Has the ECB Been Wrong? A Lesson from Counterfactual Simulations. *

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March 2004

Abstract

How did European Central Bank (ECB) fit the disparate macroeconomic needs of euro zone members? The purpose of this paper consists in providing quantitative answers to this question presenting an original methodology. Using homogeneous frameworks of monetary transmission mechanisms, we simulate the national evolutions of GDP growth and inflation since 1999, in a fictitious context where the euro was never launched. These simulations are then compared with the actual outcomes over the period 1999-2002. Our major result is that the ECB did a far better stabilisation job for euro zone countries than national central banks would have done.

JEL classification: E52, E58, F47
Keywords: Taylor rules, monetary policy transmission, alternative worlds, simulation, stabilisation

*I thank Christian de Boissieu, Hubert Kempf, Philippe Martin, Peter Hansen and Thérèse Chevallier-Farat for many useful suggestions.

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1 Introduction

This paper develops and estimates an individual monetary policy transmission framework for nine euro zone countries. Afterwards, these estimations are used in an original way, to simulate real GDP growth and price development in a counterfactual world where the euro was never launched. Our results support the unconventional view that the ECB did an efficient stabilisation job for most of eurozone countries.

Actually, this outcome is quite surprising if we consider the abundant criticisms regarding ECB's monetary policy decisions, even more numerous for two years. Indeed, the euro zone has been suffering since the beginning of 2001 the strongest business slowdown across all the industrialised areas. After a GDP growth of 3.5% in 2000, the European economy fell well below its potential growth of 2.5% in 2001, with a GDP increase of 1.4%. Moreover, after a small 0.8% in 2002, it is obvious now that the weak figure of 0.5% will hardly be reached in 2003. Nevertheless, these average performance for the area as a whole hide some various situations. Thus, if we take the two ends of the spectrum, we are confronted to almost opposite configurations. On the one hand, Germany has known since three years the weakest growth of the euro zone (0.6% in 2001, 0.2% in 2002, around 0 in 2003), characterised by rising unemployment and public deficits well above the limits defined by European regulations. Today, the situation of German economy is such that some do not hesitate to speak of a deflationary risk (see for instance Kumar, 2003). On the other hand, Ireland's GDP increased by 6.0 % in 2001 and 2002, and keeps resisting in 2003 with 3.25% forecasted. However, since January the 1st, 1999, both Ireland and Germany live with the same monetary policy, and we can reasonably doubt that it suits perfectly their different needs. Of course, various situations exist between these two extreme examples, as it will be highlighted thereafter. The problematic remains identical, however: how can monetary policy work for disparate macroeconomic communities - in that case, euro zone members?

The European Monetary Union (EMU) has been therefore a quite debated idea for one decade until today, four years after the official setting of the euro. Many academics from different fields of international macroeconomics used to predict serious troubles for the central bank which would have to set the common monetary policy for such "ill-matched" countries. The arguments have been coming from several directions, all of them emphasizing in a different way the crippling problems of the idiosyncratic shocks management. Using the Optimal Currency Area theories (Mundell, 1961; Mc Kinon, 1963), Eichengreen (1991) argued that the euro area had neither the labour flexibility and mobility, nor the fiscal integration which are necessary to replace exchange rate adjustments. Moreover, authors like Cukierman and Lippi (2001) stressed that, confronted to the long term trade-off between inflation and employment in case of cyclical shocks, the very inflation averse ECB would be unable to lead any stabilisation policy. So, the main point of this literature consists in enlightening the problems laid by macroeconomic heterogeneity to a single monetary policy. Thus, the question addressed is the following: until today, how did the single monetary policy set by the ECB fit (or not!) the specific needs of the euro zone members? However, as far as we know, it has never been tried before to provide a quantitative answer to this problem, in the sense of gauging the gains or costs of EMU membership. *Thus, our purpose in this paper is to assess quantitatively the macroeconomic costs or gains of EMU membership.* With the help of empirical specifications of monetary transmission, we compute the macroeconomic costs or gains in terms of GDP growth and inflation of euro membership for each country. This is done by simulating the evolution of those variables in a fictitious context where the euro was never launched. To our best knowledge, this is the first time that such an approach is adopted.

The remainder of the paper is structured as follows: section 2 provides a short overview of theoretical underpinning and related literature. Afterwards, section 3 set up a backward model of monetary policy transmission and addresses related econometric concerns. In section 4, simulated paths for EMU members in a world without ECB are presented and commented. Section 5 provides concluding remarks.

2 Monetary macroeconomics for EMU

Vectorial Auto Regressions (VAR) models have been widely used for empirical works on monetary policy transmission since the seminal paper of Sims (1980). Its simplicity and strong empirical power are the main and undeniable advantages explaining the success of this approach. However, VAR models remain highly questionable, both for their lack of theoretical underpinning and their structural rigidity (see Clausen and Hayo, 2002a). Our purpose is to set a more flexible dynamic framework able to capture cross-country differences in the transmission mechanisms. In other words, we want to build individual setups accounting for each country particularities. These frameworks of monetary policy transmission should all include three interdependent equations, the first one for supply side, the second one for demand side. Finally, the third one will have to model monetary policy decisions of each national central bank.

2.1 Modelling monetary policy transmission

The usual interest around monetary policy real effects recently renewed when research began to focus on so-called *New-Keynesian* framework, brought to the fore by Clarida et al. (1999). Operating the synthesis between solid microeconomic foundations (integration of optimisation behavior by households and firms, provided with rational expectations) and the essential hypothesis of prices rigidity for real effects of monetary policy, New-Keynesian models become recently the referential framework for monetary policy analysis[1]. However, several studies[2] casted some serious doubts on New-Keynesian models ability for fitting the data; as emphasizes Loisel (2003), there seems to be “a trade-off between theoretical consistency and empirical relevance”. Indeed, as shown by Estrella and Fuhrer (2002), the major failure of “pure” New-Keynesian specifications - by contrast to the hybrid ones defined below -lies in predicting jump-form responses of inflation or output after exogenous shocks, in contrast to the “hump-shaped” profiles displayed by historical series.

Some tried to circumvent the problem by including additional lags of inflation in the model in attempt to preserve both theoretical framework and empirical consistency, like Loisel

[1]See for example Svensson and Woodford (2003), who adjust the model by introducing predetermined one period, instead of forward-looking, current inflation and output gap. Another key milestone in the literature, Clarida et al. (2001) extended their original model to an open economy framework.

[2]See for instance Roberts (2001) who shows that the New-Keynesian framework does not fit properly US data.

(2003) or Roberts (2001), giving up the canonical or pure formulation of the model for a Hybrid version of the New-Keynesian Phillips Curve (HNKPC). Indeed, this modification helps most of the time to retrieve a minimum of empirical relevance. An almost impossible challenge has to be faced, yet: how can the introduction of "non-rational" lags be justified in framework based on... rational expectations? More generally, what is left of a forward-looking framework, when the Phillips curve is provided with weight around 60% on lagged inflation (Roberts, 2001)? Surely, the recent tests performed by Galí et al. (2003) were able to support the empirical robustness of the HNKPC, their specification including marginal cost, expected future inflation and lagged inflation. But they clearly emphasize at the same time the failure of pure new-Keynesian models for capturing reality properly. Finally, testing several specifications of Hybrid New-Keynesian models, Dennis (2003) finds that even the best fitting specification shows empirically inconsistent characteristics.

Beyond this non-trivial debate between fully and partially rational specifications of the New-Keynesian framework, it exists another way of modelling monetary transmission, the backward-looking formulation. Obviously opposed to the forward-looking models discussed before, the main simplification of this class of models lies on the use of adaptive anticipations for households and firms. However, these backward-looking specifications show some qualities on the empirical field, especially compared to the New-Keynesian framework overall performances on that ground. Indeed, Rudebusch and Svensson's (1999) backward-looking specification fits the US data quite well, and appears to be robust to a wide range of econometric tests. Moreover, Fuhrer (1997) has tested a backward-looking framework against its forward-looking counterpart, and could not reject it. Last argument in favor of autoregressive/adaptive expectations structure for the Phillips curve, this kind of specification is widely used in many central banks policy models[3].

In a word, empirical uncertainties of New-Keynesian models, the recurrent debate on the right way to apprehend expectations in macroeconomic analysis[4], and the most important, autoregressive specifications robustness, drive us to choose cautiously a backward-looking framework for our simulations of macroeconomic evolutions in a "without-euro-EMU". Indeed, concerning the trade-off between theoretical foundations and empirical robustness, the purpose of our paper asks clearly to give a preferential treatment to the latter. We will therefore follow the path proposed by Clausen and Hayo (2002a&b) for modelling monetary transmission across EMU members, using a backward-looking specification. But to obtain complete macroeconomic setups, we have to specify how monetary policy decisions are modelled.

2.2 Central banks reaction functions

In a seminal paper of 1993, Taylor formulates a rule stating that the short-term interest rate of any central bank should be an explicit function of plausible goal variables, like output and inflation gaps to their target values. Formally, the latter represent a small subset of the information available to the policymakers (Svensson, 2003). One of the main advantage

[3]See in particular the study provided on that topic by the Bank for International Settlements (1995), quoted by Rudebusch and Svensson (1999).

[4]See Lordon (1997).

of this type of rule lies in emphasizing simply the trade-off between short-term and long-term concerns. Thus, as emphasized by Judd and Rudebusch (1998), this rule appears to be a suitable benchmark of the "right" monetary policy. Therefore, many academics built on Taylor rules, which seem to perform empirically as well as more complex reaction functions. However, it seems that European central bankers are not really convinced by Taylor rule virtues. Wim Duisenberg, the now former President of the ECB, firmly denies the use by the board of any type of hybrid rule, and advocates strongly the now famous "two pillars strategy"[5]:

> "Well, we do not stick to rules like the "Taylor rule" (...). We have a two-pillar strategy, and in the light of that two-pillar strategy we have come to the decision that we have taken today (...)" (Press conference, November 7, 2002)

Nonetheless, several studies highlighted that ECB monetary policy decisions since the launch of the euro could be strangely well described by Taylor-type rules (see for instance, Sibi, 2004). However, as emphasized by Faust et al. (2001), the lack of data prevents from making any robust estimation of a monetary policy rule for the ECB, calling then for precaution regarding this kind of analysis. Nevertheless, as stressed above, there is a strong consensus across the literature to acknowledge the Taylor-type rule's empirical performances, and more generally to capture the important features of "real" monetary policy. That is why we chose to use this type of rule in general macroeconomic frameworks of monetary policy transmission.

2.3 An unified framework for euro area countries

As mentioned before, our approach builds mainly on Clausen and Hayo (2002a&b), to whom we basically take the backward pattern of monetary policy transmission. However, their study focuses only on Germany, France and Italy, and the framework they designed cannot be directly transposed to all other EMU countries. Indeed, those countries experienced different degrees of monetary constraint inside European Monetary System (EMS), due to the system asymmetry in favor of Deutsche Mark. Then, we borrow the three groups specifications used for the VAR study of Mojon and Peersman (2001) in order to fit the main monetary policy "regimes" inside EMS. Therefore, Germany is a group on its own, considering the leading role played by Deutsche Mark inside the EMS. A second group is made up of Austria, Belgium and Netherlands, kind of monetary "vassals" of Germany: their exchange rate parity against the German currency has been rarely modified over the period, and their monetary policy has always been tightly linked to German ones. At last, Finland, France, Greece, Spain and Italy set up the third group, the "dominated partners". Despite the EMS, their monetary history appears to be more troubled, and all of them, apart from France[6], were constrained to a floating exchange rate period.

However, we deliberately chose not to include the exchange rates in our framework. Actually, integrating endogeneous exchange rates variables would have considerably complicated

[5]Otmar Issing, ECB Chief Economist, expressed somewhat more ambiguous views: "The Taylor rule is quite important for us, because it gives us *guidelines* for the stance of monetary policy. But the rule *cannot be a directive* for our policy" (Das Gespräch, February 14, 2000).

[6]Actually, this does not make any real difference: French Franc knew several devaluations during the eighties, and the EMS crisis of August 1993 lead to a *de facto* floating rate for several months.

our framework with a probable weak expected profit. An attempt to simulate potential evolutions of exchange rates in a world without euro would have provided highly random results and poor benefits. Therefore, it is assumed that the integration of German variables as depicted above is sufficient to capture the main features of EMS asymmetric constraints.

In a word, the framework of monetary policy transmission we set offers more flexibility than VAR modelling, since it allows to use different lag length for each variable in each equation and does not consider all variables as endogeneous. An output gap equation (AD) models the demand side and a Phillips curve (AS) represents the supply side of the studied economies. Finally, the interest rate reaction function, which characterises Central bank behavior, is a Taylor-type rule, responding to both output gap and inflation. Our pattern consists therefore of a benchmark three-equations system, whose features will vary across the three-groups specification we defined above. It is analytically depicted and estimated in the next section.

3 Monetary policy in euro zone countries: some econometric evidence

3.1 Benchmark models: analytic presentation

Regarding practical concerns, we use quarterly data from 1980 (approximately the start of "modern" EMS) to end 1998, coming both from Eurostat and IFS databases. We use the money market rates, consumer prices indexes and seasonally adjusted quarterly data for real GDP. Unfortunately, the latter were not available for a sufficient period, neither for Portugal nor for Ireland. These countries are therefore excluded of our study.

As in Mojon and Peersman (2001), the benchmark model will be the German one. Formally, it sticks closely to Clausen and Hayo (2002a). Regarding the number of lags, it is current to use one-period control lag for the output gap, and a two-period control lag for the inflation and more generally all the "monetary" variables. In our case, it is practical and somewhat realistic to let the period be two quarters. Accounting that t represents a subperiod of one quarter, we set our framework as follows:

$$\pi_t = \sum_{i=1}^{4} \alpha_{\pi,i}\pi_{t-i} + \alpha_y y_{t-1} + \varepsilon_{\pi,t} \quad (1)$$

$$y_t = \sum_{i=1}^{2} \beta_{y,i} y_{t-i} + \sum_{i=1}^{4} \beta_{r,i} r_{t-i} + \varepsilon_{y,t} \quad (2)$$

$$r_t = \sum_{i=1}^{2(4)} \tau_{r,i} r_{t-i} + (1 - \sum_{i=1}^{2(4)} \tau_{r,i})(\gamma + \rho_\pi \pi_t + \rho_y y_t) + \varepsilon_{r,t} \quad (3)$$

Equation 1 is an AS curve-type, where π_t (the quarterly annualised inflation rate, i.e. $400(\ln cpi_t - \ln cpi_{t-1})$) depends on past inflation rates, the output gap in the previous period, and a exogenous supply shock $\varepsilon_{\pi,t}$. The second equation is an AD curve, where y_t is the output gap, calculated as the gap between real GDP and potential GDP, the latter deduced with a Hodrick-Prescott filter applied to the real GDP series, the smoothing parameter being fixed to $\lambda = 1600$[7]. Present output gap is then related to his past values, to the nominal interest rates in the four previous periods, and an exogenous demand shock $\varepsilon_{y,t}$. Finally, equation 3 is a Taylor-type rule, but slightly modified by the introduction of lagged interest rates, allowing then for interest rates smoothing[8]. Our monetary policy rule allows for interest rates smoothing up to lag two, exceptionally to lag four (mainly for Italy). However, the shape of the monetary policy rule is not exactly Clausen and Hayo's one, but rather like the one of Faust et al. (2001), with the opposite of the smoothing parameters - that is $1 - \tau$ - explicitly weighting the autonomous part of central bank's decision rule. Finally, the γ parameter represents the German long-term equilibrium interest rate, computed as 2.5%[9].

This benchmark model is adjusted for the second group, the one of "monetary vassals" (Austria, Belgium and Netherlands). Indeed, all these countries kept more or less strongly a fixed parity with the DM. Besides, it is likely that macroeconomic conditions in these very small-sized neighbours of Germany were largely dependant on German ones (cf. Mojon and Peersman, 2001). So, our model has to be amended for taking into account the lack of really autonomous monetary policy and dependent macroeconomic developments in these countries. Therefore, we include in the monetary vassals specification German output, prices and short-term interest rate. Finally, using a common hypothesis of small-opened economies frameworks, we suppose that there is no feedback from the smaller country to Germany. For j =Austria, Belgium and Netherlands, the model takes therefore the following form:

$$\pi_t^j = \sum_{i=1}^{4} \alpha_{\pi,i}^j \pi_{t-i}^j + \sum_{i=1}^{4} \alpha_{\pi^{Ger},i}^j \pi_{t-i}^{Ger} + \alpha_{y^j} y_{t-1}^j + \varepsilon_{\pi,t}^j \tag{4}$$

$$y_t^j = \sum_{i=1}^{2} \beta_{y,i}^j y_{t-i}^j + \sum_{i=1}^{2} \beta_{y^{ger},i}^j y_{t-i}^{Ger} + \sum_{i=1}^{4} \beta_{r,i}^j r_{t-i}^j + \varepsilon_{y,t}^j \tag{5}$$

$$r_t^j = \sum_{i=1}^{2(4)} \tau_{r,i}^j r_{t-i}^j + (1 - \sum_{i=1}^{2(4)} \tau_{r,i}^j)(\rho_{ger}^j r_t^{Ger} + \rho_\pi^j \pi_t^j + \rho_y^j y_t^j) + \varepsilon_{r,t}^j \tag{6}$$

Regarding the third group of "dominated partners", the adjustments imposed to the model in order to fit the case of Finland, France, Greece, Italy and Spain are less heavy. Their less "disciplined" monetary course inside the EMS left them with a much wider scope for autonomous monetary policy. Moreover, we are dealing here with countries whose size or specialization prevented from a too big macroeconomic dependence toward Germany. However, in order to model DM leading role inside the EMS, German short-term interest rate is included inside interest rate reaction functions. For k =Finland, France, Greece, Italy and Spain, our model becomes:

$$\pi_t^k = \sum_{i=1}^{4} \alpha_{\pi,i}^k \pi_{t-i}^k + \alpha_{y^k} y_{t-1}^k + \varepsilon_{\pi,t}^k \tag{7}$$

[7]The conventional value for quarterly data.

[8]Sack and Wieland (2000) provide a review of motivations for smoothing interest rates.

[9]This figure has been deduced from HP-filtered monthly German 3-months rates, with a smoothing parameter still equal to 1600.

$$y_t^k = \sum_{i=1}^{2} \beta_{y,i}^k y_{t-i}^k + \sum_{i=1}^{4} \beta_{r,i}^k r_{t-i}^k + \varepsilon_{y,t}^k \tag{8}$$

$$r_t^k = \sum_{i=1}^{2(4)} \tau_{r,i}^k r_{t-i}^k + (1 - \sum_{i=1}^{2(4)} \tau_{r,i}^k)(\rho_{ger}^k r_t^{Ger} + \rho_\pi^k \pi_t^k + \rho_y^k y_t^k) + \varepsilon_{r,t}^k \tag{9}$$

3.2 Econometric methodology: presentation and justifications

The first problem to address was the one of econometric model stationarity, depending of course on time series properties on that ground. This is a matter of considerable importance, because it raises the issue of possible cointegration (that is long-term) relations between variables. Most of the time, the answers provided are either ambiguous or contradictory. For instance, Rudebusch and Svensson (1999) do no explicitly address the problem. Furthermore, while Clausen and Hayo (2002a&b) find all variables to be stationary, unit root tests performed by Clarida et al. (1998) produce uncertain results. As emphasized by Österholm (2003), this is a serious problem to address, because regressions in levels on variables integrated but not cointegrated are likely to be spurious. In our case, there is of course no reason to doubt output gap stationarity, deriving directly of HP filter methodology. Nevertheless, doubts can seriously be casted on inflation and interest rates. Actually, the Augmented Dickey-Fuller (ADF) test answers are very sensitive to the hypothesis chosen for the regression: inclusion of a trend and/or a constant not, number of lags... We therefore compared several specifications of ADF tests and reached the following results: inflation series are found to be stationary most of the time in a general regression with 12 lags, neither a constant nor a trend being included; however, results are more mitigated for interest rates. So, as one can see, this is a complex issue leading to unclear answers. Finally, we reached the same conclusion that Clarida et al. (1998), who holds the low power of the ADF test responsible of these blurred results: we therefore decided to consider all variables as stationary.

Furthermore, regarding estimations concerns, the first regressions using Ordinary Least Squares (OLS) method generated two types of problem with residuals. First, White's test highlighted a problem of heteroscedasticity for almost all residuals[10]. Moreover, controls for contemporaneous correlations among residuals showed unsurprising simultaneous links among the residuals of almost each system. Each country three equations system is then estimated separately, using the Seemingly Unrelated Regressions (SUR) method. Also known as multivariate regressions, this is very appropriate technique in our case, accounting both for contemporaneous correlations of errors across equations and heteroskedasticity. Finally, for some systems not concerned by contemporaneous correlations problems, the method of weighted least squares (WLS), which controls for cross equations heteroskedasticity, is applied. Table 1 below depicts the estimation method chosen for each country according to these two criteria:

Insert table 1 here

[10]The problem is that OLS estimates are still consistent in the presence heteroskedasticity, but the conventional computed standard errors and confidence levels are no longer valid.

Moreover, in order to perform a consistent comparison of our simulated results with the effective developments in terms of inflation and real GDP, we implicitly consider that there was no change in monetary policy impact on GDP and inflation[11]. Nevertheless, this assumption is not free of both side critics. On the theoretical ground, we are directly exposed to Lucas critique. On the empirical ground, one can immediately object that such an assumption ignore the integrative power of euro on financial markets. The merging of 12 financial markets into a single one can influence greatly the transmission mechanisms across countries.

However, as emphasized by Rudebusch and Svensson (1999), the Lucas Critique can empirically be addressed by adequate structural breakdown tests of our systems. From a more general point of view, Taylor (1993) emphasizes that there is a transition period when switching from a monetary policy regime to another. In that spirit, that transition period asks for a learning process which makes rational expectations hypothesis hardly realistic... Besides, regarding financial markets integration concerns, Hayo (1999) or Clausen (2001) showed that this convergence of monetary transmission mechanisms is likely to take place gradually. Indeed, financial markets integration is far from being achieved and remain really partial. In that spirit, historical pre-euro data and related empirical studies can still provide relevant information about the transmission mechanism *after* the formation of EMU.

So, in the spirit of Clausen and Hayo (2002a), we could check wether a structural break occurred prior to the establishment of EMU, by performing out-of-sample tests of our systems[12]. However, this would reduce already limited degrees of freedom. Facing the trade-off between sparing them and performing Chow-tests, we finally chose to support the first ones. In other words, considering both theoretical and empirical arguments provided below, we will presume in the remainder of the paper that there was no major break in the monetary transmission mechanism after January 1, 1999. The models will therefore be estimated over the all sample period (1980-1998), and the structure provided by the estimates will be hold constant for simulation purpose.

3.3 Estimating Monetary transmission mechanisms

Before interpreting regressions results and their statistical significance, we had to process standard diagnostic tests on each of our nine systems. If Durbin-Watson statistics generally confirmed the absence of autocorrelation, conventional Chow tests at 5% level revealed instability of specifications for some countries. The inclusion of dummies variables correcting the presence of outliers in the data greatly helped to remove these problems. For Germany, dummies were added for the 1991-1992 period, in order to address the ruptures consecutive to reunification. Regarding France, the inclusion of dummies tackled the problem of interest rates bursts after 1981, 1982 and 1987 French Franc devaluations (the same treatment was provided to Belgium who devaluated its currency in 1982, 1983, 1986 and 1987). In Italy, the third quarter of 1992 (EMS crisis leading to the floating of Italian Lira) coincides with considerable breaks in interest rates and output. The case of Finland is a bit more complex.

[11] Indeed, if structural breakdown occurred, we would not be able to determine wether the differences stated between simulated results and effective data come from monetary transmission changes induced by the euro or only from the switch of several monetary policy rules to a single one. Basically, this means that the demand/supply shocks would have impacted differently in a world without euro that in our real single currency area.

[12] Actually, with a model for France, Germany and Italy very close to our, their controls for structural breaks did not find any instability of the estimates.

Actually, two major breaks caused significant outliers in the data. The first one occurs for interest rates around the mid-eighties: the quick financial markets deregulation associated to strong anticipations of devaluation for the Finnish Markka, leads to a sharp increase of interest rates. The second significant break concerns output gap from mid-91 until end 1992, when, following USSR disintegration, real GDP decreased by 10%. The fourth quarter of 1992 is characterised by a strong decline in interest rates, subsequent to Markka floating[13]. In both cases, these breaks appear as exceptional events blurring the natural evolution of series, so impulse dummies were included to counterbalance their effects. At last, appeared the very special problem of Greece, whose macroeconomic profile exhibited two kind of problems. First, the eighties and the very beginning of nineties are synonymous of great macroeconomic instability from all points of view, contrasting with the amazing convergence efforts made after 92-93. Besides, during all that period, Greek interbank market was strictly regulated and monetary policy was monitored by government: this led to an almost constant short-term rate sticking to a high nominal level all over the eighties. Consequently, we faced a considerable bias in our first estimations, which provided a far too important to be credible coefficient for interest rate smoothing. As a consequence, we decided to proceed our estimations on the 1993:1-2000:4 interval for Greece. Indeed, this period starts at the point where a sharp data convergence process is observed and ends with the integration of Greece inside the eurozone. However, we are aware that such a sample cut reduces considerably the degrees of freedom and therefore the significance of our analysis. That is why the results concerning Greek framework have to be taken with great care.

Finally, once all dummies included, Chow tests at 5% level were performed on each equation of each system, and did not reveal any symptom of instability anymore. Henceforth, we will consider therefore our estimations as stable over the period 1980-1998. The latter are depicted below, in three separate tables according to the classification established previously. Therefore, Table 2, 3 and 4 show our results for the nine considered countries[14]. Phillips curve coefficients are first listed, then AD curve coefficients, before ending with monetary policy rules parameters.

Insert Table 2 here

Insert Table 3 here

Insert Table 4 here

The results for Germany[15] are unsurprising and consistent with previous findings of related literature. The high smoothing parameter is therefore in line with both Faust et al. (2001) and Clausen and Hayo (2002a&b) estimates, with a high value around 91%. Furthermore, the significant strong weight on inflation and the non-significant low coefficient on output gap are totally in line with the former Bundesbank mission, focused on price stability. Besides, note the link between output gap and first lag of interest rates, one of the strongest across all

[13]Despite Markka has not belonged to the EMS before 1996, Finnish Central Bank used to maintain a strong link to ECU and more or less officially to the DM.

[14]Standard errors in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. ns = non-significant

[15]Dummies accounting for reunification are not reported for presentation clearness, but they both were find significant, respectively at 1 and 5% levels.

national estimates. Finally, all dummies except one were found significant, at least at 10% level.

"Monetary vassals" share a same profile with strong common features. Regarding AS and AD curves, it seems that German prices developments may have a significant impact on vassals own inflation developments. Conversely, we were not able to detect any real impact of German output. Besides, the presence of significant lags of opposite sign at different lengths suggests the presence of unexplained dynamics pictured by the regressions. Regarding monetary policy rule, the small smoothing coefficients emphasize lack of independency: in order to follow German monetary developments, these countries were regularly constrained to brutal interest rates variations. This tight link with German monetary policy is also perceptible when looking at the strong coefficients for German interest rates, around one (the figure is a bit weaker for Belgium, as a result of 80's devaluations). Consequently, the space for autonomous monetary policy appears to be extremely small, which is consistent with the small estimates for output gap or inflation. As the most tightly linked to Germany, Austria do not enjoy any kind of autonomy in his monetary policy rule, as shown by non-significant weights. With a connection relatively weaker, Belgium or Netherland keep a little share of autonomy, with small but significant coefficients, respectively for inflation and output gap.

Not surprisingly, the group of "Dominated partners" is much less homogeneous than the previous one, but still offers a couple of interesting common features. Then, smoothing parameters are considerably superior to previous ones, around 90% for Finland, Greece and Italy, the latter smoothing up to fourth lag of interest rates. However, France's and Spain's figures are significantly lower, around 80%. A plausible explanation can be found in the sharp adjustments needed by the EMS to keep the link with the DM. To a certain extent, these two countries are close to monetary vassals. This idea is sustained by close to unit coefficients on German interest rates and very inflation adverse behaviours. Conversely, the small and non-significant weight of German rate inside Italian monetary rule mirrors Lira chaotic course inside and especially outside the EMS. Furthermore, note that the weight on output gap is equal to 2.5 times the one on inflation: it seems that the Italian monetary policymaker would accommodate strongly output gap evolutions. While Finland estimates highlight the disturbed macroeconomic context suffered by this country during the 80's and the beginning of the 90's, Greece's profile reflects the efforts of convergence of the country, with an extraordinary strong coefficient on German rate (2.37) and a significant aversion to inflation. With such mechanisms of monetary policy transmission, what would have been macroeconomic paths of these countries if EMU step 3 had been postponed? This issue is addressed in the next subsection.

4 An EMU without euro

4.1 Construction of the alternative world

The idea of a delayed euro launch (step 3 of EMU) is not unrealistic. Remember that initially two different dates were explicitly considered in Maastricht Treaty, 1997 and 1999. Let's suppose there was a third possibility, for instance 2003. Considering the macroeconomic context of 1998, one can easily imagine number of reasons for choosing the latest date: Russian financial crisis, problems of public deficits exceeding the 3% Maastricht limit... In our world without euro, EMU institutional framework keeps therefore the same configuration it had before step three setting. In that spirit, one element is crucial: EMS is still running, which means that all twelve countries exchange rates are sill linked by fixed parities, the DM being the leading currency. In a word, the problem of EMS asymmetry is still crucial in our alternative world. Our problem can then be formulated as follows: what would have been national performances in terms of growth and inflation if the single currency have not been set up, and national currencies kept? To address this question, we use the previously estimated individual monetary transmission mechanisms in a "without-euro" EMU. Of course, the monetary policy rules will play a crucial role on that ground, because they will help us to simulate national central banks behaviours after 1999.

Nonetheless, a couple of technical concerns has to be solved before providing the simulations results. First of all, the problem of shocks specification in the AS and AD curves (respectively $\varepsilon_{\pi,t}$ and $\varepsilon_{y,t}$) was crucial to solve. Indeed, our simulations could not be decently proceeded without taking into account extra euro area macroeconomic shocks, either on prices (for example, on oil prices) or output (explosion of internet bubble and American slowdown, 11^{th} of September). We need therefore to integrate in the simulations the actual shocks which occurred after the 1^{st} of January 1999. But how can we isolate more or less precisely these shocks in the single currency context? Remember that forecasts are made with error, the latter being simply the difference between the actual and forecasted value. The estimated 1980-1998 AS and AD curve are used for retrieving shocks since the implementation of euro, computed as the difference between inflation and output gap real values and their estimated counterparts, computed with real ECB's rates. These ε are then reintroduced in the counterfactual complete models, where all countries have their own interest rate reaction function.

Eventually, what to do with non-significant coefficients of the estimated models? Theory tells us that it is probably better off removing the coefficients that are very insignificant, say $|t - statistic| < 1$. What to do with the others is less clear. Eventually, we chose to keep all coefficients with $|t| > 1$.

4.2 Comparison of real and simulated paths

Gains/losses from monetary union can therefore be computed as the difference between real values and fictive counterparts from the world without euro[16]. Of course, signs just have to be inverted to see the gains/losses in the alternative world. More precisely, the real GDP gain is equal to the difference between real output gap and fictive output gap. Therefore, a positive difference must be understood as a real GDP gain from monetary union. Conversely, a negative difference between real inflation rates and their simulated counterparts represents the inflation gain from monetary integration, since a smaller inflation is supposed to be better in terms of welfare.

Table 5 presents the fictive series of interest rates for euro zone countries in our world where euro launch was postponed. Table 6 reports the quarterly annualised real GDP gain (deduced from the difference between real and fictive output gap series: a positive difference must therefore be interpreted as a gain from single currency) from monetary union, while table 7 depicts the inflation gain (deduced from the substraction of fictive inflation rates to real ones: a negative difference must be therefore understood as a gain from monetary

[16]Complete series of fictive output gap and inflation rates are available upon request.

integration). Bold lines below Tables 6 and 7 show the cumulative gains for the considered variables over the sample period:

Insert Table 5 here

Insert Table 6 here

Insert Table 7 here

One major result as to be emphasized first: during all 1999 year and the mid-2001-2002 period, ALL national Central Banks would have set higher interest rates than European Central Bank. Especially, while ECB led an accommodating monetary policy after September 11, Bundesbank followed by most of the national central banks would have raised interest rates in order to fight inflationary pressures coming from oil prices. The major consequence consists in significant lost of output for most of the countries during the 2002 year. In a word, that means euro zone countries would suffer recession since end 2001 if national monetary policies were still running. Then, the exaggeration of business cycles seems to be the striking fact in the alternative world without euro: France, Finland, Italy, Austria, Netherlands and Belgium would have experienced better GDP growth in 1999 and 2000 in a world without euro. However, this would have led to a clear aggravation of inflationary pressures (cf. table 7), with strong interest rates rises to counterbalance the latter. As a result, the business slowdown would have begun sooner and would have been more violent for these countries than it is in the real world. For example, France seems to have lost real output from monetary integration, especially in 2000 and the first half of 2001. Keep in mind, however, that these years have seen a GDP growth around 3%, that is already above French potential growth - usually estimated around 2 or 2.5 %. France would have certainly experienced a quicker growth over this subperiod, but as Table 6 emphasizes, the last semester of 2002 would have suffered a small recession - instead of a slow growth. If we consider that output stabilisation is a desirable objective in itself, macroeconomic performances in a world without ECB are therefore undeniably worse than the ones of the real world. However, a couple of special cases diverge form this general analysis. Germany appears therefore as the country loosing more in terms of GDP, possibly because of unappropriate interest rates rises. In the same spirit, Greece would have highly suffered in the world without euro, deprived from the low interest rates provided by the ECB, relatively to the ones Greek central bank would have been obliged to set.

Finally, diagnostic regarding inflation performances is even more obvious: inflation would have been higher in almost all countries during most of the 1999-2002 period. Explanation is quite simple: 1999 and 2000 overheating GDP growths in the alternative world without euro would have aimed directly to higher inflation figures.

To sum up, our world without euro is mainly characterised by higher national interest rates and more important macroeconomic imbalances on the whole. So, the conclusion is straightforward: ECB appears to have done a better stabilisation job for most of the euro zone countries than national central banks would have done.

5 Conclusion

The purpose of this paper consisted in providing quantitative estimations of gains and costs of monetary integration for the euro area countries. To do so, this study relied on two main contributions. First, we estimated homogeneous macroeconomic models of monetary policy transmission for nine eurozone countries, allowing for more flexibility than VAR frameworks. Second, we used them to lead some counterfactual experiences, focusing on real GDP and inflation differentials between our world and the performances in a fictive universe without euro. Surprisingly, our major result comes to moderate the strong critics directed against ECB since its very creation, and can be summed up in a few words: "Don't shoot the piano player!". Indeed, our simulations supports the view that ECB monetary policy did a good stabilisation work, in any case better than the simulated national monetary policies. This is a result of considerable importance, because it means that ECB clearly accounted for output considerations in her monetary policy decisions, in spite of a mandate focused on price stability. In other words, created as a clone of inflation-phobic Bundesbank, now it possibly behaves as a close cousin of Federal Reserve...

This paper provided useful insights for further research on monetary policy transmission inside euro zone countries. Several challenges remain however, the most important being to define a possible Error Correction Model accounting for potential cointegration relationships between the data. Moreover, the modification of our backward-looking formulations into a Hybrid New-Keynesian one would certainly be an interesting path to explore.

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Table 1: Residuals characteristics and estimation method

	heteroskedasticity	contemporaneous correlation	simulation method
Germany	yes	yes	SUR
France	yes	yes	SUR
Italy	yes	yes	SUR
Austria	yes	yes	SUR
Netherlands	yes	not significant	WLS
Belgium	yes	not significant	WLS
Finland	yes	yes	SUR
Spain	yes	yes	SUR
Greece	not significant	yes	SUR/OLS

Table 2: SUR-system: Germany

	Coefficient
$\alpha_{\pi,1}$	0.350^a
	(0.096)
$\alpha_{\pi,2}$	0.057
	(0.1)
$\alpha_{\pi,3}$	0.028
	(0.1)
$\alpha_{\pi,4}$	0.37^a
	(0.094)
α_y	0.264^b
	(0.132)
$\beta_{y,1}$	0.663^a
	(0.111)
$\beta_{y,2}$	-0.068
	(0.096)
$\beta_{r,1}$	-0.368^c
	(0.213)
$\beta_{r,2}$	0.349
	(0.375)
$\beta_{r,3}$	-0.064
	(0.366)
$\beta_{r,4}$	0.038
	(0.209)
τ_1	0.908^a
	(0.033)
ρ_π	1.096^a
	(0.261)
ρ_y	0.054
	(0.492)

Standard errors in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. ns = non-significant.

Table 3: SUR-systems: monetary vassals

	Austria	Belgium	Netherlands
$\alpha_{\pi,1}$	-0.121	0.189^b	0.086
	(0.088)	(0.091)	(0.106)
$\alpha_{\pi,2}$	0.046	0.208^b	0.247^b
	(0.088)	(0.089)	(0.107)
$\alpha_{\pi,3}$	-0.006	0.254^a	-0.105
	(0.086)	(0.088)	(0.107)
$\alpha_{\pi,4}$	0.657^a	0.288^a	0.373^a
	(0.085)	(0.09)	(0.1)
$\alpha_{\pi^{Ger},1}$	0.289^a	0.023	0.23^a
	(0.103)	(0.075)	(0.077)
$\alpha_{\pi^{Ger},2}$	0.072	0.044	0.043
	(0.107)	(0.077)	(0.081)
$\alpha_{\pi^{Ger},3}$	0.075	-0.067	0.017
	(0.107)	(0.078)	(0.08)
$\alpha_{\pi^{Ger},4}$	-0.048	-0.01	0.031
	(0.106)	(0.076)	(0.08)
α_y	0.438^b	0.079	0.278^c
	(0.199)	(0.185)	(0.152)
$\beta_{y,1}$	0.452^a	0.782^a	0.593^a
	(0.12)	(0.119)	(0.116)
$\beta_{y,2}$	-0.008	-0.028	0.066
	(0.126)	(0.118)	(0.117)
$\beta_{y^{ger},1}$	0.085	0.044	0.047
	(0.101)	(0.059)	(0.069)
$\beta_{y^{ger},2}$	-0.072	-0.094^c	-0.057
	(0.093)	(0.058)	(0.066)
$\beta_{r,1}$	0.099	0.053	0.311^a
	(0.173)	(0.082)	(0.118)
$\beta_{r,2}$	-0.314	-0.026	-0.329^b
	(0.268)	(0.104)	(0.179)
$\beta_{r,3}$	0.541^b	-0.070	0.127
	(0.267)	(0.103)	(0.177)
$\beta_{r,4}$	-0.327^b	0.037	-0.114
	(0.165)	(0.081)	(0.117)
τ_1	0.453^a	0.546^a	0.520^a
	(0.102)	(0.059)	(0.057)
ρ_{ger}	1.036^a	0.901^a	1.045^a
	(0.029)	(0.057)	(0.03)
ρ_π	-0.022	0.449^a	-0.11^c
	(0.042)	(0.085)	(0.058)
ρ_y	0.185	0.091	0.398^a
	(0.124)	(0.220)	(0.107)

Table 4: SUR-systems: dominated partners

	France	Italy	Spain	Finland	Greece
$\alpha_{\pi,1}$	0.528^a	0.336^a	0.045	0.397^a	0.166^c
	(0.087)	(0.088)	(0.082)	(0.094)	(0.09)
$\alpha_{\pi,2}$	0.004	-0.082^b	0.177^b	-0.192^c	0.196^b
	(0.01)	(0.09)	(0.079)	(0.103)	(0.084)
$\alpha_{\pi,3}$	0.049	0.301^a	0.172^b	0.155	-0.227^b
	(0.1)	(0.087)	(0.078)	(0.103)	(0.086)
$\alpha_{\pi,4}$	0.361^a	0.344^a	0.519^a	0.573^a	0.733^a
	(0.087)	(0.08)	(0.08)	(0.095)	(0.08)
α_y	0.071^b	0.352^c	0.167^c	0.207^c	0.524
	(0.155)	(0.194)	(0.218)	(0.129)	(0.390)
$\beta_{y,1}$	0.807^a	0.646^a	0.609^a	0.691^a	-0.169
	(0.114)	(0.109	(0.111)	(0.112)	(0.166)
$\beta_{y,2}$	-0.027	-0.103	0.255^b	0.123	0.307^b
	(0.108)	(0.106)	(0.107)	(0.107)	(0.141)
$\beta_{r,1}$	0.097^c	0.1	0.01	0.285^a	-0.55^b
	(0.05)	(0.066)	(0.037)	(0.102)	0.242
$\beta_{r,2}$	-0.108^b	0.002	-0.002^b	-0.478^a	0.407
	(0.05)	(0.075)	(0.049)	(0.152)	(0.353)
$\beta_{r,3}$	0.006^b	-0.005	-0.004	0.284^c	0.233
	(0.364)	(0.016)	(0.046)	(0.159)	(0.37)
$\beta_{r,4}$	-0.004^b	-0.103^b	-0.008	-0.082	0.127
	(0.546)	(0.045)	(0.035)	(0.108)	(0.238)
τ_1	0.801^a	0.615^a	0.811^a	0.908^a	0.909^a
	(0.106)	(0.11)	(0.049)	(0.038)	(0.027)
τ_2	ns	-0.021	ns	ns	ns
		(0.138)			
τ_3	ns	0.095	ns	ns	ns
		(0.131)			
τ_4	ns	0.172^b	ns	ns	ns
		(0.09)			
ρ_{ger}	0.984^a	0.205	1.022^a	0.815^c	2.371^a
	(0.124)	(0.311)	(0.352)	(0.446)	(0.542)
ρ_π	0.461^a	1.352^a	0.785^a	0.194	0.491^b
	(0.136)	(0.224)	(0.291)	(0.41)	(0.237)
ρ_y	0.37	3.481^a	-0.267	1.919^b	-0.547
	(0.535)	(1.232)	(0.95)	(0.91)	(1.236)

Table 5: Quarterly interest rates in the world without ECB

	Austria	Belgium	Finland	France	Germany	Greece	Italy	Nlds	Spain	**EMU**
1999:1	3.42	3.62	3.57	3.41	3.32	NA	3.76	3.34	3.94	**3.09**
1999:2	3.55	3.85	3.73	3.62	3.46	NA	3.81	3.60	4.27	**2.64**
1999:3	3.69	3.58	3.76	3.56	3.48	NA	3.78	3.83	4.61	**2.70**
1999:4	3.58	3.73	3.81	3.67	3.37	NA	3.88	3.99	4.67	**3.43**
2000:1	3.97	4.23	4.25	3.86	3.68	NA	4.21	4.23	5.04	**3.54**
2000:2	4.05	4.50	4.89	3.99	3.58	NA	4.46	4.29	5.34	**4.26**
2000:3	4.124	4.65	5.73	4.08	3.87	NA	4.57	4.44	5.81	**4.74**
2000:4	4.05	4.33	6.61	4.15	3.7	NA	4.84	4.44	5.93	**5.00**
2001:1	4.44	4.20	7.66	4.11	4.09	6.45	5.50	4.59	6.02	**4.75**
2001:2	4.43	5.34	8.29	4.58	4.17	7.20	5.69	4.64	6.45	**4.59**
2001:3	4.22	4.85	8.63	4.50	4.04	7.24	5.21	4.47	6.46	**4.27**
2001:4	3.91	4.23	8.56	4.37	3.79	7.75	4.79	4.14	5.99	**3.44**
2002:1	4.31	4.61	8.38	4.57	4.22	8.05	4.89	4.12	5.94	**3.36**
2002:2	4.16	4.35	8.17	4.72	3.94	8.53	4.76	3.92	6.85	**3.44**
2002:3	4.03	4.23	7.80	4.65	4.00	8.42	4.31	3.77	6.16	**3.36**
2002:4	3.76	3.88	7.25	4.63	3.80	8.85	4.07	3.47	6.65	**3.11**

Table 6: Real GDP: gains from monetary integration

	Austria	Belgium	Finland	France	Germany	Greece	Italy	Netherlands	Spain
1999:1	0.12	-0.06	-0.16	-0.04	1.2	NA	0.14	0.33	-0.47
1999:2	-0.15	-0.17	0.32	0.02	0.92	NA	0.34	-0.08	-0.1
1999:3	-0.07	-0.21	0.12	-0.19	1.84	NA	0.27	-0.34	-0.45
1999:4	-0.34	-1.31	0.51	-0.38	1.07	NA	0.03	-0.52	-0.75
2000:1	0.31	-1.53	0.29	-0.74	0.33	NA	-0.13	-0.44	-0.84
2000:2	-0.95	-1.04	-1.42	-1.14	0.29	NA	-0.45	-0.43	-1.02
2000:3	-0.09	-1.09	-0.97	-1.11	-0.41	NA	-0.33	-0.02	-1.23
2000:4	0.02	-1.12	-1.43	-0.93	-0.1	NA	-0.32	0.05	-1.01
2001:1	0.24	-1.53	-1.28	-1.4	0.01	-0.11	-0.37	0.05	-0.78
2001:2	-0.68	-1.27	-1.43	-1.37	0.17	1.14	-0.91	-0.01	-0.69
2001:3	0.54	-0.70	0.96	-0.85	0.56	1.3	-0.65	0.12	-0.5
2001:4	0.64	-0.40	0.76	-0.65	0.98	1.12	-0.37	0.39	-0.49
2002:1	0.9	0.21	1.12	0.0	1.55	1.35	-0.05	0.53	-0.06
2002:2	-0.28	0.18	1.66	-0.09	1.626	1.38	0.17	0.73	0.3
2002:3	0.45	0.3	1.07	0.05	1.54	1.07	0.25	0.94	0.51
2002:4	0.62	0.39	1.09	0.33	1.54	1.25	0.39	1.18	0.58
period	**0,32**	**-2,34**	**0,31**	**-2,12**	**3,28**	**2,12**	**-0,50**	**0,62**	**-1,75**

Table 7: Inflation: gains from monetary integration

	Austria	Belgium	Finland	France	Germany	Greece	Italy	Netherlands	Spain
1999:1	0.1	-0.2	0.0	0.08	0.1	NA	-0.11	0.33	0.07
1999:2	-0.56	-0.47	0.7	1.65	-0.35	NA	-0.03	-0.15	0.1
1999:3	-0.42	-0.5	-1.19	-1.19	-0.6	NA	-0.44	-0.52	-0.16
1999:4	-0.39	-0.57	1.13	1.91	-0.52	NA	-0.43	-0.46	-0.38
2000:1	0.05	-1.23	-0.44	1.28	-0.53	NA	-1.13	-0.81	-1.14
2000:2	-0.92	-1.52	-2.03	0.18	-2.5	NA	-1.56	-0.81	-1.06
2000:3	-0.48	-1.52	-0.29	0.23	-1.74	NA	-1.83	-0.28	-1.2
2000:4	-0.46	-2.45	-2.62	0.38	-1.94	NA	-1.89	-0.52	-1.26
2001:1	-1.59	-2.49	-0.89	-1.83	-2.35	0.0	-2.11	0.19	-2.17
2001:2	-1.13	-2.05	-2.82	4.41	-2.87	-0.13	-2.51	-0.77	-2.24
2001:3	-0.64	-2.15	-1.65	-2.81	-3.33	0.29	-2.36	-0.86	-2.44
2001:4	1.37	-2.05	0.74	-0.55	-1.13	-0.89	-1.85	0.53	-2.14
2002:1	-0.16	-2.36	-0.35	2.58	-1.38	1.85	-1.92	-0.37	-1.78
2002:2	-0.58	-2.9	-3.06	-0.11	-3.36	-0.96	-1.99	-0.18	-2.16
2002:3	1.59	-0.80	1.49	-0.93	-0.77	-1.70	-1.08	0.14	-0.87
2002:4	3.02	-1.32	2.08	1.2	0.11	2.40	-1.34	1.70	-0.961
period	**-0,30**	**-6,14**	**-2,30**	**1,62**	**-5,79**	**0,21**	**-5,64**	**-0,71**	**-4,71**