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Rules Versus Discretion Under Asymmetric Shocks

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Abstract

Monetary policy design in currency unions faces more challenging scenarios like the presence of asymmetric shocks and the higher probability of time inconsistency. An evaluation of the union welfare under a monetary rule and under discretion in these circumstances is carried out. Assuming that the transmission of monetary policy is symmetric across countries, discretion is more desirable when the shocks show high variability and are symmetric. At the same time it is very important to implement a decision making process able to marginalize the influence of single countries, and therefore time inconsistency. A monetary rule is the best arrangement in the opposite scenario. A general consequence of these findings is that the best monetary institutional framework is to implement a rule with some escape clauses. Nevertheless, when shocks have high variability and are symmetric there are both negative and positive aspects for the rule and discretion, and a case by case analysis is necessary in order to decide whether the latter performs better than the former or vice versa.

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1 Introduction

The presence of economic heterogeneity in a monetary union makes the conduct of monetary policy very difficult. The most relevant economic heterogeneities that count for a Central Bank are connected with two types of macroeconomic asymmetries within the union. These are the presence of asymmetric macroeconomic shocks to member countries and the asymmetric transmission of monetary policy.
Following the pioneering works of Kydland and Prescott (1977), and Barro and Gordon (1983a, 1983b), an enormous literature has dealt with time inconsistency and the debate on rules versus discretion in monetary policy[1].
After the start of EMU a large literature has adapted these models to a multi-country framework. Lane (1996) evaluates the reaction of the Central Bank to symmetric and asymmetric shocks. De Grauwe and Sénégas (2004) focus on the consequences of the enlargement of a currency union when the transmission of monetary policy is asymmetric. De Grauwe (2000) analyzes the relationship between the effectiveness of stabilization of unemployment and the degree of asymmetries in a monetary union. Following a frequent assumption in the one-country literature[2] the authors do not allow for any time inconsistent policy, and they do not include any issue concerning the comparison between monetary rules and discretion. De Grauwe (2000) and Gros and Hefeker (2002) evaluate monetary policies under different data aggregating criteria in the Central Bank loss function. Alesina and Barro (2002) analyze unilateral currencies adoptions, while Alesina and Stella (2011) also address institutional issues concerning the feasibility, optimality and political sustainability of multilateral currency unions.
The purpose of this paper is to evaluate the welfare effects of monetary policy under a rule and under discretion in a currency union affected by shocks, allowing for time inconsistency in the Central Bank behavior. Despite the fact that the absence of time inconsistency has become the most frequent assumption in the literature, it has to be noted that in a multi-country framework there is more room for it to happen, since it can be triggered when at least one country in the union has this tendency.
The rest of the paper is organized as follows. Section 2 describes the basic model and its equations. Section 3 solves the model under a target rule and under discretion. Section 4 evaluates the welfare loss under a target monetary rule and under discretion. Section 5 deals with some policy and institutional implications. Section 6 concludes the paper.

2 The Model

The basic model is a standard macroeconomic one à la Barro and Gordon extended to a multi-country framework.

[1] It seems unnecessary to provide another survey of this literature. For detailed reviews see Walsh (2010), Alesina and Stella (2011), Persson and Tabellini (2000), and Drazen (2000).

[2] See Clarida et al. (1999), Svensson (1997), and McCallum (1999).

The Central Bank loss function is a weighted average of the loss functions of the single member countries in the union:

$$\mathbb{L} = \sum_{i=1}^{n} \alpha_i L_i \tag{1}$$

Where α_i is the weight associated to country i in the computation of the aggregate loss function, and $\sum_{i=1}^{n} \alpha_i = 1$. It is assumed that α_i also represents the weight of the ith member country in the decision making process. Each member country has a quadratic loss function depending on inflation (π) and on the gap between its observed rate of unemployment (U_i) and its target rate (U_i^*):

$$L_i = \pi^2 + \beta_i (U_i - U_i^*)^2 \tag{2}$$

Where β_i denotes the relative weight of the unemployment gap with respect to inflation in the preferences of each member country. For the sake of simplicity it is set that single countries and their representatives in the Central Bank board have exactly the same preferences. Moreover, it is assumed that the inflation rate is the same in each country in the union. This is usually assumed in the literature and it is justified by two motivations. The first motivation relies on the assumption that the Central Bank has a direct and full control over the inflation rate, therefore $\Delta M = \pi$. Second, in a monetary union the member countries share common monetary conditions as the monetary policy is centrally determined, this premise should lead to the same rates of inflation. Nevertheless, there is evidence indicating that inflation rates in monetary unions can differ across countries. However, when the member countries enter the union with different price levels, convergence towards a common long-run equilibrium price level necessarily entails a deviation in inflation rates. Moreover, it is likely that those inflation differentials are also influenced by the Balassa-Samuelson effect[3]. Since these are primarily structural features, they are not very much influenced by monetary policy.
The rate of unemployment in each country is determined by the following Phillips curve:

$$U_i = U_{ni} - a_i(\pi - \pi^e) + \varepsilon_i \tag{3}$$

In equation (3) a_i is the countries elasticity of unemployment with respect to the gap between observed and expected inflation ($\pi - \pi^e$). It is worth noting that, since it has been assumed that the Central Bank fully controls inflation, a_i can also be interpreted as the parameter reflecting the transmission of monetary policy on unemployment in

[3]See Honohan and Lane (2003).

each union member country. In the Phillips curve the term $\varepsilon_i \sim N(0, \sigma^2_{\varepsilon i})$ is interpreted as a stochastic supply shock.
The relation between the target rate of unemployment and the natural rate of unemployment for each member is represented by the following equation:

$$U_i^* = k_i U_{ni} \tag{4}$$

Where $0 < k_i \leq 1$. When $0 < k_i < 1$, the target rate of unemployment is smaller than the natural rate, and this is the source of the time inconsistency problem. When $k_i = 1$, the national authorities abstain from pursuing a target rate of unemployment below its natural rate. In this case there will be no inflation bias. Although the latter has become the more frequent assumption, it is worth noting that in a multi-country framework this assumption seems to be too restrictive. Since k_i is the source of the inflation bias, it is needed that only one country in the union has $k_i \neq 1$ to trigger possible time inconsistent behaviors.

3 Solutions of the Model Under Discretion and Under a Target Rule

Without loss of generality the model can be solved under the assumption that the monetary union is composed of two blocks of countries (namely l and r). Therefore, the model is solved setting $i = l, r$. Solving the optimization problem, the Central Bank minimizes (1) with respect to π, subject to (2), (3), and (4). The solution is the following:

$$\begin{aligned}\pi^* = \frac{\alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}{1 + \alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}\pi^e + \frac{(1-k_r)\alpha\beta_r a_r}{1 + \alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}U_{nr} + \\ + \frac{(1-k_l)(1-\alpha)\beta_l a_l}{1 + \alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}U_{nl} + \frac{\alpha\beta_r a_r}{1 + \alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}\varepsilon_r + \\ + \frac{(1-\alpha)\beta_l a_l}{1 + \alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}\varepsilon_l\end{aligned} \tag{5}$$

The rate of inflation that minimizes the loss is different from the rate expected by agents. Moreover, even if the Central Bank announces that the inflation target is zero, and the agents believe in it, the optimal inflation will still be positive, because the Central Bank has the typical incentive to deviate from the announcement creating surprise inflation. Nevertheless, under rational expectations agents know that the optimal inflation rate for the Central Bank is π^*. The expected rate of inflation is obtained taking the expected value of (5):

$$\pi^e = [(1-k_r)\alpha\beta_r a_r]U_{nr} + [(1-k_l)(1-\alpha)\beta_l a_l]U_{nl} \tag{6}$$

The equilibrium rate of inflation under discretion is obtained by substituting (6) into (5):

$$\begin{aligned}\pi^{dis} = [(1-k_r)\alpha\beta_r a_r]U_{nr} + [(1-k_l)(1-\alpha)\beta_l a_l]U_{nl} + \\ + \frac{\alpha\beta_r a_r}{1+\alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}\varepsilon_r + \frac{(1-\alpha)\beta_l a_l}{1+\alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}\varepsilon_l\end{aligned} \tag{7}$$

Where the superscript dis stands for discretion. The inflation is composed by a weighted average of the shocks in the two blocks plus a weighted average of the natural rates of unemployment in the two blocks. From equations (5) and (7) it is easy to verify that k_i is the parameter determining time inconsistency. Even if one block has a target of unemployment that is equal to its natural rate (for instance $k_r = 1$), the fact that the other bock has $k_l \neq 1$ will still generate the inflation bias. Only when each member has $k_i = 1$, time inconsistency is eliminated.
The equilibrium rate of unemployment in the two blocks under discretion can be obtained substituting equations (6) and (7) into (3):

$$U_l^{dis} = U_{nl} + \frac{1+\alpha\beta_r a_r^2}{1+\alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}\varepsilon_l - \frac{\alpha\beta_r a_r a_l}{1+\alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}\varepsilon_r \tag{8}$$

$$U_r^{dis} = U_{nr} + \frac{1+(1-\alpha)\beta_l a_l^2}{1+\alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}\varepsilon_r - \frac{(1-\alpha)\beta_l a_l a_r}{1+\alpha\beta_r a_r^2 + (1-\alpha)\beta_l a_l^2}\varepsilon_l \tag{9}$$

The rate of unemployment is a positive function of the shocks in the same block. On the contrary, the effect of a positive shock in the other block has a negative impact on unemployment. A positive shock in the other block increases the (unique) rate of inflation, and from (3) is clear that an increase in inflation reduces unemployment. The most common solution to the inflation bias problem is the introduction of a monetary policy rule. For the sake of simplicity a zero inflation rule is assumed. The solution of the model under a strict target rule that forces the Central Bank to keep inflation at zero implies that $\pi^{rul} = \pi^e = 0$, $U_l^{rul} = U_{nl} + \varepsilon_l$, and $U_r^{rul} = U_{nr} + \varepsilon_r$. Under a rule the inflationary bias is eliminated and inflation is forced to zero, while unemployment can deviate from the natural rate only as a consequence of a shock. It is worth noting that when inflation is forced to be zero a shock in one block does not affect the unemployment in the other block.

4 Rule Versus Discretion

The solution of the model allows for a comparison between the expected union wide welfare under discretion and under a monetary rule. It requires to substitute the equilibrium inflation and unemployment, obtained under the rule and discretion, in the expected loss function in order to assess under which conditions one is preferable than the other. When $\mathbb{E}\left[\mathbb{L}^{dis}\left(\pi^{dis}, U_l^{dis}, U_r^{dis}\right)\right] > \mathbb{E}\left[\mathbb{L}^{rul}\left(\pi^{rul}, U_l^{rul}, U_r^{rul}\right)\right]$ the rule dominates discretion.

4.1 Single Block Monetary Union

In case of a union in which every country has exactly the same characteristics it can be set that $\alpha = 0.5$, $U = U_l = U_r$, $U_n = U_{nl} = U_{nr}$, $a = a_l = a_r$, $\beta = \beta_l = \beta_r$, $k = k_l = k_r$, and $\varepsilon = \varepsilon_l = \varepsilon_r$. Under this extreme assumption the model collapses to the standard one country specification. Consequently, the comparison of the welfare loss under rule and discretion provides the typical result that a monetary rule increases the welfare according to the following condition:

$$\frac{\sigma_\varepsilon^2}{1+\beta a^2} < [(1-k)U_n]^2 \tag{10}$$

Therefore, the higher the variance of the shocks (σ_ε^2), the more desirable are discretionary monetary policies. Moreover, the rule is more desirable: 1) the higher the relative weight of the unemployment gap with respect to inflation in the Central Bank preferences (β); 2) the higher the unemployment elasticity to the inflation gap (a); 3) the higher the natural rate of unemployment (U_n). Nonetheless, the more the Central Bank has an unemployment target that is close to the natural one ($k \to 1$), the less desirable the rule is. When the target is exactly the natural rate of unemployment ($k = 1$), there is no need for any monetary rule since this implies no time inconsistency.

4.2 Heterogenous Monetary Union

The conduct of monetary policy in a currency union faces two main types of macroeconomic heterogeneities. These are the presence of asymmetric macroeconomic shocks to member countries and the asymmetric transmission of monetary policy. In this paper the case in which member countries experience different shocks ($\varepsilon_l \neq \varepsilon_r$), and the transmission of monetary policy is symmetric ($a_l = a_r = a$), is analyzed.
In this scenario the comparison of the welfare loss under rule and discretion evidences that discretionary monetary policies provide a lower welfare according to the following condition:

$$\left[0.5(1-k_r)\beta a U_{nr} + 0.5(1-k_l)\beta a U_{nl}\right]^2 + \Omega_1(\sigma_{\varepsilon,r}^2 + \sigma_{\varepsilon,l}^2) + \Omega_2 Cov_{r,l} > 0 \tag{11}$$

Where $\Omega_1 = \left(\frac{0.5\beta a}{1+\beta a^2}\right)^2 + \beta\left(\frac{0.5\beta a^2}{1+\beta a^2}\right)^2 + 0.5\beta\left(\frac{1}{1+\beta a^2}\right)^2 + \frac{0.5\beta^2 a^2}{(1+\beta a^2)^2} - 0.5\beta$, and where $\Omega_2 = 2\left(\frac{0.5\beta a}{1+\beta a^2}\right)^2 - 2\beta\left(\frac{0.5\beta a^2}{1+\beta a^2}\right)^2 - 2\beta\frac{0.5\beta a^2}{(1+\beta a^2)^2}$. The parameter Ω_1 measures how the variability of the shocks in the two blocks influences the comparison of the union-wide loss under discretion and under a zero-inflation targeting rule. Since it is easy to demonstrate that $\Omega_1 > 0$, it can be concluded that also under this specification when the variances of the shocks increase, discretion is preferable. On the other side, Ω_2 measures the impact of the covariance of the shocks in the two blocks on the comparison between rule and discretion. It can be shown that $\Omega_2 < 0$. Therefore, from (11) it can be concluded that when the level of symmetry in the union ($Cov_{r,l} > 0$) increases, discretion is preferable to a monetary rule. Concluding, the rule is superior in situations in which the shocks have low variability and are asymmetric. On the contrary, discretion is preferable under symmetric and highly variable shocks. It is worth noting that the more the single countries target is close to the natural rate of unemployment ($k_r \to 1$ and $k_l \to 1$) the lower the loss under discretion than under a rule, because the time inconsistency problem becomes less severe.

During periods of economic turbulence the variability of shocks is much stronger, this scenario implies an increase in $\sigma^2_{\varepsilon,r}$ and $\sigma^2_{\varepsilon,l}$. In such phases the need for discretion in monetary policy increases as the Central Bank should be free to act with ample margin of maneuver in order to stabilize the economy. Discretion is the best course of action then. When very few shocks should be accommodated a rigid rule is preferable. Therefore, it can be expected that rigid rules could break down during a crisis since discretion becomes preferable.

Nevertheless, the degree of co-movement of shocks is of major importance when comparing monetary rules and discretion in a currency union. As already stated, from solution (11) it can be concluded that the more asymmetric are the co-movements, the more desirable the monetary police rule is. This result can be explained using equations (7), (8) and (9). When the two shocks are asymmetric, they tend to cancel each other in the determination of inflation; however, it has to be noted that under discretion inflation will not be zero since the bias is not cancelled. On the other side, under a zero inflation rule the bias is eliminated and the Central Bank is forced to stabilize the shocks, as a consequence the inflation rate will be zero. At the same time it is clear that under discretion asymmetric shocks will reinforce each other, increasing unemployment in the whole union.

5 Policy Implications

The results of the model provide some important institutional and policy implications. Firstly, forming a currency union requires certain institutional rules to set monetary policy, and in this respect the voting system is crucial. With multiple countries it can be assumed that the voting rules affect the weight of each member in the decision process (α_i). Thus, in a currency union the choice of the decision process is very important in order to prevent time inconsistency in the conduct of monetary policy.

It has been shown that in a multi-country framework there is a higher probability of time inconsistent policies, then the choice of voting rules that marginalize the impact of single countries (or groups) targets in the decision process is extremely important to minimize (or even eliminate) time inconsistency. This is the reason why for instance the ECB is intended to be a supranational institution rather than a committee of national authorities. This implies that the Central Bank welfare loss should not be a weighted average of the losses of the single members based on single countries data, but a single function based on aggregated data.

Secondly, assessing the development of the surrounding economic scenario is extremely important for the creation of the monetary policy institutional framework. If the Central Bank is supposed to react to a multitude of shocks, discretion is preferable. If on the contrary the Central Bank is supposed to react to very few shocks, then a strict rule is the best solution. Moreover, the way the single countries will react to the phenomena in the surrounding economic scenario is also very important. When the monetary union is supposed to face many asymmetric shocks a strict rule is the best institutional arrangement, while if the level of heterogeneity in the union is considered to be high, discretion is more desirable. During a crisis the level of variability of shocks is high and a strict rule would prevent the Central Bank from reacting in order to stabilize the economy. Moreover, if these shocks are symmetric the need for discretion is reinforced, and the rule would put the conduct of monetary policy under stress and adverse criticisms. Hence, the best institutional arrangement would be based on a rule that could be abandoned in the case of severe crises. Nevertheless, it would be very difficult to implement such arrangement since it will not be easy to asses what a severe crisis is, and the identification of the threshold to allow the switching could be very subjective. Moreover the uncertainty about the switch would affect the formation of expectations, and consequently the effects of monetary policies would be changed too. It is worth noting that under a crisis that hits only a part of the union, it would be much more difficult to find the best institutional framework. The increase in the variability of shocks would call far more discretion, while the decrease in the correlation between shocks would call for a rule. The solution can only be found depending on the economic structure and on the members preferences. In this situation, a case by case solution would be needed.

Thirdly, at this point the convergence across countries in the union becomes very important. The covariance of shocks should increase together with the improvement in policy coordination and market integration to the extent that this process would not lead to specialization in the single member countries. Therefore, fighting the latter would trigger the benefits from economic integration, reducing the problem of asymmetric reactions to shocks. At this point the debate between rule and discretion is only left to the assessment of the variability of shocks, and the arrangement of a rule with escape clauses is once again a favorable one.

6 Conclusion

Compared to a single country framework, monetary policy design in currency unions faces much more challenging scenarios. Considering these additional challenges, the presence of asymmetric shocks and the higher probability of time inconsistency have been highlighted in this paper. Under the assumption that the member countries share the same level of inflation, an evaluation of the union welfare under a monetary rule and under discretion has been carried out.

Assuming that the transmission of monetary policy is symmetric across countries, discretion is more desirable when the shocks show high variability and single countries react symmetrically to them. In these circumstances, discretional monetary policies can improve the social welfare stabilizing the economy. In order to exploit the benefits from discretion in this scenario, it is very important to implement a decision making framework that is able to marginalize the influence of single countries preferences. If this is the case, the time inconsistency problem can be minimized. Under the opposite circumstances a monetary rule is the best arrangement.

These results imply that in periods of strong economic turbulence, the rule can be under pressure to break down. Thus, the best monetary institutional framework is the rule with some escape clauses. Nevertheless, some problems still arise. Firstly, the difficult definition of the conditions and the threshold to switch from the rule to discretion. Secondly, the possible scenario in which the shocks have high variability and hit the single countries asymmetrically would imply both negative and positive aspects for the rule and discretion. Thus, in this circumstance a case by case analysis is necessary in order to decide whether discretion performs better than the rule or vice versa.

The model used in this paper is a simple but significant one, as it can be extended in many directions. Since the model was solved in a one-shot game framework, one of these extensions can be to solve the model in a repeated game setting in order to introduce the effects of reputation on the Central Bank policies. This is left for further research.

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