv \frac{\sigma_v^2}{\sigma_v^2 + \sigma_{\varsigma_v}^2} \qquad \text{and} \qquad \tau^\mu \equiv \frac{\sigma_\mu^2}{\sigma_\mu^2 + \sigma_{\varsigma_\mu}^2} \tag{39}$$

where $0 \le \tau^v, \tau^\mu \le 1$. Perfect transparency about central bank forecasts is characterised by $\sigma_{\varsigma_v}^2 = \sigma_{\varsigma_\mu}^2 = 0$, in which case the signals ξ_i^v and ξ^μ transmits v_i and μ, respectively, without noise. The private-sector rational expectations of v_i, ς_{v_i}, μ and ς_μ equal $v_i^e = \tau^v\left(v_i + \varsigma_{v_i}\right)$, $\varsigma_{v_i} = \left(1-\tau^v\right)\left(v_i + \varsigma_{v_i}\right)$, $\mu^e = \tau^\mu\left(\mu + \varsigma_\mu\right)$ and $\varsigma_\mu = \left(1-\tau^\mu\right)\left(\mu + \varsigma_\mu\right)$, respectively. The corresponding conditional variances are $V\left[v_i \mid \xi_i^v\right] = \left(1-\tau_v\right)\sigma_v^2$, $V\left[\varsigma_{v_i} \mid \xi_i^v\right] = \tau_v\sigma_{\varsigma_v}^2$, $V\left[\mu \mid \xi^\mu\right] = \left(1-\tau^\mu\right)\sigma_\mu^2$ and

$V\left[\varsigma_{\mu_i} \mid \xi^{\mu}\right] = \tau^{\mu}\sigma^2_{\varsigma_\mu}$. [28] The conditional expectation and conditional variance of the overall Phillips curve disturbance thus are $\varepsilon_i^e = \tau^v\left(v_i + \varsigma_{v_i}\right) + \tau^{\mu}\left(\mu + \varsigma_{\mu}\right)$ and $V\left[\varepsilon_i \mid \xi_i^v, \xi^{\mu}\right] = \left(1-\tau_v\right)\sigma_v^2 + \tau_v\sigma^2_{\varsigma_v} + \left(1-\tau^{\mu}\right)\sigma_{\mu}^2 + \tau^{\mu}\sigma^2_{\varsigma_\mu}$, respectively. For the monetary union case, we have that the corresponding conditional expectation and conditional variance equal $\varepsilon^e = \tau^{\mu}\left(\mu + \varsigma_{\mu}\right)$ and $V\left[\varepsilon \mid \xi^v, \xi^{\mu}\right] = \left(1-\tau^{\mu}\right)\sigma_{\mu}^2 + \tau^{\mu}\sigma^2_{\varsigma_\mu}$, where ξ^v is the vector of individual country signals, that is, the ξ_i^v's. Notice that the terms associated with the country-specific shock component drop out of the area-wide aggregates in light of the assumption of small countries.

4.1 National monetary policy regime

Starting with a country that does not participate in monetary union, discretionary monetary policy leads under rational expectations to

$$\pi_i = \frac{\beta\left(1-s_i\right)u_i^*}{\chi} + \frac{\beta\left(1-s_i\right)^2\left[\chi\varepsilon_i + \beta^2\left(1-s\right)^2\varepsilon_i^e\right]}{\chi\left[\beta^2\left(1-s\right)^2 + \chi\right]} \tag{40}$$

The government decides about labour market institutions by setting s_i, taking into account the dependence of inflation – as given by (40) – on equilibrium unemployment and (expected and actual) shocks realisations. The government's goal is to minimise the expectation of (19) subject to (35) and (40). The expectation of (19) adopts a different specific form depending on whether we focus on the extreme of full transparency or that of full opacity (denoted by *T* and *op*, respectively). Under full opacity, we have $\tau_i^v = \tau^{\mu} = 0$ and the government then minimises[29]

$$E_{op}L_i^G = \frac{1}{2}\left\{\left[1 + \frac{\beta^2\left(1-s_i\right)^2}{\chi}\right]\left(u_i^*\right)^2 + \frac{\chi\left(1-s_i\right)^2}{\beta^2\left(1-s_i\right)^2 + \chi}\left(\sigma_v^2 + \sigma_{\mu}^2\right)\right\} + \gamma s_i \tag{41}$$

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[28] Here we employ the property that, if *x* and *z* are jointly normal, $\mathrm{V[x \mid z]} = V[\mathrm{x}] + \dfrac{\mathrm{Cov[x,z]Cov[z,x]}}{\mathrm{V[z]}}$.

[29] Formally, this case resembles Calmfors' (2001a) standard treatment since the latter corresponds to a case where the government also ignores ε_i (even if, unlike here, within a context of common knowledge about the shock where also the central bank ignores ε_i).

whereas the corresponding loss function under full transparency (when $\tau_i^v = \tau^\mu = 1$ and $\varsigma_{v_i} = \varsigma_\mu = 0$) is

$$E_T L_i^G = \frac{1}{2}\left\{\left[1+\frac{\beta^2(1-s_i)^2}{\chi}\right](u_i^*)^2 + \frac{2(1-s_i)\left[\beta^2(1-s_i)^2+\chi\right]}{\chi}u_i^*\varepsilon_i\right\} + \gamma s_i \qquad (42)$$

Under full opacity, the government's first order condition is

$$\frac{dE_{op}L_i^G}{ds_i} = -\left[1+\frac{\beta^2(1-s_i)^2}{\chi}\right]\delta u_i^* - \frac{\chi^2(1-s_i)}{\left[\beta^2(1-s_i)^2+\chi\right]^2}\left(\sigma_v^2+\sigma_\mu^2\right) - \frac{\beta^2(1-s_i)}{\chi}(u_i^*)^2 + \gamma = 0 \qquad (43)$$

and under full transparency

$$\frac{dE_T L_i^G}{ds_i} = -\left[1+\frac{\beta^2(1-s_i)^2}{\chi}\right]\delta u_i^* - \left\{\delta(1-s_i)+u_i^* + \frac{\beta^2(1-s_i)^2}{\chi}\left[\delta(1-s_i)+3u_i^*\right]\right\}\varepsilon_i - \frac{\beta^2(1-s_i)}{\chi}(u_i^*)^2 + \gamma = 0 \qquad (44)$$

Rather than solving (43) or (44) explicitly for s_i, which is complicated, we assess reform intensity by looking at each first order condition. In each case, reform is pursued up to the point when the marginal gain balances the marginal loss. For the sake of concreteness, let us start by describing the full opacity results in (43) – which follows Calmfors (2001) closely – then mentioning the one specific difference with respect to the full transparency case in (44). The marginal gain arises in (43) for four reasons. The first term is composite, and captures the two effects arising from the connection between reform, s_i, and equilibrium unemployment, u_i^*: a) reform directly reduces equilibrium unemployment and thus expected unemployment; and b) reform lowers expected inflation, given that reduced equilibrium unemployment brings the inflation bias down. The marginal gain is also due to the two other effects of reform, which relate to the latter's impact on the flexibility of the economy. The second term represents the effect of enhanced labour market flexibility on unemployment variability. This term is in turn given by the net effect of two forces pointing in different directions: i) reform directly dampens the

unemployment consequences of shock ε_i in (35); and ii) reform indirectly makes monetary policy less effective in the face of unpredictable events, as can be gauged by comparing (35) and (40).[30] The third term captures an additional gain arising from a further reduction of the inflation bias, one that comes on top of that due to a lower equilibrium unemployment (and mentioned under item b) earlier in this paragraph). This time, the inflation bias is lower because of reform's stabilising role vis-à-vis the disturbance ε_i.

These results mostly carry over to the perfect transparency results in (44). The only difference concerns the second term. Due to the full dissemination of information the variability of shocks in $\left(\sigma_v^2 + \sigma_\mu^2\right)$ no longer plays any role. In (44) reform now induces favourable consequences by dampening the anticipated impact of the disturbance ε_i. The reason is that, instead of affecting the macroeconomic impact of shocks (and inflation surprises), reform can dampen the contribution to unemployment and inflation variability arising from the cross-effects of equilibrium unemployment and the shocks themselves. The first two terms in the curly bracket premultiplying ε_i in (44) are associated with the mitigation of unemployment variability, while the corresponding last two terms relate to reduced inflation variability.

4.2 Monetary union case

This subsection analyses reform under currency union participation. Here, the SMA decides a common inflation rate for all the member states. As in the previous subsection, reform remains determined by national governments, in line with the EMU case where centralisation of reform is not stipulated by the EU treaty. The currency union is made up of a large number of countries, denoted by *N*, that are symmetric ex ante, that is, except for country-specific shocks. The loss functions used here have been used earlier in this paper: each of the national governments minimises the expectation of (19) and the SMA minimises (20).

In analogy to section 3, the SMA chooses the inflation rate

$$\pi = \frac{\beta(1-s)u^*}{\chi} + \frac{\beta(1-s)^2\left[\chi\varepsilon + \beta^2(1-s)^2\varepsilon^e\right]}{\chi\left[\beta^2(1-s)^2 + \chi\right]} \tag{45}$$

[30] The partial effect under item (i) prevails over that in (ii). Intuitively, the stabilising effect of reform under item (i) is larger than the "crowding out" by reform of the also stabilising role played by monetary policy – the latter being meant to offset disturbances in only a partial manner.

As with the national policy regime, the SMA is here confronted with an inflation bias (the first term) as it aims at stabilising the economy in reaction to unemployment disturbances (the second term).

We derive the choice of reform, s_i, by the governments, taking as given inflation, π, which is the same across the currency union. Each government minimises the expectation of (19) subject to (45). Following a reasoning similar to that in subsection 4.1 for national autonomy, under the monetary union regime the expectation of (19) for the case of full opacity equals

$$E_{op}L_i^G = \frac{1}{2}\left\{\left(u_i^*\right)^2 + \left(1-s_i\right)^2\sigma_v^2 + \frac{\chi^2\left(1-s_i\right)^2}{\left[\beta^2\left(1-s_i\right)^2+\chi\right]^2}\sigma_\mu^2\right\} + \frac{\chi}{2}\pi^2 + \gamma s_i \tag{46}$$

and under the assumption of full transparency

$$E_{op}L_i^G = \frac{1}{2}\left[\left(u_i^*\right)^2 + 2\left(1-s_i\right)u_i^*\varepsilon_i\right] + \frac{\chi}{2}\pi^2 + \gamma s_i \tag{47}$$

The optimisations based on either (46) or (47) are evaluated at the levels of reform and thus equilibrium unemployment consistent with a symmetric equilibrium, that is, $s_i = s$, which implies $u_i^* = u^*$. The government's first order condition under full opacity equals

$$\left.\frac{dE_{op}L_i^G}{ds_i}\right|_{s_i=s} = -\delta u^* - \left(1-s\right)\sigma_v^2 - \frac{\chi^2\left(1-s\right)}{\left[\beta^2\left(1-s\right)^2+\chi\right]^2}\sigma_\mu^2 + \gamma = 0 \tag{48}$$

while the corresponding expression under full transparency amounts to

$$\left.\frac{dE_T L_i^G}{ds_i}\right|_{s_i=s} = -\delta u^* - \left[\delta\left(1-s\right)+u^*\right]\varepsilon_i + \gamma = 0 \tag{49}$$

Both for full opacity and full transparency, the interpretation attached to the terms in the optimisation conditions (48) and (49) is similar to that given in the previous subsection for the corresponding expressions under monetary autonomy. Once more, let us start with the full opacity case. The first term in (48) captures the marginal gain from reform owing to lower expected unemployment, while the second and third terms represent reform's dampening of the impact of disturbance ε_i. The fourth term is the direct utility cost.

Compared with the national case in (43), it is unclear whether the net gain from reform has increased or diminished. Two reasons push reform activity down in the monetary union: a) the first term now captures only the direct effect of reform on equilibrium unemployment, missing the impact via lower expected inflation (relating to the reduced inflation bias accompanying the fall in equilibrium unemployment); and b) compared to (43), we notice the disappearance of the third term – capturing a extra motive for reform due to an additional reduction of the inflation bias, one that occurs for a given equilibrium unemployment and thus comes on top of the one owing to a reduction in the latter variable. This second reason for a lower marginal gain from monetary union membership is connected to the circumstance that, under our maintained assumptions, each government correctly perceives that it is too small to influence inflation. The latter is determined at the area-wide level (cf. the loss functions (41) and (46)).[31] Based on items a) and b) above, the incentive for reform tends to be greater under monetary autonomy, where reform lowers not only expected unemployment (as in a currency union), but also the inflation bias. However, there is one reason making the net gain from reform larger in the monetary union, which concerns the comparison of the terms including σ_v^2 between (43) and (48). Reform's marginal gain from this source is attributable to inducing (relative to monetary autonomy) more wage responsiveness and thus lower unemployment volatility in the face of asymmetric shocks. When this type of shocks hit the national economy, the gain from reform is larger than in a currency union owing to the absence, under the latter regime, of monetary policy stabilisation that dampens country-specific disturbances. This can be appreciated in that, evaluated at the symmetric equilibrium (i.e. $s_i = s$), in (43) $1-s$ is larger than $\chi^2(1-s)/\left[\beta^2(1-s)^2+\chi\right]^2$ in (48).[32] This finding in part supports the notion that giving up monetary sovereignty raises the advantage of wage flexibility and thus entails stronger incentives for labour market reform. Overall, it is thus unclear whether there is more reform under monetary autonomy or a currency union. We have two reasons for more reform under the former regime, and one reason for more reform under the latter. In the specific case where there is no

[31] The governments continue to react to unemployment and the (exogenous) cost of reform in the monetary union. Labour market reform by a national government lowers inflation only to the extent that area-wide equilibrium unemployment is reduced, which in the symmetric equilibrium occurs only if reform intensity rises.

[32] The latter factor continues to premultiply also the variance of common shocks, σ_μ^2. So the factor premultiplying σ_v^2 is smaller in a currency union than under monetary autonomy, but also smaller than that premultiplying σ_μ^2 in a currency union (and not only under monetary autonomy). Intuitively, asymmetric disturbances are less dampened by reform in a currency union both in comparison asymmetric shocks under monetary autonomy and common shocks in the currency union regime.

inflation bias,[33] we are left only with the welfare-improving effect of reform in monetary union – a regime in which reform takes up some of the macroeconomic stabilisation role given up by monetary policy. That is, in this case the conclusion is unambiguous, with reform activity being larger in the currency union.

Turning to full transparency, the first term in (49) is the marginal gain from reform because of reduced expected unemployment and the third term is the direct utility cost – both terms also featuring under full opacity. The new term with respect to full opacity is the second term in (49), which represents the marginal gain arising from a lower cross-effect of equilibrium unemployment and the shock ε_i. The comparison with the case of monetary autonomy in (44) is clear-cut, in contrast with the ambiguity found for the case of full opacity. To show this, and given that the cost term, γ, is common to both fully transparent regimes, we can concentrate on the marginal gain terms in (44) and (49). Two of the reasons pushing reform activity down in the monetary union have already been discussed in the case of full opacity. They both concern unresponsiveness of reform to the inflation bias, in light of the failure of each government to internalise the benefit that each of the other participating countries derives from a reduction in domestic equilibrium unemployment, as this reduction contributes to lowering area-wide inflation.[34] To these two deficits of reform in the currency union case we have to add one more, which is attributable to the same externality just referred to, but which is specific to the full transparency scenario. It is captured in the second term of both (44) and (49), and concerns the cross-effect of equilibrium unemployment and Phillips curve disturbance and is larger in absolute value under monetary autonomy (since, from comparing (44) and (49), we obtain $\delta(1-s_i)+u_i^*+\frac{\beta^2(1-s_i)^2}{\chi}\left[\delta(1-s_i)+3u_i^*\right]>\delta(1-s_i)+u_i^*$). Therefore, in contrast to the full opacity case, for which it is unclear which of the two monetary arrangements dominates its alternative, full transparency unambiguously favours monetary autonomy. It is worth saying that this refers to a comparison between policymakers' communication styles for a given economy (conducting autonomous monetary policies).

[33] The inflation bias can be eliminated if the central bank's objective function can be written as involving cyclical unemployment (the deviation of actual from equilibrium unemployment) instead of actual unemployment, as assumed here in (20) and (36).

[34] The two effects in question, referred to under items a) and b) in the previous paragraph, concern the reductions in the inflation bias induced by reform, which yield lower expected inflation via, first of all, a lower equilibrium unemployment, and, secondly, owing to reform's price-stabilising effect for a given (or initial) value of equilibrium unemployment.

So far we have made two types of comparisons: a) between opacity and transparency for one given regime (be it monetary autonomy or a currency union), and b) across regimes for one type of policymakers' communication style (be it opaque or transparent). We have found that the former type of comparison was clear-cut for monetary autonomy (favouring opacity) and ambiguous for a currency union arrangement. Furthermore, the latter type of comparison (i.e. across regimes) is found to be unclear regardless of which monetary regime we consider. This is the case simply because opaque and transparent policymakers face different dimensions of the Phillips curve shock, namely, the shock itself (interacting with equilibrium unemployment) under transparency, and the variance of the shock (separate from equilibrium unemployment considerations) under opacity.

In contrast with the previous two partial perspectives for contrasting results, our key final result concerns the full comparison of how transparency affects (vis-à-vis opacity) the relative reform intensity between monetary autonomy and the currency union. By looking in full at equations (43), (44), (48) and (49), it can be established that:

Proposition 2. Concerning the relative intensity of each national government's reform in a currency union vis-à-vis monetary autonomy,

(i) it is unclear how such relative intensity of reform is affected when comparing the cases of full transparency and full opacity.

(ii) in the absence of national inflation bias, full transparency leads to a higher such relative intensity of reform than full opacity.

Proof. (i) First of all, by comparing (43), (44), (48) and (49), it can be seen that in all of these expressions the utility cost is given purely by γ. So this can be ignored in the comparison in question, which can thus concentrate exclusively on the marginal gain terms. As we have seen by comparing (44) and (49), under full transparency participation in the monetary union reduces the marginal benefit of reform, and thus reform activity itself. The mechanism involved is the larger internalisation that, under monetary autonomy, each government makes of its reforms' disinflationary impact – thereby helping reduce the inflation bias by more than in the monetary union regime. In contrast, the role of currency union membership regarding the marginal gain of reform is unclear when monetary policy is conducted in an opaque manner. In this context, we still have the same general mechanism just described, which involves an inflation bias externality that is less effectively handled by governments in a monetary union. While this tends to elicit more reform from governments under monetary autonomy, a currency union has one favourable feature which is

present only when monetary policy is opaque. In the latter case, shocks are not disclosed fully, their enhanced variability turning out to call for more action from stabilisation policies. Given that the national central banks are able to tackle idiosyncratic disturbances (with variability given by σ_v^2) better than the SMA, reform's stabilising role is at the margin more valuable in a currency union. As we have seen above, this effect can be gauged by comparing, at the symmetric equilibrium, the factors premultiplying σ_v^2 under each monetary regime, with $1-s$ in (43) exceeding $\chi^2(1-s)/\left[\beta^2(1-s)^2+\chi\right]^2$ in (48).

(ii) The latter effect is precisely the only one that is left once inflation bias considerations are removed, and with them the related externality effect facing each government when inflation bias is present. Therefore, in the absence of national inflation bias, one gets the result that full transparency leads to more reform than full opacity. QED.

6. Conclusion

Compared with other areas of economics, there has been little research about the role of transparency considerations in the choice and macroeconomic consequences of structural reform. The present paper aims at filling this gap by adopting various perspectives that are deemed relevant. The results presented here are obtained from theoretical approaches employed to model the interaction between the government, the central bank and the private sector. Our starting point is a closed economy analysis which leads us to challenge the conventional wisdom that, in an expectations augmented Phillips curve model, opacity concerning the shock to this curve is always better than transparency. Formally, the same conclusion was reached by Laskar (2010), albeit with a very different interpretation about the underlying informational imperfection. For this author, the Phillips curve shock is a private sector, labour productivity-type disturbance that may be communicated to the public by the central bank as a forecast. Our closed economy analysis interprets the Phillips curve disturbance as a policy (structural reform) shock that may be publicly disclosed by the government. The derivation involves a game-theoretical setup where the government interacts with monetary policymakers and trade unions.

In addition to our closed economy results, this paper addresses the case of monetary union. In so doing, we go beyond the assumption that structural reform affects only equilibrium unemployment, by allowing reform to also enhance labour market flexibility. We carry out the following two monetary union analyses. First, we show that, to a first-order approximation, an area-wide "expectations augmented Phillips curve" can be obtained in a model that

extends Calmfors' (2001a) workhorse model by incorporating explicit wage bargaining and transparency imperfections. Again, as with closed economy results, we provide a game-theoretical interpretation of the area-wide "expectations augmented Phillips curve" on the basis of government transparency imperfections. In this extension, wage setting is explicitly conducted by unions and structural reform may fail to be fully transparent. Second, we turn to the assessment of reform intensity in the monetary union. Despite the fact that structural reform is at the core of the analysis throughout this paper, in the latter's final part the assessment of reform intensity in a monetary union is carried out for a reduced form specification, where the emphasis of transparency is shifted from reform itself to central bank forecast dissemination. This is done for simplicity, having in mind that the goal then pursued is not to evaluate the role of transparency for a given economy but to characterise how information disclosure affects a country engaging in currency union membership relative to monetary autonomy. We show that transparency may induce more reform activity than opacity, even in the presence of an inflation bias. This, together with our closed economy results, can be interpreted as casting transparency's implications in a more positive light than is often the case in the related literature. In particular, we find that, in the absence of national inflation bias, full transparency leads to more reform in the monetary union than if policymakers were fully opaque.[35] In this case, there is no role for monetary union regime's main deficit regarding reform activity, namely, governments' failure to internalise the favourable contribution of national reform to lower equilibrium unemployment and thus area-wide price stability. What is left is the pro-reform feature of the currency union, given by the circumstance that enhanced labour market flexibility plays a more stabilising role following the abandonment of national monetary policies, which are in principle able to tackle idiosyncratic disturbances better than the single monetary authority.

All of the results presented in this paper have been produced in terms of closed form solutions to linear (or linearised) systems of equations. Future work could consider the use of simulations in a non-linear context for both the more involved cases here considered and possible additional extensions of our analysis. In any case, the limitations of the current state of theoretical work in the field of reform and transparency in a monetary union signal the need for further development. Looking forward, studies in this area could benefit from

[35] It must be borne in mind that, in addition to the circumstances under which we here find that transparency has favourable consequences, it is often acknowledged that there are some general beneficial effects stemming from open and accountable policymaking.

ongoing interest in reform in EMU as well as the increasing interest in communication and transparency in the economics profession.

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