MONETARY POLICY TRANSMISSION ASYMMETRIES: SOME IMPLICATIONS FOR EMU AND ITS ENLARGEMENT

by

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Abstract

In this paper we analyse how the enlargement of a monetary union may affect the design of the common monetary policy when the latter transmits asymmetrically between the member countries. We find that the use of national information about inflation and unemployment in the design of the common monetary policy allows for tackling the heterogeneity induced by this asymmetry. This implies that if the enlargement contributes to augmenting the transmission asymmetry of monetary policy in EMU, it will raise the need to take into account information about national economies in the formulation of optimal monetary policies in the monetary union. Furthermore, the choice for a new EU member state to enter into EMU will also depend on the monetary strategy which is implemented and, in particular, whether the former takes the asymmetries in the transmission of monetary policy actions into account or not.

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1- Introduction

The conduct of monetary policy in Euroland is made difficult because of the existence of asymmetries within the union. Asymmetries exist both at the level of the macroeconomic shocks to which members of the union are subjected and at the level of the transmission of monetary policies. The future enlargement of EMU is likely to increase these asymmetries (all the more so as the new EU member states experience different processes of financial liberalisation, labour market reforms, etc...)[2]. Empirical studies on the differences in the transmission processes between those countries and the members of EMU are scarce. The evidence that exists today, however, seems to confirm that the heterogeneity in the transmission process will tend to increase after enlargement[3].

Recent theoretical analysis has shown that the existence of asymmetries in the transmission of monetary policy actions of the ECB calls for a design of monetary policies that takes into account national data. Thus, in order for monetary policies to be set optimally it is not sufficient to use aggregated (euro) data on inflation and output gaps, but also to consider non-aggregated national data on these same variables if asymmetries in the transmission of monetary policies exist (see Gros and Hefeker (2002) and De Grauwe and Senegas (2003)). Empirical evidence seems to support this view. In the case of the US Federal Reserve System Meade and Sheets (2002) have shown that the members of the Board take into account regional data when deciding about monetary policy, presumably because they believe that the use of regional data is welfare improving. Similar results have been obtained by Heinemann and Hufner (2002).

In this paper we analyze the question of how the enlargement of EMU will affect the choice between a strategy that uses national (regional) data and one that only relies on euro-aggregates. To analyze this issue, we develop a model of a monetary union in which the transmission of monetary decisions is asymmetric (see De Grauwe and Senegas (2003)). We apply this analytical framework, first, to analyse the case of the monetary union taken as a whole and faced with an increase in the transmission asymmetry due to its enlargement; then, we focus on one specific Accession country entering into EMU[4]. We study the optimal monetary policy strategy in each

[2] On the problem of the asymmetry of the shocks between the euro area and the Accession countries, see Fidrmuc and Korhonen (2003).
[3] See, among others, the reports made out by the European Investment Bank (2002) and by the Austrian Central Bank (see Oesterreichische Nationalbank (2001)), which focus on the financial channels involved in the monetary transmission mechanism.
[4] On this point, we complement the results provided by Gros and Hefeker (2002, p. 256-257).

case.

2- Enlargement, dispersion and monetary union: national *or* union-wide aggregation?

2.1- The modelling framework

We use a standard macroeconomic model and apply it to a monetary union framework. The asymmetry is introduced in the model by considering that the features of the national (linear) Phillips curves differ from one country to the other, so that:

$$U_i = U_i^* - a_i \cdot \left(\pi_i - \pi_i^e\right) + \varepsilon_i \quad (1)$$

i is the country i = 1,2,..., N. U_i is the current unemployment rate in the country i and U_i^* is the related natural rate of unemployment. a_i denotes the transmission parameter of (unexpected) inflation impulses to the unemployment rate. As our objective is to analyse the implications of asymmetries in transmission, we assume that this coefficient differs across countries.

We focus on the asymmetries in the transmission process because it is at this level that the enlargement issue will be introduced in the model (see *infra*). Thus, we suppose that $\varepsilon_i = \varepsilon$ for all *i*. Put differently, we intend to analyse a world of symmetric shocks that are transmitted asymmetrically. In the following, ε may be therefore considered as a common supply shock.

π_i refers to the current inflation rate in country *i* (while π_i^e refers to the expected inflation rate). It will be assumed that when the countries in the model form a monetary union the inflation rate is the same in all countries (formally, in the monetary union we impose that $\pi_i = \pi \ \forall i$). We use this simplifying assumption for two reasons.

First, it is commonly assumed in this kind of literature that the monetary authorities directly control the inflation rate. It is also possible to suppose that the Central bank does not directly control the inflation rate but uses an interest rate rule to implement its policy. Divergences in the inflation rates could then be due to asymmetries in the "financial part" of the national monetary transmission mechanisms[5]. In what follows, we abstract from this complication and focus on the idiosyncrasies arising from the national labour and good markets which imply (through the Phillips curves) that the common monetary policy leads to divergent developments in unemployment within the monetary

union. The alternative approach would certainly be more realistic but also more intricate. We prefer to confine ourselves to a simple framework and consider this configuration as a (minimal) benchmark to assess the impact of monetary transmission asymmetry in a monetary union[6].

Second, in a monetary union, the member countries share common monetary conditions, which should lead to the same rates of inflation. There is of course evidence indicating that inflation rates in the eurozone differ across countries. However, it is likely that those inflation differentials are very much influenced by the Balassa-Samuelson effect (especially if we focus on the new member states which experience a catch-up process[7]). Since this is primarily a structural feature, it is not very much influenced by monetary policy.

We suppose that the single monetary policy in a monetary union can be designed in two ways. In the first strategy, the common Central Bank uses information of the national aggregates, such as the national unemployment rates and output levels. It then aggregates the welfare functions of the member countries (which use these national aggregates) to obtain one aggregate "welfare function" for the union as a whole. In the second strategy, the common Central Bank does not use national information on unemployment and output. Instead, it only uses the corresponding aggregates at the Union level and substitutes them into another welfare function which is directly defined in terms of Union-wide variables. We now describe the implementation of these two strategies more formally.

1- In the first strategy, the common Central Bank chooses to minimise a weighted average of national loss functions. We define this strategy as a national aggregation (NA) procedure. The national loss function depends on the squared deviations of national inflation[8] and output from target levels in the following way:

$$L_i \equiv (\pi_i)^2 + b \cdot (U_i - U_i^*)^2$$

where b denotes the weight the authorities attach to stabilizing the unemployment rate around its

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[5] i.e. the channels through which the changes in the interest rate could affect demand conditions.

[6] It is likely that complementing the model with imperfect control of the inflation rate and/or allowing for structural factors leading to different rates of inflation in the monetary union would, to some extent, strengthen the results we obtain here. See Artis (2003) who tries to identify empirically the importance of diverse differences in national transmission mechanisms with respect to the business cycle developments of several European countries.

[7] For an assessment of the Balassa-Samuelson effect and of the behaviour of real exchange rates in the new member states of the European Union, see MacDonald and Wojcik (2004).

[8] According to the assumptions made *supra*, when country *i* belongs to the monetary union, its inflation rate is given by the inflation rate which is common to all the member countries and which is determined at the Union level by the common Central Bank.

natural level[9]. Note that for the sake of convenience we set the target rate of inflation equal to 0. In addition, we assume that the unemployment target of the authorities coincides with the natural rate. As a result, we disregard issues relating to credibility problems which could arise when the unemployment rate target is lower than the natural rate[10]. Indeed, we want to emphasize that the monetary authorities are likely to face the heterogeneity in the transmission of monetary policy, their potential time-inconsistency notwithstanding.

In the (NA) scenario therefore, the central bank of the monetary union determines its optimal strategy by minimising the "average" of the loss functions of the member countries in the Union[11]:

$$\Lambda^{NA} \equiv \sum_{i=1}^{i=N} \mu_i \cdot L_i$$

where μ_i is the weight associated to country i in the computation of the aggregate loss function. We have: $\sum_{i=1}^{i=N} \mu_i = 1$.

As the inflation rate is common to all the member countries, we may rewrite the former expression as:

$$\Lambda^{NA}(\pi) = (\pi)^2 + b \cdot \sum_{i=1}^{i=N} \mu_i \cdot \left(U_i - U_i^*\right)^2 \quad (2)$$

Since $\left(U_i - U_i^*\right)$ depends on the (rationally) unexpected component of the (common) inflation rate, Λ^{NA} will be a function of π (for a given value of the shock, ε). In the following, we define π^{NA} as the optimal inflation rate under the NA strategy (i.e. the one for which Λ^{NA} is minimal).

2- The second scenario refers to a strategy where the Central Bank minimizes a loss function defined in terms of Union-wide aggregate variables, i.e. an average inflation rate and an average unemployment rate. As we implicitly refer to the EMU case, we designate such a strategy as a **euro** (area)-**aggregation** (EA) procedure, which we specify as follows:

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[9] We assume that the common Central Bank and its national counterparts share the same preferences concerning inflation and unemployment in their welfare loss functions.

[10] As it is well known, credibility issues concerning monetary policy have been initially addressed by Barro and Gordon (1983) and in numerous studies thereafter.

[11] By convention, X^{NA} (resp. X^{EA}) refers, in the following, to the value taken by the (endogenous) variable X when the so-called national-aggregation (resp. Union-wide) strategy is implemented by the Central Bank.

$$U_E \equiv \sum_{i=1}^{i=N} \mu_i \cdot U_i \; ; \; U_E^* \equiv \sum_{i=1}^{i=N} \mu_i \cdot U_i^* \; ; \; \pi_E \equiv \sum_{i=1}^{i=N} \mu_i \cdot \pi_i = \pi$$

where the subscript E refers to a variable defined at the Union level. The relevant loss function may then be defined as follows:

$$\Lambda^{EA} \equiv (\pi_E)^2 + b \cdot (U_E - U_E^*)^2$$

or:

$$\Lambda^{EA}(\pi) = (\pi)^2 + b \cdot \left[\sum_{i=1}^{i=N} \mu_i \cdot (U_i - U_i^*) \right]^2 \qquad (3)$$

Again we observe that Λ^{EA} is a function of π. In the following we define π^{EA} as the optimal inflation rate under the (EA) strategy (i.e. the one for which Λ^{EA} is minimal).

Finally, both strategies could be compared with a common welfare measure. In this case, we may assume that it is the welfare of the individual agents (countries) that should form the basis for such an evaluation (note that this view underlies the (NA) strategy). Some may object to this and argue that in a monetary union it is the "representative union agent" whose welfare should be optimised (as in the (EA) strategy). We take the view that in the context of the European monetary union, the nation state cannot be ignored[12]. It is still the overriding presence, so much so that there can be no doubt that decisions by the ECB that would systematically hurt the national interests would lead to conflicts and possibly even a break-up of the system. Put differently, the European monetary union is still very different from say the "US monetary union" in that the degree of political unification of the former falls far short of the latter.

All this leads us to define a welfare criterion based upon the weighted average of the *ex ante* (expected) national losses obtained under each of the two alternatives. Thus welfare is defined as:

$$W \equiv E_\varepsilon \left[\sum_{i=1}^{i=N} \mu_i \cdot L_i \right] \quad (4)$$

where E_ε is the expectation operator taken with respect to the distribution of ε (which is

[12] Furthermore, as the model we use has no explicit microeconomic foundations, utility-based welfare loss functions

assumed to be an (i.i.d.) shock). We posit $E_\varepsilon[\varepsilon]=0$ and $\text{var}_\varepsilon[\varepsilon^2]=\sigma^2$ (where var_ε refers to the variance of ε). Note that $W=E_\varepsilon[\Lambda^{NA}]$.

2.2- Comparison of the strategies

The framework just derived may be used to analyse the suitability of the two strategies for the monetary union, assuming that the enlargement of the latter is associated with an increase in the transmission asymmetry of monetary policy.

The differences between the (NA) and (EA) strategies are primarily reflected in the expressions of the optimal inflation rates[13].

- Under the (NA) strategy, the optimal inflation rate is given by:

$$\pi^{NA}=\frac{b\cdot a_E}{1+b\cdot\left(a_E^2+\theta_{a_E}^2\right)}\cdot\varepsilon\equiv\Omega_{NA}\cdot\varepsilon$$

with a_E which could be qualified as the *mean* transmission parameter $\left(a_E\equiv\sum_{i=1}^{i=N}a_i\right)$ and $\theta_{a_E}^2$ which is a measure of the dispersion in the national transmission parameters $\left(\theta_{a_E}^2\equiv\sum_{i=1}^{i=N}\mu_i\cdot\left(a_i-a_E\right)^2\right)$. Thus $\theta_{a_E}^2$ accounts for the asymmetry in the transmission process. (Besides we have the following relation: $\overline{a_E^2}=a_E^2+\theta_{a_E}^2$ with $\overline{a_E^2}\equiv\sum_{i=1}^{i=N}\mu_i\cdot a_i^2$).

We observe that when the asymmetry in the transmission process increases, the authorities' optimal inflation rate reacts less to shocks. This, in turn, has implications for the stabilisation in unemployment (at the national level) as it can be seen from the following expression of the equilibrium unemployment rate (obtained by substituting the optimal inflation rate in the Phillips curve):

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cannot be considered.

[13] To determine the value of the inflation rates (at equilibrium) under both strategies, we make use of two results concerning inflationary expectations. First, they are the same between the countries when the monetary union prevails. This comes from the fact that, when forming such expectations, the national private sectors take into account that there is a single monetary policy (and, in turn, only one inflation rate) for the whole monetary union. Second, under each strategy, the equilibrium value of these expectations is nil. This is partly due to the fact that the private sector cannot observe the common supply shock to which the Central Bank of the monetary union reacts. Moreover, as there is no problem of time inconsistency in the model, no inflation bias is associated with the use of monetary policy.

$$U_i^{NA} = U_i^* + (1 - \Omega_{NA} \cdot a_i) \cdot \varepsilon$$

- Under the (EA) procedure we obtain:

$$\pi^{NA} = \frac{b \cdot a_E}{1 + b \cdot a_E^2} \cdot \varepsilon \equiv \Omega_{EA} \cdot \varepsilon$$

Note that this is the same optimal inflation rate which would be derived if the model had been applied to the case of a single country (whose role is played in our framework by the monetary union).

As in the first scenario the equilibrium level of the national unemployment rates can be obtained by substituting the optimal inflation rate into the national Phillips curves, i.e.:

$$U_i^{EA} = U_i^* + (1 - \Omega_{EA} \cdot a_i) \cdot \varepsilon$$

The main reason why the two inflation rates differ under the two strategies is that, under the (NA)-strategy, the monetary authorities take into account that the impact of their decisions differ between the countries, while this is not the case under the (EA) strategy. As a consequence, under a strategy which aims at minimising the variability of Union-wide variables only, the asymmetry in the transmission of the common supply shocks does not act as a motive for changing the inflation rate and, thereby, for affecting the variability of the national unemployment rates.

A graphical illustration may be useful for comparing the two strategies and their consequences on the stabilisation of inflation and unemployment at the Union level (i.e. in terms of *Union-wide* defined variables). The impact of a symmetric, positive supply shock on the national Phillips curves is to move to the right the corresponding Union-wide schedule in the $(U_E ; \pi)$ plane (see figure 1). The two strategies lead to two different stabilisation lines[14]. These lines give the combinations of optimal inflation rates and corresponding unemployment rates after supply shocks of different sizes (the

[14] The stabilisation path associated with the (EA) strategy could be obtained by grouping the tangency points (in the $(U_E ; \pi)$ plane) between the indifference curves relative to the loss function of the monetary authorities (defined in terms of Union-wide aggregates) and the different Union-wide Phillips curves arising from different supply shocks. This reflects the optimizing problem faced by the monetary authorities under the (EA) strategy. It does not seem possible to trace out this parallel in the case of the (NA) strategy as the relevant loss function does not depend on Union-wide defined variables only.

analytical expressions of their slopes are given below the graphs).

We note that the higher the dispersion in the national transmission parameters, the flatter the slope of the stabilisation line related to the (NA) strategy. Furthermore, for a given, supply shock (ε), the (NA) strategy moves the economy to (B) instead of (A) obtained under the (EA) procedure. In other words, the increase in unemployment is higher under the NA-strategy than under the EA-strategy. This is due to the fact that in the NA-strategy the monetary authorities are less aggressive in changing the inflation rate than in the EA-strategy.

- insert figure 1 –

Finally, it might be interesting to assess the impact of an increase in the transmission asymmetry on the welfare gains associated with the (NA) strategy. The latter are given by the differential loss:

$$\Delta W \equiv \frac{1}{\sigma_{\varepsilon}^{2}} \cdot \left(W^{EA} - W^{NA} \right)$$

After substituting the relevant values of the inflation and unemployment rates in (4) and simplifying, we obtain:

$$\Delta W = \left[\Omega_{EA} - \Omega_{NA} \right] \cdot \Omega_{EA} \cdot b \cdot \theta_{a_E}^{2} \qquad (5)$$

which is positive as $\Omega_{EA} > \Omega_{NA}$. The following result then obtains:

$$\frac{\partial(\Delta W)}{\partial \theta_{a_E}^{2}} > 0$$

We may thus conclude that, as the asymmetry in the transmission process rises, the welfare gains from using the (NA) strategy increase for the whole monetary union. Since the enlargement is likely to increase the asymmetries in the national transmission processes, it will become even more important for the monetary authorities to take national data on output and inflation into account when formulating the optimal monetary policy for the union as a whole.

3- Accession and heterogeneity: better off, out or in?

This "one fits all monetary policy" problem can be given an interesting extension by analysing the welfare implications of the choice between the (NA) and (EA) strategies for an individual country. Even though the monetary union as a whole would gain from using a monetary policy which takes the prevailing heterogeneity into account, it is worthwhile to look at an individual country (e.g. a new member state). As we will show, despite the fact that the union as a whole gains from the use of the (NA) strategy, this may not be the case for all the individual countries.

Let us first consider the case of country *i* once in the union. In this country, depending on the strategy chosen by the central bank of the monetary union (either EA or NA), the inflation would be given by:

$$\pi_i^{EA} = \Omega_{EA} \cdot \varepsilon \ \left(= \pi^{EA}\right) \text{ or } \pi_i^{NA} = \Omega_{NA} \cdot \varepsilon \ \left(= \pi^{NA}\right)$$

Let us now compare these inflation rates to the inflation rate which would have been chosen if the country did not take part in the monetary union. In this case, the reaction of the national monetary authorities of country *i* would have led to[15]:

$$\pi_i^{ID} = \frac{b \cdot a_i}{1 + b \cdot a_i^2} \cdot \varepsilon \ \equiv \Omega_{ID}^i \cdot \varepsilon$$

The consequences in terms of unemployment variability of these three different monetary policy strategies are illustrated graphically. Figures (2) and (3) plot the outcomes for inflation and unemployment *in country i* after the occurrence of one symmetric supply shock. The different properties of the three rules depend on the slopes of the corresponding stabilisation lines.

First, note that the monetary policy rules defined at the EMU level are defined in terms of EMU average parameters and thus do not involve the features of the transmission channel of country *i* (a_E instead of a_i prevails).

To compare both cases (EMU-based versus national based stabilisation), it is thus necessary to be more precise about how a_i differs from its "EMU" average. Accordingly, we make the assumption, in Figure (2), that both EMU-based stabilisation profiles ((NA) or (EA) strategies) are flatter than the idiosyncratic one whereas, in figure (3), we make the reverse assumption.

[15] See Sibert (2003) for a critical statement about the ability to formulate such a policy (within a flexible exchange rate regime).

If we compare the national- and EMU-based monetary policy reactions (points (E), (C) and (D) in figures 2 and 3), we observe that, depending on the extent to which country *i* deviates from the average in terms of the transmission of its monetary policy, the actions defined at the EMU-level will be more or less suited to the stabilisation needs of this country.

More specifically, if country *i*'s stabilisation line is steeper than both the stabilization lines under the EA- and NA-strategies, country *i* will always prefer the EA-strategy to the NA-strategy if it is a member of the union. This can be seen from the fact that country *i*'s stabilisation line represents the best possible response to the shock ε. Since the EA-stabilisation line deviates less from country *i*'s stabilisation line than the NA-stabilisation line, country *i* will prefer the former to the latter (see the appendix for a more formal treatment of this implication).

- insert figure 2 –

The opposite occurs in figure (3), which represents the case where country *i*'s stabilisation line is flatter than both the NA-and EA-stabilisation lines. In this case, when country *i* joins EMU, it will prefer the (NA) strategy.

- insert figure 3 –

There is an intermediate case (not shown in the figures). This arises when country *i*'s stabilisation line has a slope that falls between the slopes of the EA-and NA-lines. In that case the outcome is uncertain and will depend on how close country i's stabilisation line is to either the EA- and the NA-lines.

The intuition of these results is the following. In the previous section we have seen that the EA-strategy is a more ambitious strategy in terms of stabilizing unemployment (at the Union level) than the NA-strategy. This result finds its expression in the fact that the EA-line is steeper than the NA-line in this case. When country *i* has a very ambitious stabilisation strategy it will feel more comfortable with the EA-strategy. Conversely, when country *i* has a very conservative stabilization strategy, it will prefer the NA-strategy which is also relatively conservative.

4- Conclusion

In this paper we have analysed the optimal design of monetary policies in a monetary union, using a simple N-country model. We focused on the issues that arise when the transmission process of the common monetary policy is asymmetric. Our main conclusion here is that in such an environment, the common monetary policy would benefit from using national information on inflation and unemployment. Thus the design of common monetary policy that uses only union-wide averages will be suboptimal. The larger are the asymmetries the stronger the welfare gains that are obtained from using national information. To the extent that enlargement of the Eurozone is likely to lead to more asymmetries in the transmission of the common monetary policy, this implies that the need to use national information in the setting of the common monetary policy will increase.

While the design of the common monetary policy that uses national information is always be preferred from the point of view of the welfare of the union taken as a whole, this is not necessarily the case for all the individual members. We showed that the member countries may sometimes prefer the common central bank to disregard national information and to use only union-wide averages of inflation and unemployment. This will be the case when the individual country's ambitions to stabilize unemployment are sufficiently strong.

These results suggest that although the union as a whole will gain from a policy that uses all available information, including national information, not all members of the union would gain from such a strategy.

There are many aspects of the optimal design of the common monetary policy that have not been touched upon in this paper. One relates to uncertainty of the transmission process. In another paper (see De Grauwe and Senegas (2003)), we showed that the general conclusion concerning the desirability of using national information in the design of the common monetary policy is reinforced in this case. How these gains are distributed among the member countries of the union when there is transmission uncertainty is an issue left for future research.

5- References

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6- Appendix

The choice for country *i* is based on the welfare indicator *W* considered now on the national basis, so that $W_i \equiv E_\varepsilon[L_i]$. Accordingly, we obtain:

$$W_i^{NA} = \left[(\Omega_{NA})^2 + b \cdot (1 - \Omega_{NA} \cdot a_i)^2\right] \cdot \sigma_\varepsilon^2 \qquad (6)$$

$$W_i^{EA} = \left[(\Omega_{EA})^2 + b \cdot (1 - \Omega_{EA} \cdot a_i)^2\right] \cdot \sigma_\varepsilon^2 \qquad (7)$$

The relative benefits of a national aggregation strategy *versus* a Union-wide procedure *for country i* are given by the differential loss:

$$\Delta W_i \equiv \frac{1}{\sigma_\varepsilon^2} \cdot \left(W_i^{EA} - W_i^{NA}\right)$$

Making the relevant substitutions, we obtain:

$$\Delta W_i = \left[\Omega_{EA} - \Omega_{NA}\right] \cdot P\left(b\,;\,\theta^2_{a_E}\,;\,a_i\,;\,a_E\right) \qquad (8)$$

with:

$$P\left(b\,;\,\theta^2_{a_E}\,;\,a_i\,;\,a_E\right) \equiv \left(\Omega_{EA} + \Omega_{NA}\right) \cdot \left(b \cdot a_i^2 + 1\right) - 2 \cdot b \cdot a_i \qquad (9)$$

The choice between the two strategies – from the viewpoint of country *i* - depends above all on three elements: the relative value of the country specific transmission coefficient (a_i) with respect to the mean transmission parameter (a_E), the degree of transmission asymmetry in the whole monetary Union $\left(\theta^2_{a_E}\right)$ and the relative preferences parameter (b).

We illustrate how those parameters influence the choice of country *i* by focusing on the two polar cases mentioned in the main text, that is by considering the stabilisation issues in this country.

Looking at equation (8), it follows that the choice between a national aggregation and a euro-aggregation strategy within EMU depends on whether $P\left(b\,;\,\theta^2_{a_E}\,;\,a_i\,;\,a_E\right)$ is positive or negative.

1- Let first consider the case for the (NA) strategy. The related condition, $P\left(b\,;\,\theta^2_{a_E}\,;\,a_i\,;\,a_E\right) > 0$, is equivalent to:

$$\frac{b \cdot a_i}{1 + b \cdot a_i^2} < \frac{\left(\Omega_{EA} + \Omega_{NA}\right)}{2} \qquad (10)$$

(as all the parameters involved in the condition are supposed to be positive).

Now consider the case where the country has a stabilisation line's slope which is lower than the one associated with the (NA) strategy (which in turn is lower than the one related to the (EA) strategy). This case, amounts to suppose that the parameters a_i, a_E and b are such that[16]:

$$S^i_{ID} < S_{NA} < S_{EA}$$

[16] In the following we always suppose that ($1 - a_i\,\Omega_{NA}$) and ($1 - a_i\,\Omega_{EA}$) are positive, what is implicit in the graphical

(conditions on the related slopes).

It is easy to see that the previous inequality is equivalent to consider that $\Omega_{ID}^{i} < \Omega_{NA} < \Omega_{EA}$. But, by the same token, we immediately observe that this case belongs to the ones covered by the inequality (10).

In other terms, the country whose stabilisation line is flatter than the one which is provided by the (NA) strategy (and by extension by the (EA) strategy as well) would benefit from the latter strategy from a welfare viewpoint.

2- The case for the country whose stabilisation line is steeper than the two EMU-stabilisation lines can be made in a similar way. First note that the (EA) strategy is welfare improving for country *i* whenever

$$\frac{b \cdot a_i}{1 + b \cdot a_i^2} > \frac{\left(\Omega_{EA} + \Omega_{NA}\right)}{2} \qquad (11)$$

For the case we consider (i.e. the country with a steeper, idiosyncratic stabilisation line) we have:

$$S_{ID}^{i} > S_{EA} > S_{NA}$$

This is equivalent to analyse the configuration for which $\Omega_{ID}^{i} > \Omega_{EA} > \Omega_{NA}$. Again, we may observe that this case belongs to the ones covered by the inequality (11). As a consequence, we may conclude that, for the country whose stabilization line is steeper than the two EMU- average lines, being subjected to the EA strategy would be beneficial in terms of welfare.

The intermediary cases (i.e., those for which the idiosyncratic stabilization line locates between its two EMU based corresponding schedules.) may or may not favour the (EA) strategy from a welfare viewpoint. A detailed analysis, would prove that the result depends on the relative values of the national and the EMU-average transmission parameters. In graphical terms, those values would indeed determine whether, while located in-between, the country *i*'s stabilisation line is closer to the (EA) or to the (NA) related line. The following figure summarizes the main points involved in the issue just covered:

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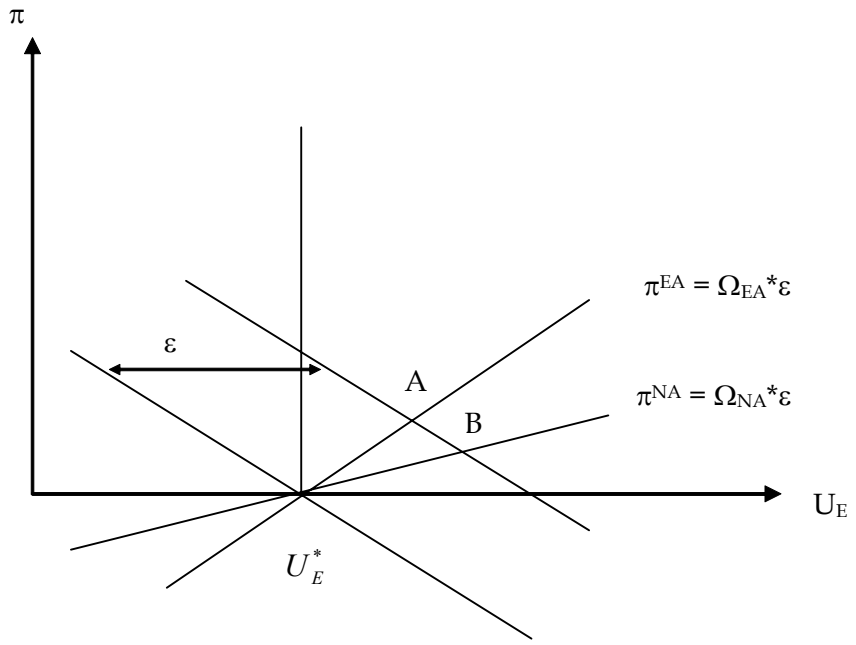
analysis.

- insert figure 4 -

To conclude, we may observe that the choice between the two strategies is related to the way how the latter affect the variability of inflation and unemployment compared to the case where an idiosyncratic monetary policy would have been implemented. For one specific country, the variability of inflation is less under the (NA) strategy than under the (EA) strategy in so far as the former implies a more cautious reaction to the shock than the latter. However whether the variability of inflation would be of a less or a more extent than the one induced by an idiosyncratic monetary policy depends on the relative position of a_i with respect to a_E . This, in turn, affects the variability of the unemployment through the Phillips curve.

Stabilisation of shocks and transmission asymmetry in the monetary union

The case of the monetary union taken as a whole



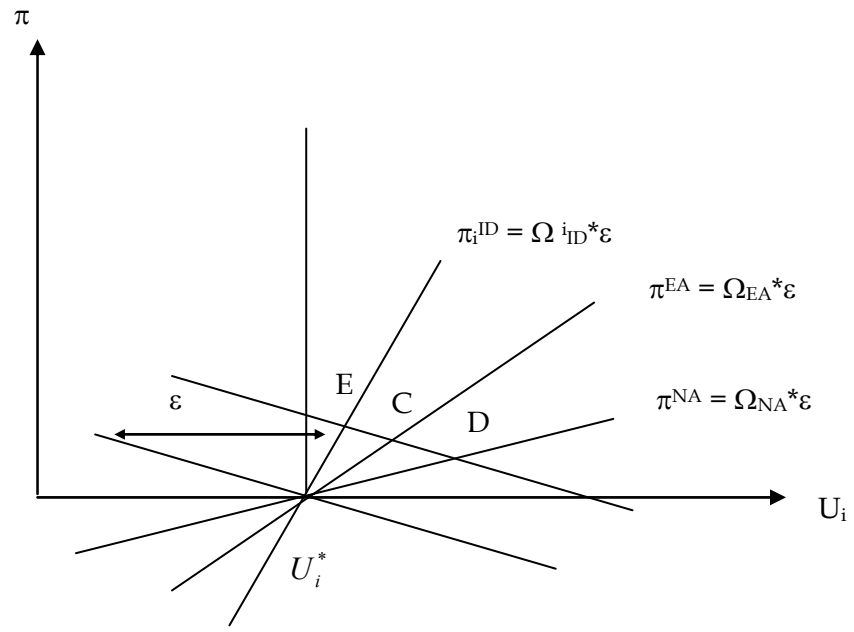
$$S_{EA} \equiv \left.\frac{\partial \pi^{EA}}{\partial U_E^{EA}}\right|_{\varepsilon} = \frac{\Omega_{EA}}{1 - a_E \cdot \Omega_{EA}} = b a_E$$

$$S_{NA} \equiv \left.\frac{\partial \pi^{NA}}{\partial U_E^{NA}}\right|_{\varepsilon} = \frac{\Omega_{NA}}{1 - a_E \cdot \Omega_{NA}} = \frac{b a_E}{1 + b\theta_{a_E}^2}$$

Figure 1

Stabilisation of shocks and transmission asymmetry in the monetary union

The case of country i (1)



$$S_{EA} \equiv \left.\frac{\partial \pi^{EA}}{\partial U_i^{EA}}\right|_{\varepsilon} = \frac{\Omega_{EA}}{1 - a_i \cdot \Omega_{EA}} = \frac{ba_E}{1 + ba_E\left(a_E - a_i\right)}$$

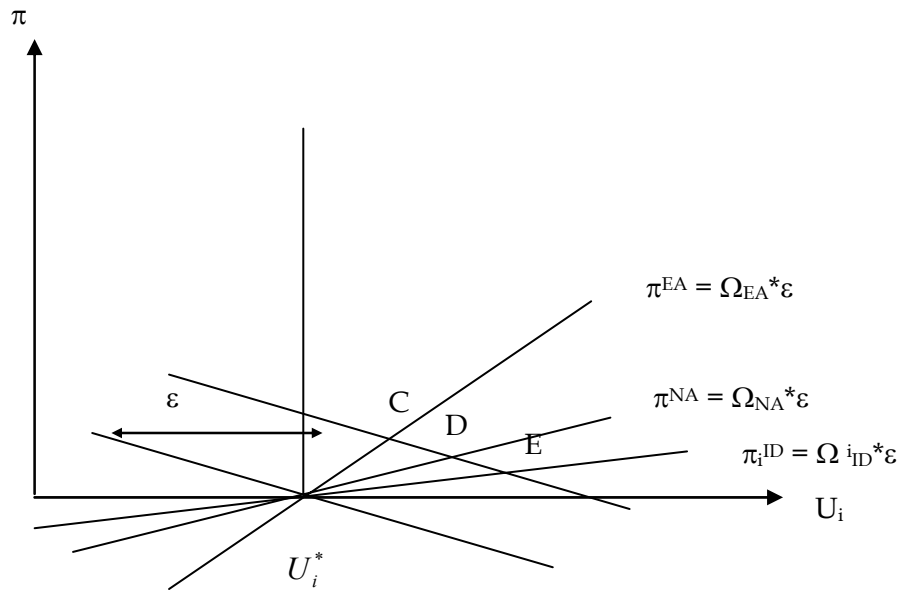
$$S_{NA} \equiv \left.\frac{\partial \pi^{NA}}{\partial U_i^{NA}}\right|_{\varepsilon} = \frac{\Omega_{NA}}{1 - a_i \cdot \Omega_{NA}} = \frac{ba_E}{1 + ba_E\left(a_E - a_i\right)}$$

$$S_{ID}^{i} \equiv \left.\frac{\partial \pi_i^{ID}}{\partial U_i^{ID}}\right|_{\varepsilon} = \frac{\Omega^{i}{}_{ID}}{1 - a_i \cdot \Omega_{ID}^{i}} = ba_i$$

Figure 2

Stabilisation of shocks and transmission asymmetry in the monetary union :

The case of country i (2)



$$S_{EA} \equiv \left.\frac{\partial \pi^{EA}}{\partial U_i^{EA}}\right|_{\varepsilon} = \frac{\Omega_{EA}}{1 - a_i \cdot \Omega_{EA}} = \frac{ba_E}{1 + ba_E\left(a_E - a_i\right)}$$

$$S_{NA} \equiv \left.\frac{\partial \pi^{NA}}{\partial U_i^{NA}}\right|_{\varepsilon} = \frac{\Omega_{NA}}{1 - a_i \cdot \Omega_{NA}} = \frac{ba_E}{1 + ba_E\left(a_E - a_i\right)}$$

$$S_{ID}^{i} \equiv \left.\frac{\partial \pi_i^{ID}}{\partial U_i^{ID}}\right|_{\varepsilon} = \frac{\Omega_{ID}^{i}}{1 - a_i \cdot \Omega_{ID}^{i}} = ba_i$$

Figure 3

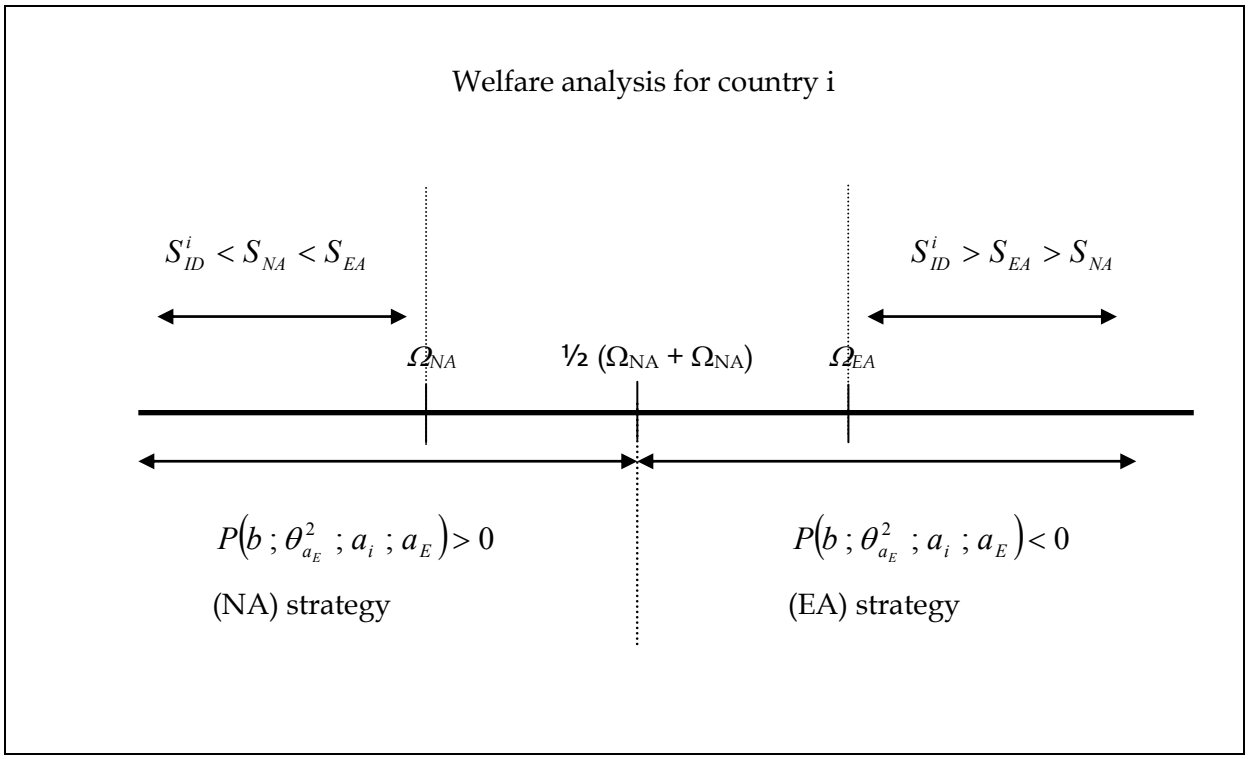

Welfare analysis for country i
$S^i_{ID} < S_{NA} < S_{EA}$
$S^i_{ID} > S_{EA} > S_{NA}$
Ω_{NA}
½ (Ω_{NA} + Ω_{NA})
Ω_{EA}
$P\left(b\,;\,\theta^2_{a_E}\,;\,a_i\,;\,a_E\right) > 0$
$P\left(b\,;\,\theta^2_{a_E}\,;\,a_i\,;\,a_E\right) < 0$
(NA) strategy
(EA) strategy

Figure 4