Transmission of the European monetary policy: A measure of asymmetry

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Abstract : we propose a measure of asymmetry of the European monetary policy. It aims to satisfy the three Dornbusch, Favero et Giavazzi (1998) conditions. The existing economic literature proves to be partially satisfying. We use a VAR model to identify monetary shocks (Blanchard et Quah 1989 and de Desserres et Lalonde 1994). Then a Kalman filter allows us to calculate their common and specific components. We obtain a measure of asymmetric monetary transmission in terms of variance decomposition.

Keywords: Structural VCAr, kalman filter, common and specific shocks, monetary policy transmission.

JEL classification: C32, C61, E52

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Introduction

During the phase of construction of the EMU, one attended a resurgence of the literature of the optimal monetary areas. While taking as a starting point the seminal work of Mundell (1961), a certain number of authors analyzed the consequences of the occurrence of asymmetrical shocks for the countries of the Euro zone. Thus, Do Bayoumi and Eichengreen (1992) highlight a structure heart periphery, Obstfeld and Peri (1998) study the flexibility of the prices and the mobility of the factors, Fatas (1998) considers the budgetary federalism appropriateness. We could quote of many studies: these last, in spite of their diversity, have a common approach: they implicitly make the assumption of identical economic structures for the Member States of the union and wonder which are the consequences of the loss of the instrument of monetary policy with regard to the management of the asymmetrical shocks. One observes an “opposite” logic more recently.

Indeed, the EMU has just celebrated the fourth year of its existence. The time of the theoretical debates as for the criteria of the theory of the optimal monetary areas seems exceeded to leave room to a pragmatism of the monetary and scientific authorities completely justified. Thus these last consider that asymmetries are with the load of the national budgetary authorities or within the competence of the structural policies. We passed from a “symmetrical structures - asymmetrical shocks” to a “symmetrical shock - asymmetrical structures” logic. It is not a question any more of knowing if the single monetary policy is desirable but to know its transmission systems. Thus one can up to what point ask for the various countries of the EMU, or in a more general way the members of a monetary union, benefit from the decisions of their central bank.

In the best of the cases, a single monetary policy would involve an identical response of the real macroeconomic variables of the various countries to the centralized impulses, to the variations of the instruments of monetary policy. However a whole field of the economic literature shows that it is not obvious whole that the transmission of the American or European monetary policy is symmetrical. It is within this framework that we propose to establish a measuring instrument of the degree of symmetry/asymmetry of the European monetary policy.

Indeed, the existing empirical studies do not manage to fill the three criteria established by Dornbusch, Favero and Giavazzi (1998) essential on the matter: taking into account of the intra/extra EMU exchange rate effects of the centralized monetary policy, validity test of transmission asymmetries and installation of simultaneous impulses. We will show that in a first part devoted to the literature of reference. We propose our method in one second part within which we build a Kalman filter with unobservable component which enables us to establish a common monetary shock identified within the same national shocks. The latter are the fruit of multivariate identifications. We obtain a measurement of the transmission asymmetry of the European monetary policy in terms of monetary shocks decomposition variance. We thus hope to answer the three raised requirements. The third part of our study will be devoted to the description of our results highlighting the structure, less traditional in the monetary field, of a European "heart and periphery".

I Asymmetrical transmission of the European monetary policy: general and prior agreement.

Dornbusch, Favero and Giavazzi (DFG) (1998) defined three conditions to empirically measure the (asymmetrical) transmission of the European Central Bank monetary policy. Firstly, the direct impact of an interest rate variation on the production and inflation must be distinguished from the indirect effect on these same variables of the exchange rate variations. This exchange rate channel must be broken up between intra - community variations, intended to disappear after the common currency implementation, and extra – community variations. If this distinction is not made, identified transmission asymmetries can concern the intra-European exchange rate effects. In the second time, in order to identify the effects of the common monetary policy, the empirical device must be able to characterize simultaneous impulses in all the union member states. Lastly, it must be possible to obtain statistical data on the asymmetries significance of the central bank policy transmission. We will see that the studies which attempt to describe the asymmetrical transmission of the European monetary policy do one's utmost to gradually fill these conditions.

The econometric field of this domain is divided into various kinds of approaches: large national central bank models, structural multi – countries models, small vector autoregressive models, small structural models and micro-econometric models which we don't consider in this paper. The first type models were presented by the bank for international settlements (1994 and 1995). Those correspond to simulations which make it possible to identify asymmetries in the transmission of the monetary policy compared to different financial structures. These approaches consist in observing the effect of a rise in a point in the national interest rate on the production and inflation during two periods. The problem of these studies lies in the fact that the results are not directly comparable. Indeed, each national bank works on its own model, a difference in essential approach between them corresponding to the endogeneity or exogeneity of the exchange rate variable. Within this framework, the first criterion of DFG is only partially respected and the two others been unaware of.

The multivariate approach for this reason represents an obvious progress in the direction where it allows a direct comparison of the monetary shocks transmissions through the impulse response functions. The Gerlach and Smets (1995) study constitutes a first step on this way. They use a SVAR model including the real GDP, the consumer price index and the real interest rate for the whole G7 countries. Their sample is homogeneous between the various members, it covers quarterly data over the period 1979:1 - 1993:4. Their identification scheme has moreover the particularity of resting on a combination of short and long term assumptions. Indeed, and in respect to the traditional structural VAR literature, they characterize the supply shocks as those which have only a long-term influence on the production. The demand shocks have only one short-term effect on it. These are subdivided between real demand and monetary shock insofar as this last does not have any influence on the production and inflation in the quarter when it occurs. Finally they note similar effects of the monetary shocks on the production between the various countries: the increase in a point of the interest rate lowers the production of 0.2 to 0.4 %, except for England for which these effects are stronger. They make moreover simulations as for the effects of a coordinated interest rates movement.

We feel a first frustration compared to this study insofar as few European countries are represented there, which is awkward compared to our objective studied the asymmetrical transmission of the European monetary policy. Our second remark is more critical: it relates to the identification scheme of the authors. The constraint of nullity of the monetary shocks effects in the very short term on the production can appear very restrictive. It makes certainly it possible to obtain more conventional results in terms of immediate effects of the monetary policy (disappearance of the "price puzzle") but is not completely satisfactory from the point of view of the monetary impulses transmission. We can obtain results quite as conventional compared to the problem of the “price puzzle” while avoiding such strong identification assumptions. Lastly, even if the homogeneity of the econometric tool allows a comparison of the monetary impulses transmission between country (following a standardization of the monetary shocks, the latter not having the same amplitude and propagation velocity), we are not in the situation of occurrence of a common and simultaneous shock. The DFG criteria are not thus respected. The condition of simultaneity is not met, but also that of taking into account of the intra – European exchange rate effects (the most detrimental defect) and of asymmetries significance.

Barran, Coudert and Mojon (1996) will allow a progress in the field by taking into account explicitly the exchange rate effect. The authors work on a sample of 9 European countries available from the point of view of the quarterly data. These last correspond to the traditional variables of VAR models which attempt to describe the monetary shocks transmission. One finds the production, the prices, and various interest rates. Several VAR are thus estimated with dynamics of which take part moreover other representative variables of the various monetary policy channels transmission, including the exchange rate. This study approaches more our topic by adopting a resolutely European approach, the whole within the framework of a monetary policies transmission asymmetry description. Moreover, this approach has the advantage, as we already said, of including the exchange rate effects.

Nevertheless, this transmission channel is studied only through the nominal bilateral parities with respect to the DM; however this channel will be inoperative within the EMU framework; and paradoxically, the extra - EMU exchange rate channel is not considered, which is all the more detrimental. Remainder, the two other criteria which are at the base of our study, them, are not also respected. Indeed, the adopted approach once again adopts the logic which consists in imposing the same econometric model on the whole of the countries in a comparison preoccupation. The monetary policy on a European scale thus is not considered yet. And a coordinated centralized policy will have surely much more impact than each isolated monetary policy (repercussion and reinforcement effects). Finally, and by the force of circumstances (third criterion), the transmission asymmetries significance is not tested. It should be noted in addition that the size and the persistence of the interest rates shocks used in their simulations are completely different. Thus, noted transmission asymmetries can be more the fruit of the divergences of monetary policies led in the past and intended to disappear, that the reflection of real asymmetries.

Let us note, always within the VAR literature, the Ramaswamy and Sloek(1997) study. They also carry out the estimate of a multivariate model, however on a broader sample of European countries. Their results make it possible to identify two groups: in the first, Austria, Belgium, Finland, Germany, Netherlands and United-Kingdom, the effect of a monetary shock is twice longer and deeper than in the second group (France Denmark, Portugal, Spain and Sweden). However, it should be noticed that their estimate does not take into account the intra-European exchange rate effects and that the transmission asymmetries significance is not tested.

This problem is tackled within a certain number of structural models such as those which Britton and Whitley (1997) or Favero and Giavazzi (1998) present in their studies. From the point of view of the three criteria which we underlined, these contributions constitute unquestionable progress. Nevertheless, the simultaneity and unity effect of a shock at the European level is not collected. It is this effect which the last articles in the field try to highlight. Peersman and Smets (2001) carry out a multivariate analysis of a monetary shock transmission at the aggregate European level. They underline of it the resemblance to the American model of transmission. However, the asymmetry of transmission between European countries is forsaken. Van Els, Locarno, Mojon and Morgan (2002) give a progress report on the recent multivariate structural models which try to combine simultaneity of the monetary shock and transmission asymmetries modelling. They note rather similar effects between aggregate level and national level and distinguish two groups from country according to whether the answers of inflation and the production to the monetary shock are broad or moderate. They raise a certain number of doubts about the robustness of the studies in the field. We can moreover notice that the investigations on which they are based directly do not study the occurrence of a common monetary shock and that they consider the asymmetrical effects of such standardized shocks through the taking into account of exchange rate effects and of economic interactions between the various countries.

Finally, we note that the literature suitable for the study of the asymmetrical transmission of the European monetary policy appeared extremely prolific. It tried to gradually take into account the criteria of DFG. However, we note that the three conditions of simultaneity, asymmetries significance and intra European exchange rate effects are not at any time joined together. We propose another method to try to satisfy them.

The greatest difficulty lies obviously in the fact that the asymmetrical transmission of the European monetary policy is not observable statistically, the centralized impulses of the BCE appearing only since 1999 with the birth of the EMU. We thus could note, through the preceding studies, that the play consists in surmounting this obstacle by standardizing the effects of the monetary shocks between country or by making the assumption that the European countries followed and will follow the German monetary policy. Nevertheless we can object that the first approach compares impulse response functions which are despite everything the fruit of the last national monetary policies. However these last will dissolve in the centralized policy, they do not make it possible to really study the effects of a common policy, and can just reflect structural asymmetries dedicated to disappear. In addition, they do not take at all into account the effect of simultaneous shocks. As for the second approach, we will object to it that the common European monetary policy won’t be a reflection of the German monetary policy and seems much more to correspond to an average of the various national monetary policies. Which alternative can thus be considered?

II Identification model of a common to Europe monetary shock

We propose to identify the centralized monetary policy shock with a monetary shock common to nine European countries (Germany, France, Italy, Austria, Netherlands, Finland, Portugal, United - Kingdom, Spain). Thanks to a Kalman filter with unobserved component, we can up to what point describe a common shock monetary explains the various national monetary shocks. The share of each national monetary shock explained by the common component will constitute a measure of the asymmetry of European monetary policy transmission having as advantages:

a) to present a character of simultaneity and community of the monetary shocks.

b) to propose statistically verifiable measures of transmission asymmetries.

c) to overcome the difficulty of intra European exchange rate effects (the common monetary shock not involving intra European exchange rate variations).

In addition this approach answers a certain number of limits of the VAR models specific to this literature relating to the monetary policy transmission. It first of all makes it possible to make an optimal arbitration between the number of variables contained in the VAR and need for taking into account the exchange rate. Thus, the traditional VAR models containing the production, inflation and the money supply or the interest rate, do not consider the interdependences related to the exchange rate. It is for that that some of them introduce it like fourth variable. However this type of model suffers from too great quantities of variables contained and consequently of the number of identification assumptions required. Thus, to identify a common monetary shock makes it possible to reduce to its minimum (3) the number of variables to be included in our VAR to isolate a monetary shock. Moreover, we neutralize the exchange rate intern variations effects by considering only the effects of a common monetary shock.

This last, as we said allows to catch simultaneity effect; within this framework we really study the simultaneous and in the same direction variation of all the interest rates or money supplies of the Euro zone countries, what is assimilated to the existence of a single interest rate, major characteristic of a single currency existence.

Lastly, our study makes echo to a certain extent with the criticism of Mc Callum (1999) of the VAR models with regard to the study of the monetary policy transmission systems. He stresses that the identified impulse response functions and shocks do constitute, by definition, only the non systematic part of the central banks monetary policy. However it specifies that a weak fraction of the variability of the monetary instruments is explained by the non systematic component of monetary authorities policy. It thus recommends other models of study. From this point of view, our proposal rehabilitates the VAR approach, by systematizing the coefficients of transmission of the common component, beside the specific component of the monetary shocks. We define the latter according to two VAR models. The firs one (VAR1) utilize the derivative of the logarithm of the GDP, prices and short term interest rate. The second one (VAR2) utilize the derivative of the logarithm of the money supply in the place of the interest rate of short term. Apart from the used variables, the models are different by their identification assumptions: those of VAR 1 relate to only the short term. We then make a Cholesky decomposition of the shocks variance - covariance matrix. Those of VAR 2 take as a starting point the Blanchard and Quah (1989) method of with assumptions on the court and the long term. Finally, a kalman filter with unobserved component will enable us to identify common and specific components within the national monetary shocks. We will be able to compare the results of identification of a common tendency of the monetary shocks resulting from VAR 1 and those resulting from VAR 2.

1) Monetary shocks determination within structural VAR

One of the most significant points in the analysis of the effects of the monetary shocks resides in the identification of the latter. Within the VAR method (see work of Sims, 1980, 1992, of Bernanke, 1986, of Bernanke and Blinder 1992, of Gali 1994, of Gerlach and Smets 1994), the idea consists in describing the economy within a dynamic stochastic model. I identify thus, starting from the method of Blanchard and Quah(1989), supply, real demand and monetary shocks.

Let Δy_t, Δp_t, Δm_t et Δr_t the derivatives of the logarithm of GDP, consumer price index, short term interest rate (discount rate in level) or money supply (M3). The data are quarterly.

$$X_t = \begin{pmatrix} \Delta y_t \\ \Delta p_t \\ \Delta r_t \text{ or } \Delta mt \end{pmatrix}$$

The stationarity conditions of each series are checked (in appendix 1 page 17) what enables us to consider the following VAR:

$$X_t = B_1 X_{t-1} + B_2 X_{t-2} + ... + B_q X_{t-q} + e_t$$

The multivariate identification wants to lead to the formation of the following structural equation:

$$\begin{pmatrix} \Delta y_t \\ \Delta p_t \\ \Delta r_t \text{ ou } \Delta m_t \end{pmatrix} = \sum_i L^i \begin{pmatrix} a_{11,i} & a_{12,i} & a_{13,i} \\ a_{21,i} & a_{22,i} & a_{23,i} \\ a_{31,i} & a_{32,i} & a_{33,i} \end{pmatrix} \begin{pmatrix} \varepsilon_{st} \\ \varepsilon_{dt} \\ \varepsilon_{mt} \end{pmatrix}$$

where ε_{st} is a supply shock, ε_{dt} a real demand one, ε_{mt} a monetary one and the a_{ii} impulse response functions coefficients.

Assumptions on the variance covariance matrix of the shocks, as those concerning the effects of the shocks on the various aggregates represent a sufficient number of equations to determine the a_{ii} coefficients of our impulse response functions. Thus: the three disturbances are independent and not autocorrelated. Their variance covariance matrix is thus diagonal. This assumption makes it possible to obtain n(n+1)/2 equations on the n^2 required by the identification. There thus remain n(n-1)/2 equations to be produced. Those are provided by the assumptions relating to the effects of the shocks on the variables in the course of time. Like we already said it, we propose identification schemes.

The first possibility consists in making assumptions only on the short term, while assuming that the variance covariance matrix of shocks is lower triangular. We then carry out a Cholesky decomposition. This approach is traditional since the Sims articles (1980). It leads to a lower triangular matrix of the impact multipliers. This is why a shock on variable i affects the variable j instantaneously if and only if j ≥ i. The order of the variables in the VAR model is thus fundamental. To place the variable of economic policy (here r_t) in first position means that the decisions of the authorities are made without taking account of the simultaneous evolutions of the other economic variables. One could imagine for example that the data on these variables are not available quickly. On the other hand, to place Δr_t to the last rand in the VAR model amounts making the assumption that the monetary authorities take into account the simultaneous effect of their decision on the production and inflation for the orientation of their policy. In this case, the monetary shock does not have any contemporary effect. That can that be justified through the existence of convex adjustments costs, of production and delivery periods, of menus costs…We adopt this point of view in the VAR 1 utilizing the short term interest rate. That can appear too restrictive. That's why we propose a second identification scheme, apart from the fact that this new scheme will make it possible to test, to a certain extent, the robustness of our results.

Another method to obtain the n(n-1)/2 equations consists in making assumptions on the short and long-term effects of the shocks. We are is inspired in this direction by the method of Blanchard and Quah. That will enable us moreover to consider short-term effects of the monetary shocks. It is thus supposed that the supply shocks are the only one to have a permanent effect on the growth rate; the real and monetary demand shocks exert only one transitory effect on this last. It is made also the assumption of long-term neutrality of the monetary shocks: these the last are compensated by a proportionate change of the prices. That enables us to distinguish the latter from the non monetary demand shocks: if these two types of shocks do not exert any influence on the long-term on the growth rate, they are different by their effect on the level of the real balances: contrary to the real demand shock, the monetary shock does not have any effect on real balances (in the long run). We can illustrate a real demand shock by a right-hand side IS displacement. This shock corresponds to a modification of the global demand but does not modify the aggregate output in the long run.

If we call A_{LT} the matrix which describes the long-term effect of the various shocks on the three variables of our VAR, we have:

$$X_t = A_{LT}\begin{pmatrix}\varepsilon_{st}\\ \varepsilon_{pt}\\ \varepsilon_{mt}\end{pmatrix} = \begin{pmatrix}A_{ys} & 0 & 0\\ A_{ps} & A_{pn} & A_{pr}\\ A_{ms} & A_{mn} & A_{mr}=A_{pr}\end{pmatrix}\begin{pmatrix}\varepsilon_{st}\\ \varepsilon_{pt}\\ \varepsilon_{mt}\end{pmatrix}$$

In order to solve the practical problem of identification, we use the technique employed by DeSerres and Lalonde (1994) which consists of a triangulation of this matrix of the long-term shocks effects[1].

2) Common and specific components identification of monetary shocks by the Kalman filter

Once the shocks identified, the objective is as follows: it is a question of identifying a common component and a specific component (with each country) within the latter and for the group of studied countries. We consider as envisaged the case of the monetary shocks of a

[1] The mathematical of VAR2 more original presentation, is in appendix 2 page 18

group of n country (here 8 European countries for the first model and 9 European countries for the VAR 2). These shocks should then be broken up in the following way:

$$\begin{pmatrix} \varepsilon_{1t}^{m} \\ \varepsilon_{2t}^{m} \\ \vdots \\ \varepsilon_{nt}^{m} \end{pmatrix} = \begin{pmatrix} \theta_1^m & 1 & 0 & 0 & 0 \\ \theta_2^m & 0 & 1 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \theta_n^m & 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \alpha_{ct}^{m} \\ \alpha_{1t}^{m} \\ \alpha_{2t}^{m} \\ \vdots \\ \alpha_{nt}^{m} \end{pmatrix}$$

where the first vector contains the monetary shocks which we determined previously. The θ indicate for each country up to what point the common component determines these monetary impulses; α_C represents the common monetary shock and α_i the shock specific to each country. The θ and α not being observable, it is a question of estimating them through a state-space model (with unobserved components) by the procedure of the Kalman filter. We thus should determine a measurement equation and a transition equation. In fact, the measurement equation is expressed by the preceding equation. The transition equation arises as for it in the following way:

$$\begin{pmatrix} \alpha_{ct}^{m} \\ \alpha_{1t}^{m} \\ \alpha_{2t}^{m} \\ \vdots \\ \alpha_{nt}^{m} \end{pmatrix} = \text{IIDN}\left(\begin{pmatrix} 0 \\ 0 \\ 0 \\ \vdots \\ 0 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & \sigma_1^2 & 0 & 0 & 0 \\ 0 & 0 & \sigma_2^2 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & 0 & \sigma_n^2 \end{pmatrix} \right)$$

We make so the assumption that the common components are white noises and that the various structural shocks are not auto-correlated. The Kalman filter will thus enable us to estimate the α series (common and specific components), the θ shares of common component within the national monetary shocks, as well as the σ variances. It is an iterative procedure which builds an estimator of the maximum of probability. Here we maximize the probability of the n countries monetary shocks law, so that the probability that their variance is explained by a common and specific component is the strongest possible.

From there, we have with the common tendency identification a new measuring instrument of asymmetry across countries. The more the share of the monetary shocks variance of a country will be explained by the common component, the more will tend it to present a symmetrical character of these shocks with respect to country presenting the same tendency. We are conscious of measuring above all the common monetary shocks up to what point (shocks of world rates…) determined the national monetary shocks. However we can reasonably think that the countries transmitting to a lesser extent the common shocks, will transmit to a lesser extent the centralized shocks. Why can we say that?

If it is considered that the monetary policy followed by the ECB is an average of the national policies, then it can reasonably be estimated that its impulses will follow the same process as the estimated common shock. This one expresses effectively, by construction, the policy common to the national monetary authorities. One could object to that that the specific component of the national monetary shocks has vocation to disappear after EMU setting-up and consequently that our identification scheme is inappropriate. However, this specific component will endure, in particular through the demand for money factors. Moreover, the centralized monetary policy aims at answering only the only common shocks: it is quite this same answer which is identified in our scheme. Finally, the countries presenting a strong common tendency within their monetary shocks will more profit of the central bank policy. We have our results in the following section.

III Results

We first of all have the general results of the estimate of the VAR 1 and VAR 2. The various types of shocks obtained enable us to identify the common and specific tendencies of monetary shocks. We thus describe the results of our Kalman filter with non observed component. We finally obtain the sought variance decompositions, described and interpreted in the third time.

VAR 1 is characterized by homogeneous impulse response functions from one country to another: as a whole, the interest rate monetary shock is characterized by a downward effect on the growth of 0.1 to 0.3 % during three or four quarters. We also observe the price puzzle phenomenon which can be explained (Sims 1992) by the fact that the VAR 1 variables are not the only ones to be taken in account in inflation anticipations or that the consumer price index is not the most adapted to study the effects of the monetary policy (it would rather be necessary to use a commodity price index) or that it would be necessary to replace the production by the output gap within the VAR (Giordani, 2001).

With regard to VAR 2, we obtain conventional impulse response functions. The positive supply shocks cause a fall of the inflation rate. As envisaged, the real demand and monetary shocks effects on the production are null in the long run. The supply shock causes a constant rise of real balances. In what relates to the effect of a positive real demand shock on real balances, this one should take the form of a reduction in these last, the real demand shock corresponding to a right-hand side displacement of IS. We observe this reaction only in 50% of the cases. The positive effect in the short run of the monetary shock on the production appears negligible. We think however that this identification method perhaps is not the most adapted to observe the effects of the monetary policy on the production.

Finally, the two series of impulse response functions reveal thin differences between the countries in the monetary policy transmission, i.e. in the effects of a variation of one standard deviation of the monetary policy instrument. We deduce from it right now that the transmission coefficient of the common monetary tendency acquires a certain importance. Indeed, asymmetries will be more in the transmission of the common impulse to the various countries than in the transmission within each one of them.

We obtain the following results from the point of view of the θ transmission coefficients of the common component:

Table 1: transmission coefficients of the common component

	Germany	France	UK	Italy	Finland	Austria	Netherlands	Spain	Portugal
M1	0.36**	0.28 *	0.39**	0.32	0.17	0.54 **	0.55 **	0.08	
M2	1.17**	0.67*	0.001	-0. 0003	-0. 001	0.41 *	0.40	-0. 24	-0. 0009

*significance at 5% level

**significance at 1% level

Those do not interest us directly; the various national monetary shocks presenting heterogeneous standard deviations, the comparison of these coefficients is not to us of any utility. On the other hand, their significance appears instructive right now because it is noted that the two models testify the existence of a “European heart” (Germany, Austria, France in both cases plus Netherlands and England in the first case) for which the common component intervenes significantly in the determination of the monetary shocks.

On the other hand, the monetary shocks variance decomposition allows a comparison of the asymmetrical effects of the common monetary policy. It is presented in the following way:

$$\sigma_{\varepsilon i}^2 = \theta_i^2 + \sigma_{\alpha i}^2$$

with i the studied country. The variance share of the shock explained by the common tendency is then equal to the ratio $\frac{\theta_i^2}{\sigma_{\varepsilon i}^2}$. We present these ratios in the following table:

Tableau 2: national monetary shocks variance explained by the common tendency

	Germany	France	UK	Italie	Finland	Austria	Pays-bas	Spain	Portugal
M1	1559%	9.43%	1830%	1220%	3.47%	35.09%	36.40%	0.07%	
M2	74.21%	44.37%	0.1%	0.01%1	0.01%	1654%	15.71%	5.9%	0.01%

Thus, according to the first model, more than 10% of the monetary impulses are explained by the common shocks for Germany, France, England, Austria and the Netherlands. These the last two countries reach even degrees of transmission higher than 40%. We find a heart – periphery structure which would mean that the centralized monetary policy would be more efficient for the center economies. That is worrying for the EMU everlastingness and unit in that sense that would mean that the periphery countries, subjected to the most asymmetric supply and demand shocks, which would profit the less of centralized monetary policy. The real European periphery would correspond to its monetary periphery.

We finally make a point of underlining some limits in this work. First, traditional criticisms carried to the VAR models apply obviously to our study. In particular, we can find in certain cases, according to assumptions' made for our three types of variables, cointegration relations, which can give fallacious results in terms of VAR. Moreover, it is clear that the common/ specific component distinction would have been modified if we had taken into account the whole of the Member States of the EMU and if we had excluded the United Kingdom from it. Lastly, we could not, for data availability reasons, consider the after 1999 and the possible structural modifications of our models.

Conclusion

We presented a measurement model of the monetary policy transmission asymmetry of the European Central Bank. This measure has the advantage of answering the three criteria of Dornbusch, Favero and Giavazzi: it is isolated from the "pre-union" internal exchange rate effects. It represents the transmission of a common monetary impulse which is really simultaneous. It proposes statistically verifiable asymmetries. Moreover, it is built from the identification of a common tendency within the national monetary shocks. A Kalman filter with unobserved components, and two VAR models are the two types of econometric tool which we use to reach that point.

The results of the estimates are exploited in two directions: from the point of view of the transmission coefficients significance and of variance decomposition of national monetary shocks, a "heart – periphery" structure seems characterize the European Monetary Union. Countries of the "heart" would be thus those for which the centralized monetary policy would be most efficient. That is all the more worrying insofar as the countries of the periphery suffer from the occurrence of more asymmetrical demand and supply shocks. The non efficiency of the monetary policy for their stabilisation could appear all the more detrimental.

These observations concern a more general empirical framework which notes the maintenance of heterogeneities structural after setting-up of the EMU. Financial structures, labour markets remain dependent on national specificities, and the incentives with the reforms on the European level insufficient. Monetary authorities appear rather carefree with respect to that and justify it through comparison with the American model. The United States knows them also real structural and cyclical deviations. However, it should be specified that the EMU does not have for the moment a powerful federal budget. It seems that a better coordination of the budget policies is necessary and that it would simplify the task of the European Central Bank.

As possible extensions of this contribution, let us specify that investigations, in the field of the stability of the common shock transmission coefficients would be surely interesting. It would thus be a question up to what point of knowing 1999 constitutes a true rupture in the transmission of common monetary shocks and to describe the effects of the convergence of the European economies.

Appendix 1: ADF tests for unit roots

1977: 1 – 1997:1

	Δy_t	Δp_t	Δm_t	Δr_t
Germany	-4.32***	-3.17*	-5.37***	-3.15*
	-3.40***	-1.48	-2.48**	-3.05***
France	-3.32*	-3.72**	-4.70***	-5.53***
	-1.86	-1.82*	-1.35	-5.24***
Italy	-4.30***	-5.86***	-21.89***	-4.34***
	-2.80***	-2.43**	-5.78***	-4.14***
Austria	-6.33***	-5.42***	-7.41***	-3.51**
	-4.15***	-1.84*	-2.90***	-3.44***
Netherlands	-4.46***	-4.31***	-9.32***	-6.47***
	-2.54**	-1.31	-2.61***	-6.62***
Finland	-2.66	-7.16***	-3.91**	-4.75***
	-1.97**	-7.26***	-1.63*	-4.53***
United-Kingdom	-3.13	-3.59**	-18.60***	-4.89***
	-2.18**	-1.39	-8.32***	-4.95***
Portugal	-4.41***	-5.61***	-4.53***	
	-3.46***	-2.62***	-1.19	
Spain	-3.42*	-4.08***	-8.58***	-9.22***
	-2.00**	-1.66*	-1.93*	-9.03***

For each country, the first line indicates the results of the tests with trend, and the second without trend. In the first case, the critical values are -3.25; -3.46;-4.07. In the second: -2.58;-2.90;-3. 51. */**/*** indicates a degree of significance to 10/5/1%.

Annexe 2: VAR 2 description

Let Δy_t, Δp_t et Δm_t be the derivative of the logarithm of the GDP, the prices and the money (M3).

$$X_t = \begin{pmatrix} \Delta y_t \\ \Delta p_t \\ \Delta m_t \end{pmatrix} \tag{1}$$

In general, the variables considered being I(1), each component of X is stationary. It has a MA representation:

$$\begin{aligned} X_t &= A_0\varepsilon_t + A_1\varepsilon_{t-1} + ... + A_n\varepsilon_{t-n} + ... \\ &= \sum_{i=0}^{\infty} A_i L^i{}_t \end{aligned} \tag{2}$$

Where L is the lag operator and $VAR(\varepsilon_t) = I$

The A_i matrices represent the impulse response functions of the shocks on the elements of X.

$$\begin{pmatrix} \Delta y_t \\ \Delta p_t \\ \Delta m_t \end{pmatrix} = \sum_i L^i \begin{pmatrix} a_{11,i} & a_{12,i} & a_{13,i} \\ a_{21,i} & a_{22,i} & a_{23,i} \\ a_{31,i} & a_{32,i} & a_{33,i} \end{pmatrix} \begin{pmatrix} \varepsilon_{st} \\ \varepsilon_{dt} \\ \varepsilon_{mt} \end{pmatrix} \tag{3}$$

$$\Sigma = \begin{pmatrix} var(\varepsilon_{st}) & cov(\varepsilon_{st}, \varepsilon_{pt}) & cov(\varepsilon_{st}, \varepsilon_{mt}) \\ cov(\varepsilon_{st}, \varepsilon_{pt}) & var(\varepsilon_{pt}) & cov(\varepsilon_{pt}, \varepsilon_{mt}) \\ cov(\varepsilon_{st}, \varepsilon_{mt}) & cov(\varepsilon_{pt}, \varepsilon_{mt}) & var(\varepsilon_{pt}) \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \tag{4}$$

$E(\varepsilon_t\ \varepsilon s) = 0\ \forall s, t, s \neq t$.

The variables being stationary, we know that there is a standard VAR representation:

$$X_t = B_1 X_{t-1} + B_2 X_{t-2} + ... + B_q X_{t-q} + e_t \quad \text{or}$$

$$X_t = \begin{pmatrix} B_{11}(L) & B_{12}(L) & B_{13}(L) \\ B_{21}(L) & B_{22}(L) & B_{23}(L) \\ B_{31}(L) & B_{32}(L) & B_{33}(L) \end{pmatrix} X_{t-1} + e_t \tag{5}$$

with q the number of lags.

$$e_t = \begin{pmatrix} e_t^y \\ e_t^p \\ e_t^m \end{pmatrix}$$

$$var(e_t) = \begin{pmatrix} \sigma_{yy} & \sigma_{yp} & \sigma_{ym} \\ \sigma_{py} & \sigma_{pp} & \sigma_{pm} \\ \sigma_{my} & \sigma_{mp} & \sigma_{mm} \end{pmatrix} = \Omega$$

$$X_t = [I - B(L)]^{-1} e_t$$

$$X_t = e_t + D_1 e_{t-1} + D_2 e_{t-2} + ... = \sum_{i=0}^{\infty} D_i e_{t-i} = D(L) e_t \quad (7)$$

where D(L) is a polynomial of the lag operator of an infinite order.

The critical point of the identification stresses that the residuals of the VAR are compounds of the pure innovations ε_{st}, ε_{pt} and ε_{mt}:

$$e_t = \begin{pmatrix} c_{11}(0) & c_{12}(0) & c_{13}(0) \\ c_{21}(0) & c_{22}(0) & c_{23}(0) \\ c_{31}(0) & c_{32}(0) & c_{33}(0) \end{pmatrix} \begin{pmatrix} \varepsilon_{st} \\ \varepsilon_{pt} \\ \varepsilon_{mt} \end{pmatrix} \quad (8)$$

By identification with the equation (2), we can write that:

$$A_0 = \begin{pmatrix} c_{11}(0) & c_{12}(0) & c_{13}(0) \\ c_{21}(0) & c_{22}(0) & c_{23}(0) \\ c_{31}(0) & c_{32}(0) & c_{33}(0) \end{pmatrix} \text{, que } A_0\varepsilon_t = e_t \quad (9)$$

$$A_i = D_i A_0 \quad (10)$$

We can see that $E(e_t e_t') = A_0 E(\varepsilon_t \varepsilon_t') A_0' = \Omega$

By assumption: $E(\varepsilon_t \varepsilon_t') = I_3$ so that $A_0 A_0' = \Omega$

This equality enables us to determine a certain number of equations on the unknown factors $c_{ii}(0)$ wich will allow us to calculate the shocks starting from the residuals e_t of the reduced form of the VAR. We thus have 6 equations for 9 unknown factors. It remains us to determine three equations which are provided to us by the assumptions inspired of Blanchard and Quah on the temporal structure of the macroeconomic shocks.

If D is the determinant of $[I - B(L)L]$, we can write according to (5):

$$X_t = \frac{1}{D}\begin{pmatrix} B_{22}(L)B_{33}(L) - B_{23}B_{32}(L) & -(B_{21}(L)B_{33}(L) - B_{23}B_{31}(L)) & B_{22}(L)B_{33}(L) - B_{23}B_{32}(L) \\ -(B_{12}(L)B_{33}(L) - B_{13}B_{32}(L)) & B_{11}(L)B_{33}(L) - B_{13}B_{31}(L) & -(B_{11}(L)B_{33}(L) - B_{13}B_{31}(L)) \\ B_{12}(L)B_{23}(L) - B_{13}B_{22}(L) & -(B_{11}(L)B_{23}(L) - B_{13}B_{21}(L)) & B_{11}(L)B_{22}(L) - B_{12}B_{21}(L) \end{pmatrix} e_t$$

B_{ii} correspond to the long-term effect of the shocks on the growth, the prices and the currency on these same variables. We rewrite this equation in the form:

$$X_t = \frac{1}{D}\begin{pmatrix} \Lambda_{11} & \Lambda_{12} & \Lambda_{13} \\ \Lambda_{21} & \Lambda_{22} & \Lambda_{23} \\ \Lambda_{31} & \Lambda_{32} & \Lambda_{33} \end{pmatrix} e_t = \Lambda_{LT} e_t \qquad (11)$$

We have for example:

$$\Delta y_t = \frac{1}{D}\left(\Lambda_{11} e_t^y + \Lambda_{12} e_t^p + \Lambda_{13} e_t^m\right) \qquad (12)$$

And $e_t = \begin{pmatrix} c_{11}(0) & c_{12}(0) & c_{13}(0) \\ c_{21}(0) & c_{22}(0) & c_{23}(0) \\ c_{31}(0) & c_{32}(0) & c_{33}(0) \end{pmatrix}\begin{pmatrix} \varepsilon_{st} \\ \varepsilon_{pt} \\ \varepsilon_{mt} \end{pmatrix}$ from (9), which means:

$$\Delta y_t = \frac{1}{D}\begin{pmatrix} \Lambda_{11}(c_{11}(0)\varepsilon_{st} + c_{12}(0)\varepsilon_{pt} + c_{13}(0)\varepsilon_{mt}) + \Lambda_{12}(c_{21}(0)\varepsilon_{st} + c_{22}(0)\varepsilon_{pt} + c_{23}(0)\varepsilon_{mt}) \\ + \Lambda_{13}(c_{31}(0)\varepsilon_{st} + c_{32}(0)\varepsilon_{pt} + c_{33}(0)\varepsilon_{mt}) \end{pmatrix} \qquad (12)$$

By assumption, the non monetary demand and the monetary shocks do not have a long term effect on the growth rate. We can thus write:

$$\Lambda_{11}c_{12}(0) + \Lambda_{12}c_{22}(0) + \Lambda_{13}c_{32}(0) = 0 \qquad (13)$$

$$\Lambda_{11}c_{13}(0) + \Lambda_{12}c_{23}(0) + \Lambda_{13}c_{33}(0) = 0 \qquad (14)$$

Lastly, the monetary shock or nominal demand shock does not influence in the long run real balances: that means that this monetary shock has, in the long run, the same effect on the rate of inflation and the monetary growth rate. The effect of the monetary shock on the inflation rate appears in the following equation:

$$\Delta p_t = \frac{1}{D}\begin{pmatrix} \Lambda_{21}(c_{11}(0)\varepsilon_{st} + c_{12}(0)\varepsilon_{pt} + c_{13}(0)\varepsilon_{mt}) + \Lambda_{22}(c_{21}(0)\varepsilon_{st} + c_{22}(0)\varepsilon_{pt} + c_{23}(0)\varepsilon_{mt}) \\ + \Lambda_{23}(c_{31}(0)\varepsilon_{st} + c_{32}(0)\varepsilon_{pt} + c_{33}(0)\varepsilon_{mt}) \end{pmatrix}$$

While the effect of the monetary shock on the monetary growth is distinguished in this other equation:

$$\Delta_{mt} = \frac{1}{D}\begin{pmatrix} \Lambda_{31}(c_{11}(0)\varepsilon_{st} + c_{12}(0)\varepsilon_{pt} + c_{13}(0)\varepsilon_{mt}) + \Lambda_{32}(c_{21}(0)\varepsilon_{st} + c_{22}(0)\varepsilon_{pt} + c_{23}(0)\varepsilon_{mt}) \\ + \Lambda_{33}(c_{31}(0)\varepsilon_{st} + c_{32}(0)\varepsilon_{pt} + c_{33}(0)\varepsilon_{mt}) \end{pmatrix}$$

According to the assumptions, we can establish the following equality:

$$\Lambda_{21}c_{13}(0)+\Lambda_{22}c_{23}(0)+\Lambda_{23}c_{33}(0)=\Lambda_{31}c_{13}(0)+\Lambda_{32}c_{23}(0)+\Lambda_{33}c_{33}(0) \qquad (17)$$

We thus obtain our ninth equation for nine unknown factors, which enables us to determine the $c_{ii}(0)$ coefficients which we connect to the residues of the reduced VAR to calculate our three macroeconomic shocks (equation (9)).

From a practical point of view, a difficulty appears as for the identification of these shocks, and in particular as for the specification of the assumptions on their structure. The econometric software requires that we introduce the matrix of the long-term effects of the macroeconomic shocks on the various variables of the VAR. Moreover, it seems that the structural assumptions can appear only in the form of zeros within this same matrix. Thus, we can easily specify the restrictions relating to real demand shocks and nominal demand shocks with regard to their long-term effect on the production, this effect being precisely null. On the other hand, the assumption of neutrality of the monetary shocks on real balances poses problem because it stipulates the equality of two coefficients within the matrix which occupies us. Let us examine it: it thus describes the long term effect of the various shocks on the three variables of our VAR. We call it A_{LT} and we thus have:

$$X_t = A_{LT}\begin{pmatrix}\varepsilon_{st}\\ \varepsilon_{pt}\\ \varepsilon_{mt}\end{pmatrix}=\begin{pmatrix}A_{ys} & 0 & 0\\ A_{ps} & A_{pn} & A_{pr}\\ A_{ms} & A_{mn} & A_{mr}=A_{pr}\end{pmatrix}\begin{pmatrix}\varepsilon_{st}\\ \varepsilon_{pt}\\ \varepsilon_{mt}\end{pmatrix} \qquad (18)$$

with A_{is} the long term supply shocks effects on the various variables, A_{in} effects of the demand shocks and A_{ir} effects of the monetary shocks. We note within matrix A_{LT} that the demand shocks do not have indeed any long-term effect on the growth rate, while the long-term effect of the monetary shock on the rate of inflation and the monetary growth rate is the same one, which gives the neutrality of this shock with respect to the real balances (see equation (4)).

In order to solve the practical problem of identification, we use the technique employed by Chamie, DeSerres and Lalonde (1994) which consists of a triangulation of this matrix of the long-term shocks effects. Let the matrix B be defined such as:

$$B=\begin{pmatrix}1 & 0 & 0\\ 0 & 1 & -1\\ 0 & 0 & 1\end{pmatrix}$$

Then let us indicate by X the following matrix:

$$X = BA_{LT} = \begin{pmatrix} A_{ys} & 0 & 0 \\ A_{ps} - A_{ms} & A_{pn} - A_{mn} & 0 \\ A_{ms} & A_{mn} & A_{mr} \end{pmatrix} \quad (19)$$

In addition, as we know: $A_{LT} = \Lambda_{LT}A_0$, so :

$$A_{LT}A_{LT}' = \Lambda_{LT}A_0A_0'\Lambda_{LT}' = \Lambda_{LT}\Omega\Lambda_{LT}' \quad (20)$$

We can thus write:

$$BA_{LT}A_{LT}'B' = B\Lambda_{LT}\Omega\Lambda_{LT}'B' \quad (21)$$

and $XX' = B\Lambda_{LT}\Omega\Lambda_{LT}'B'$ (22)

However X is a triangular matrix, which enables us to identify the components through a Cholesky decomposition of the matrix $B\Lambda_{LT}\Omega\Lambda_{LT}'B'$ which all the elements are known. From there, we obtain:

$$A_{LT} = B^{-1}X$$

$$A_0 = \Lambda_{LT}^{-1}A_{LT}$$

What gives us the value of the various macroeconomic shocks:

$$\varepsilon_t = A_0^{-1}e_t$$

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