The Fed and the ECB: Why such an apparent difference in reactivity?

Grégory Levieuge* and Alexis Penot†

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*Laboratoire d'Économie d'Orléans (LEO), UMR CNRS 6221, gregory.levieuge@univ-orleans.fr.
†GATE, University of Lyon, CNRS, ENS-LSH, Centre Léon Bérard, France, penot@gate.cnrs.fr.

Abstract

Compared with the U.S., the amplitude of the European monetary policy rate cycle is strikingly narrow. Is it an evidence of a less reactive ECB? This observation can certainly reflect the preferences and then the strategy of the ECB. But its greater inertia must also be assessed in the light of the singularity of the European structure and of the shocks hitting it. From this perspective, several contributions assert that the nature, size and persistence of shocks mainly explain the different interest rate setting. Therefore, they rely on the idea that both areas share the same monetary policy rule and, more surprising, the same structure. This paper aims at examining this conclusions with an alternative modelling. The results confirm that the euro area and U.S. monetary policy rules are not fundamentally different. But we reject the differences of nature and amplitude of shocks. What is often interpreted as such is in fact the consequence of how distinctly both economies absorb shocks. So differences in the amplitude of the interest rate cycles in both areas are basically explained by structural dissimilarities.

Resumé

Comparé au cas américain, l'amplitude du cycle monétaire européen frappe par son étroitesse. Faut-il y voir la preuve d'une BCE moins réactive ? Ce constat peut refléter les préférences et donc la stratégie de la BCE mais cette plus grande inertie doit être étudiée à la lumière de la structure de l'économie européenne et des chocs qui l'affectent. Plusieurs contributions antérieures ont indiqué que la nature, la taille et la persistance des chocs sont la principale origine des différences de fixation de taux d'intérêt. Par conséquent, elles reposent sur l'idée que les deux zones partagent la même règle monétaire, et plus étonnamment, les mêmes structures économiques. Cet article examine donc ces conclusions avec une modélisation alternative. Les résultats confirment que les règles américaine et européenne ne sont pas fondamentalement différentes. Mais nous rejetons les différences de nature et d'amplitude des chocs économiques. Ce qui est souvent interprété comme tel ne fait en réalité que refléter les différentes manières dont les deux économies absorbent les chocs. Ainsi, les différences d'amplitude des cycles monétaires dans les deux zones s'expliquent essentiellement par des divergences structurelles.

Keywords: Policy activism, structural divergence, interest rates, monetary policy rules, macroeconomic shocks
JEL Code: C51, E52, E58

Introduction

'*Too little, too late*', is the frequent comment about the stance of the European monetary policy, in particular when the evolution of its policy rate is compared to the fed funds rate (see fig. 1 in appendix). Excepted if a cyclical gap is assumed between the euro area and the United States, the observed interest rates discrepancy leads to suppose that the ECB is systematically late in comparison to the Fed, especially in case of cycle reversal. Moreover, the ECB appears to be less dynamic. Between January 1999 and September 2007, the ECB moved its key interest rate 23 times, against 35 movements registered by the Fed. Even more, between 1999 and 2005, the U.S. policy rate changes were twice as frequent as the Euro rates moves (respectively 30 against 15). And since average interest rate variations are not higher than the U.S. ones, the latters are logically more volatile than the formers. The fed funds rate variance is 4.5 times higher than the European repo rate. Can we deduce from this observation that the ECB is apathetic *per se*? More basically, where does this difference come from?

Roughly, an economy consists of three elements: 1) a structure (which represents the way the economy absorbs shocks and monetary policy impulses), 2) temporary shocks and 3) a monetary policy based on an interest rate rule. This rule reacts to economic variables (inflation rate and output gap) driven by the structure and temporary shocks. Thus, despite appearances, it is possible that the ECB is *per se* as activist as the Fed, and that the discrepancies observed ex post are due to radically different structural and cyclical contexts in both areas. It is the reason why J-C. Trichet[1] claims that '*activist is an attribute that applies to a strategy, not to a policy path*'. In his speech, J-C. Trichet asserts on the one hand that both areas are structurally similar[2] and on the other hand that the ECB and the Fed subscribe to the same monetary policy conduct. Certainly, he acknowledges the higher rigidity of the European economy, especially prices. But under cover of a credible monetary policy, the anchor of expectations and wages on the inflation objective of the ECB is so asserted that price stickiness does not imply too much inflation persistence. And finally, the ECB president concludes that the differences of interest rate evolutions between both areas are mainly explained by differences in shocks. The 2001 financial boom-bust cycle illustrates his assertion, inasmuch as this event led to a favourable demand shock in the United States (consumption and investment growth) instead of a negative supply shock (decrease of the TFP) in the euro area[3].

Precisely, the paper by Sahuc & Smets (2007) startlingly echoes those arguments. Indeed, they claim that the interest rate divergences are explained by differences in shocks, more than differences in structure or in monetary policy. Using a similar structural model estimated with U.S. and EA data, Smets & Wouters (2005) also conlude that both areas

[1]Conference about *'Activism and Alertness in Monetary Policy'* organised by the Bank of Spain on '*Central Banks in the 21st Century*', 8 June 2006.

[2]M. Trichet asserts that '*the half –life of the effect of a shock to inflation is considerably less than one year, which is close to the figure of USA*'. This argument is debatable as we will see latter.

[3]According to J-C. Trichet, '*The euro area seems to have had its fair share of stock market turbulence, without enjoying the side benefit of improved supply conditions*'.

are structurally similar. According to Christiano, Motto & Rostagno (2007), structural and cyclical differences could explain some divergences concerning the evolution of output and inflation. But since the ECB monetary policy rule implies more inertia than the U.S. one, these divergences do not turn up on interest rate paths.

Nevertheless, these contributions suffer from factual and methodological inconsistencies. First, it is difficult to admit that a young central bank, which is still establishing its credibility, and which is not always well understood (in particular at its beginning), benefits from an expectation channel that would be more obvious than in the United States. If, as asserted by Christiano et al. (2007), under cover of an inertial monetary policy and its subsequent expectation channel, the ECB needs not to move its rate as much as the Fed for the same results, why does the Fed endeavour to be so dynamic in comparison? Moreover, financing systems, labour markets, specializations, and price rigidities imply important disparities between the two areas, to such an extent that their structural proximity is hard to concede. Then, regarding shocks, the evolutions of consumption, investment and TFP are more endogenous than what is implicitly assumed in these analyses. Effectively, both areas lived the same financial boom-bust at the turning point of 2000. So, the differences will not result from the nature of shocks but rather from how each economy reacts to them. This draws the attention on the structural dissimularities only. Finally, given the institutional and historical points which differentiate them, the ECB and the Fed monetary policies are unlikely to be conducted similarly[4].

Turning to methodology, these last references rely on structural DGSE models. But despite some ad hoc accomodations (like backward looking price setting, capital adjustment costs, autoregressive shocks, etc...) they often do not duly consider the inertial behaviours of agents and then sluggishness of data (see Fuhrer (1997), Estrella & Fuhrer (2002)). The inertia ignored by these models is finally discharged in what is identified as 'shocks', with the risk to overestimate them if the economy is rigid. More basically, this models have not demonstrated their superiority in terms of shock identifications. Moreover, the conclusion of structural similarity muscles necessarily when the structure of both economies is identical and established *a priori*, while only the calibration is supposed to be different. In this respect, Smets & Wouters acknowledge: '*the more structure is imposed on the estimated model, the more the results will be coloured by the selected theoretical specification*'.

So, an alternative approach is desirable to fill this gap. Since imposing an *a priori* structure is likely to pervert the conclusions, it is interesting to use VAR models, which precisely get rid of this constraint. Indeed, they intend to 'let the data speak', with few structural preconceptions. Moreover these models duly consider the sluggishness of macroeconomic variables. In this respect, they are often used as reference for analyzing the dynamic of economies. We will then apply the method of counterfactual simulations to VAR models estimated for the euro area and the U.S.. This method consists in replacing successively the ECB monetary policy rule, the European shocks, and finally the European

[4] The Fed is explicitly mandated to take care of the output cycle (and not only to fight against inflation as it is the case in the EA). Besides, the composition of monetary policy committees and the way they come to a decision can induce more or less inertia. See for instance Gerlach-Kristen (2005). At least, the preference parameters of the monetary authorities' loss function should be different.

structure by their U.S. counterparts. The subsequent changes on interest rates will allow to reveal what are the essential sources of differences. The results of our simulations will be submitted to econometrical tests that we expect to be more rigorous than the mere graphical analyses used by the pre-cited articles.

The reminder of the paper is organized as follows. The first section aims at formally delivering the three sources of divergence between both areas (monetary policy, structures, shocks). The second section explains the characteristics of the VAR models estimated for both areas. Then we proceed to the counterfactual simulations, comparing successively the monetary policies (section 3), the shocks (section 4) and the structures (section 5) of the EA and the U.S.. We conclude that structures do explain the differences observed *ex post* between the ECB and the Fed interest rates paths. This result is finally discussed in section 6, where we seek to reveal the deep preference parameters of the Fed and to apply them to the ECB monetary policy framework.

1 What are the potential sources of divergence?

The aim of this section is to develop the idea formulated in introduction, according to which an economy can be reduced to four elements: a structure ($F(.)$), some temporary shocks (ε_X), a monetary policy (hereafter MP) governed by a rule ($f(.)$), and some monetary policy shocks (ε_i). Typically, the EA can be symbolized by the following system:

$$\begin{cases} X = \widehat{F}(X) + \varepsilon_X \\ i^{EA} = \widehat{f}(X) + \varepsilon_i^{EA} \end{cases}$$

with X a vector of n state variables ($\forall n$). Concretely, $\widehat{F}(.)$ is an estimated multidimensional function and ε_X the vector of the associated error terms. These errors, which correspond to the difference between the actual values and the values predicted by the estimated structure, represent by definition the shocks that hit this structure. Next, i^{EA} is the short-term interest rate, i.e. the MP instrument which depends, through an estimated MP rule $\hat{f}(.)$, on the state variables of the system. The difference between the actual interest rate and the estimated interest rate deduced from the rule constitutes the MP shocks (including the discretionary part of the MP), noted ε_i. In sum, the model variables (X et i^{EA}) are guided by a structure $\widehat{F}(.)$, temporary shocks, a MP rule $\hat{f}(.)$ and MP shocks (or 'surprises'). The U.S. can be represented following the same way:

$$\begin{cases} W = \widehat{G}(W) + \varepsilon_W \\ i^{US} = \widehat{g}(W) + \varepsilon_i^{US} \end{cases}$$

A priori, its structure $\widehat{G}(.)$, its shocks ε_W, its MP rule $\widehat{g}$ and / or its MP shocks ε_i^{US} are distinct from their counterparts of the EU system.

Thereby, we resort to counterfactual simulations to detect the main cause(s) of divergence. Concretely, successively substituing the EA structure, shocks, MP rule and MP shocks with their U.S. counterparts, we calculate pseudo European interest rates and test if they are significantly different from the actual rate or if they come closer to the actual U.S. rate. This implies four exams. Firstly, what would have happened if the ECB had followed the U.S. MP rule? (Would the EA interest rate be closer to the U.S. rate?) The response is given by the examination of the following simulated interest rate:

$$\tilde{i}^{EA} = \widehat{g}(X) + \varepsilon_i^{EA} \tag{1}$$

Secondly, what would be the EA interest rate if the European MP surprises had been similar to the american ones? Solution is given by:

$$\tilde{i}^{EA} = \widehat{f}\left(\widehat{X}\right) + \varepsilon_i^{US} \tag{2}$$

with $\widehat{X}$ the estimated endogenous of the European system, given that the European state variables can be decomposed as $X = \widehat{X} + \varepsilon_X$. Then, to determine to what extend the cyclical differences are likely to explain the observed divergences between actual U.S. and EA interest rates, ε_X has to be substituted with ε_W in the European system to deduce a pseudo interest rate as:

$$\tilde{i}^{EA} = \widehat{f}\left(\widehat{X} + \varepsilon_W\right) + \varepsilon_i^{EA} \tag{3}$$

In these cases, MP rules, MP shocks and structures remain proper to each area. Finally, a pseudo interest rate can be calculated, under the assumption that the EA structure correspounds to the U.S. one, everything else equal[5] :

$$\tilde{i}^{EA} = \widehat{f}\left(\widehat{W} + \varepsilon_X\right) + \varepsilon_i^{EA} \tag{4}$$

In the end, this method allows to identify which sources of divergence among the four contribute to explain the lower volatility of the European interest rate. Previously, it is necessary to explain the models used to implement the generic method exposed so far.

2 Modeling the euro area and the United States

In the light of the arguments presented in introduction, VAR models are particularly relevant in this problematic. They usually serve as reference models for stylized facts and they get away from DGSE models which are inadequately discriminant and sometimes empirically unsatisfying. Finally, in the perspective of counterfactual simulations, VAR models benefit from few theoretical preconceptions.

[5]Symetrically, the same exercice done with the US economy would lead to the examination of the respective following relations: $\tilde{i}^{US} = \widehat{f}(W) + \varepsilon_i^{US}$, $\tilde{i}^{US} = \widehat{g}\left(\widehat{W}\right) + \varepsilon_i^{EA}$, $\tilde{i}^{US} = \widehat{g}\left(\widehat{W} + \varepsilon_X\right) + \varepsilon_i^{EA}$, and $\tilde{i}^{US} = \widehat{g}\left(\widehat{X} + \varepsilon_W\right) + \varepsilon_i^{US}$.

2.1 Models, data and estimation

The VAR model of the EA can be written as follows:

$$X_t = A_1 X_{t-1} + \ldots + A_p X_{t-p} + BZ_{t-k} + \epsilon_t \quad (5)$$

with X a five-element vector composed of the long term -real interest rate ρ, the output gap y, the wage annual growth rate w, the inflation rate π and the short- term nominal interest rate i. For degrees of freedom purposes, VAR models require to be parsimonious in terms of variables. This is why we only consider the most important variables at stake in the monetary policy transmission mechanism. We also add the wage growth to capture the institutional and cyclical divergences often observed between the U.S. and EA labour markets (cf. Sahuc & Smets (2007), Christiano, Eichenbaum & Evans (2005*a*)). ϵ is the vector of innovations associated to the endogenous variables, i.e. $(\varepsilon_\rho, \varepsilon_y, \varepsilon_w, \varepsilon_\pi, \varepsilon_i)$, which respectively represent a shock on the long-term interest rate (or financial shock), a demand shock, a labour shock, a supply shock and a MP shock. As the equation defining the short-term interest rate (the last equation) is comparable to a MP rule, the shock ε_i stands for a temporary deviation to the rule, that is central bank discretionary decisions[6]. The vector $Z = (z_1, z_2; \ldots)'$ stands for commodity prices, exogenous variables in the VAR, insered in order to limit the price puzzle effect (with k depending on its informational contribution).

The U.S. VAR model includes the same variables. U.S. data stems from Datastream. All variables are seasonally adjusted. Exogeneous variable is the Goldman Sachs Commodity Prices Index. The EA data come from the AWM database (see Fagan, Henry & Mestre (2005)), updated in autumn 2006, up to the fourth quarter of 2005. These aggregated European data are seasonally adjusted with the standard X-11 seasonal adjustment method (via the X-11 procedure of SAS). For both areas, as the presence of a unit root can not be excluded for the real GDP series, the output gap is not calculated following an usual HP filter. Instead, it is defined as the residuals of the regression of the GDP on a constant and a quadratic trend. Short term and long-term interest rates respectively correspound to the 3-month monetary rate and the 10-year benchmark rate[7].

Estimations covers the 1985-2005 period. The p order of VAR models is determined with the parcimonious BIC criterion. Starting from this benchmark, VAR lags may be augmented if the disturbances do not follow a white noise process (then p is increased until the validation of white noise hypothesis). Finally, $p = 3$ for the EA and $p = 5$ for the U.S.. Table 10 in appendix reports the results of normality and white noise tests applied to disturbances series. In all cases, normality is accepted and serial correlation rejected.

[6] The backward looking feature of this MP rule can be justified by the unavailability of data in real time. See McCallum & Nelson (1999). Moreover, as it is shown by a lot of reaction function estimates, the past interest rate has to be added to the baseline Taylor rule for a good fitting, as $i_t = \beta_1 i_{t-1} + \beta_2 \widehat{\pi}_t + \beta_3 y_t$, with $\widehat{\pi}_t = (\pi_t - \bar{\pi})$. In this case, the MP rule can be written: $i_t = \beta_2 \sum_{n=0}^{\infty} \beta_1^n \widehat{\pi}_{t-n} + \beta_3 \sum_{n=0}^{\infty} \beta_1^n y_{t-n}$, where reference to the past is far from negligeable.

[7] Preliminary unit root tests (ADF) reject the unit root hypothesis. Studying the cointegration is then useless.

Once these statistical imperatives satisfied, impulse response functions (IRF) are generated[8] to assess the models dynamics (in the light of some well-known stylized facts) on one hand, and to establish a first focus on the differences between both areas on the other hand.

2.2 The main characteristics of the U.S. and EA models

Figure 2 represents the essential IRFs in the perspective of studying the transmission of shocks and MP impulses. As a whole, it actually describes the textbook MP transmission mechanism. In the euro area, the short-term interest rate has a positive effect on the long-term interest rate. Given the Cholesky decomposition, this link is not contemporaneous. In fact, if MP is credible, the long-term interest rate should anticipate the movement of the short-term rate. But whatever the decomposition, the autoregressive structure of the model makes it impossible to model, by definition. In sum, VAR models share the same deficiency with structural theoritical models concerning the spread term modelling. Be that as it may, the relation between both rates is positive and significant. Next, the long-term interest rate impacts the output gap negatively. In accordance with the expected transmission delay of MP, this influence is only significant after the 6th quarter following the initial shock on the long term interest rate. Then it appears that a positive output gap has a huge and positive incidence on inflation, to such an extend that a demand shock has still an influence on inflation after 15 quarters.

On the U.S. side, the standard monetary policy transmission mechanism is also revealed, but now with the short-term interest rate as main source (cf. fig. 2). Owing to institutionnal matter[9], the short-term interest rate is indeed more representative (than the long-term one) of the U.S. MP transmission channels. Strictly speaking, the real short-term interest rate should be considered. But expressed in real terms, the last equation of the U.S. VAR loses some of its reaction function meaning, which makes the counterfactual simulations more difficult. Certainly, IRF confirm the negative impact of the nominal short-term interest rate on the output gap, with a significant effect that begins one year after the shock and that is still effective 3 years latter. But the effect of the real short-term interest rate is also verified: the response of the output gap is then significantly negative from the 7th quarter and remains during the 6 following quarters. Finally, the output gap has a positive incidence on inflation (which is significant for the 3 years following the initial shock).

Regarding the link between inflation and wages (cf. fig. 3) in the EA, we can observe that an inflationary shock leads to an acceleration of wage growth, two quarters later (the time needed for wage contracts to be adjusted). In turn, wages have a positive influence on inflation (excepted the non-significant response of the inflation at the second quarter). In addition, an inflationary shock graphically leads to a non-significant output gap increase (cf. fig. 4). After the reaction of the monetary authorities, such a supply shock tends to

[8]IRFs are based on a Cholesky decomposition. Variables are declared following the order specified in (5).

[9]See section 5.2.

rather have a depressive impact (between the 7th and the 9th quarter). As expected, an output gap rise pushes wage growth forward, with high persistance.

The price/wage spiral is less obvious to interpret for the U.S.. While an inflation increase leads to a significant wage rise, the contrary is not true. Furthermore, an inflationary shock does not have any significant effect on the output gap; as in the EA case, the rigorous conduct of MP involves an output sacrifice three years after the supply shock (fig. 4). As expected, a positive demand shock accelerates the wage growth, but without the persistence previously observed for the EA. Note that despite the high inertia of some variables, the U.S. and EA models are stable[10]. So both models are well behaved and respect the usual econometrical requirements.

Finally, it is worth noting that counterfactual simulations rely on the assumption of structural invariance to monetary policy. So this exercice is a priori subject to the Lucas criticism. Nevertheless, while European economies experimented an unprecedented upset in January 1999, the estimated VAR relations are strikingly stable. Indeed, table 11 in appendix reproduces the results of the Hansen global stability test, applied to the five relations of the EA VAR model. The null hypothesis of joint stability of parameters and residual variance is always accepted. The conclusions of the Chow predictive test (with a break point in 1999:Q1) are similar at the 5% level. So, all the relations are stable over the estimation period. It is the case in particular for the monetary policy rule. Not only this result attenuates the practical thrust of the Lucas criticism, but it also allows to consider a common European monetary policy before 1999[11].

3 Comparing monetary policy rules

Are the difference in interest rate paths due to divergences of behaviour between the U.S. and the EA central banks?

3.1 What are the lessons learned from the models?

The U.S. and EA MP rules are easily assimilated to a Taylor rule, as it is shown by figure 5, where supply, demand and MP shocks are normalized to one for comparison purposes[12]. In the EA, the nominal short-term interest rate responds positively and gradually to a demand shock, with a hump-shaped profile. A one-point increase of the output gap leads to a one-point interest rate rise after 6 months, which reachs more than one point and a half after 6 quarters. Then European monetary authorities ease the monetary conditions, so gradually that the interest rate response remains significant after 15 quarters. A one-unit demand shock has more effect, both in terms of amplitude and length, in the EA interest rate than in the U.S. one. The latter raises progressively, up to reach a bit less

[10]Indeed, all the eigenvalues modulus associated to the companion matrix of the model are less then unity.

[11]In fact, convergence of national economies began in 1979 with the European Monetary System.

[12]In the other cases, initial shocks correspound to the standard deviation of the corresponding residuals.

than one point increase 6 quarters after the initial disturbance. But this response ceases to be significant after 10 quarters. In other words, the Fed's easing is more prompt, as if the U.S. authorities do not have to maintain a restrictive policy once the effects of the inflationary shock are ready to be curbed.

The response of the interest rate to a supply shock is quite similar in the two areas: a one-point increase of the inflation rate involves a gradual rise of interest rates (more than 1.2 points from one year). The easing is likewise gradual. The whole effect is absorbed after two years and a half.

Lastly, a MP shock induces an immediate surge of the European short-term interest rate, as would be the case with a more traditional augmented Taylor rule following an AR(2) partial adjustment process, and with a first autocorrelation coefficient greater than one[13]. As a second step, the interest rate converges overly gradually toward its equilibrium (still significant after 3 years), following a sine curve. Certainly, this over-reaction is also evident for the U.S.. But the U.S. interest rate converges more rapidly to the equilibrium. Indeed, its response is no longer significant after 10 quarters, whereas it is still after 15 quarters in the EA.

Table 1 dispays a measure of the adjustment speed of interest rate, defined as the share of its response after 6-months, one-year and two-years of its long-run effect[14]. The table clearly indicates that the european MP confronted with a demand shock induces a slower reaction than the U.S. policy. Whereas the European interest rate completes only 4.8% of its total evolution 6 months after the initial shock, the U.S. rate reachs 16% of its total adjustment. As a whole, the speed of convergence of the EA interest rate is three times lower during the first two years. So much that two years latter, the U.S. interest rate has almost reached its initial equilibrium, whereas the EA interest rate has only completed one third of its total adjustment. The EA interest rate persistence is equally outstanding in the case of discretionary MP shock. The U.S. interest rate evolves with a relative advance of about one to two years. Concretely, one year (two years) after the initial disturbance, the response of the EA interest rate stands for only 24% (36%) of its long term effects, against 54% (80%) for the U.S.. On the other hand, responses to supply shocks exhibit analogous convergence delays.

Figure 7 represents the estimated U.S. and EA interest rates and their respective MP shocks. Clearly, it suggests that the possible difference between actual interest rate paths can not be explained by differences about dicretionary stance. Indeed, table 9 confirms that this MP disturbances have the same variance in both areas[15]. Therefore, it is more relevant to focus on the difference of MP rules, instead of discretionary decisions, to find an explanation of the difference of interest rate variances.

[13]See for instance the Fed's reaction function estimated by Clarida, Gali & Gertler (1998).

[14]Noting $\phi_{ij,t}$ the dynamic multiplier deriving from the VMA representation of a VAR model, it represents the effect of an innovation ε_j occurring at date t on the i^{th} variable, observed in $t+m$. The measure of adjustment delay of the i^{th} variable submitted to an idiosyncratic shock is then given by : $\sum_{t=0}^{m} |\phi_{ij,t}| / \sum_{t=0}^{\infty} |\phi_{ij,t}|$ with $i=j$ and $m=\{2,4,8\}$ quarters. For the denominator, the sum stops when $\phi_{ii,t}$ is no longer significant.

[15]Moreover, table 3 points out that these series are correlated.

Reponse of interest rate	euro area 6 months	euro area 1 Year	euro area 2 Years	United States 6 months	United States 1 Year	United States 2 Years
to a shock on inflation	22%	40%	76%	22%	42%	75%
to a shock on the output gap	4.8%	12%	30%	16%	41%	92%
to an idiosyncratic shock	16%	24%	36%	37%	54%	80%

Table 1: Speed of adjustment of the Interest rate

3.2 Counterfactual exercice on policy rules

In accordance with (1), we determine what would have been the EA interest rate if the European monetary authorities had followed the Fed's rule during the 1999-2005 period. As a whole, the results exhibited in table 2 lead to accept the equivalence of the EA and the U.S. MP rules in terms of interest rate volatility. There is only one ambiguity concerning the variance equality of the actual and the simulated (under European MP rule hypothesis) U.S. interest rate: equality is accepted at the 5% but rejected at the 10% level. Nevertheless, even if we conclude that the U.S. interest rate would have been less volatile with the EA MP rule, such a transposition does not enable the U.S. rate to come closer to the EA rate. Indeed, equality between the simulated U.S. rate and the EU rate is rejected. So MP rule differences do not explain the divergences of interest rate paths. If the European monetary authorities had followed the Fed's rule, they would not have appeared as more 'reactive'.

To be exhaustive about MP, we examine the differences due to MP shocks, according to (2). Logically, given the mean and variance equalities of these disturbances, the second part of table 2 indicates that the discretionary stance of monetary policies do not explain the observed divergence of interest rate paths. Consequently, if the U.S. and EA interest rates remain different despite analogous MP rules and MP shocks, the reasons for actual divergences are of structural and/or cyclical order(s).

4 Comparing Shocks

Is the larger inertia of the European monetary policy due to smaller and less frequent shocks? Figure 8 displays the shock series (supply, demand, labor, monetary policy) and their variance[16] over 1999-2005. Firstly, table 3 shows the correlations between the shocks of each area. It confirms the well known resultat that long-term interest rates are correlated, mainly because of international financial spillovers. Interestingly, we find that the financial globalization makes this correlation even higher for the last sub-period. Supply shocks are also strongly correlated, especially for the end of the period. Therefore, demand and labor shocks are the only potential explanation for different monetary policy stances[17].

[16] The persistence of shocks is not relevent in that matter since they are white noises.
[17] Cross correlations do not modify this conclusion.

euro area with the Fed Monetary Policy Rule		
1999:1 - 2005:4	Variance	Variance Equality
Actual EA interest rate	0.92	YES
Simulated EA interest rate	0.90	(SL=0.47)
U.S. with the EA Monetary Policy Rule		
	Variance	Variance Equality
Actual U.S. interest rate	3.72	YES / NO
Simulated U.S. interest rate	2.11	(SL=0.07)
Actual EA interest rate	0.92	NO
Simulated U.S. interest rate	2.11	(SL=0.01)
euro area with the Fed Monetary Policy Shocks		
	Variance	Variance Equality
Actual EA interest rate	0.92	YES
Simulated EA interest rate	0.69	(SL=0.22)
U.S. with the EA Monetary Policy Shocks		
	Variance	Variance Equality
Actual U.S. interest rate	3.72	YES
Simulated U.S. interest rate	3.99	(SL=0.42)

Table 2: Tests on counterfactual interest rate series - Monetary Policy scenarios

Corr.	$\left(\varepsilon^{EA}_{\rho,t};\varepsilon^{US}_{\rho,t}\right)$	$\left(\varepsilon^{EA}_{y,t};\varepsilon^{US}_{y,t}\right)$	$\left(\varepsilon^{EA}_{w,t};\varepsilon^{US}_{w,t}\right)$	$\left(\varepsilon^{EA}_{\pi,t};\varepsilon^{US}_{\pi,t}\right)$	$\left(\varepsilon^{EA}_{i,t};\varepsilon^{US}_{i,t}\right)$
1985-2005	0.25**	0.14	0.08	0.47****	0.17
1999-2005	0.36**	0.19	0.12	0.56***	0.31

*, ** : Rejection of the independence hypothesis at respectively 1 and 5% level.

Table 3: Correlation coefficients between historical shocks

Then historical decomposition enables to determine to what extent these shocks impact prices, the output gap, wages and interest rates. Graph 9 gives some details about the results for the 1999-2005 period. Each panel indicates the direction and the magnitude the shocks have on the endogeneous variable. In the two regions, the output gap is mainly affected by demand shocks. However, these latter lead to a lower output gap in the U.S. but higher in the euro area early 2000's. Conversely, the European output gap recently underwent adverse demand shocks while the U.S. output gap is positively affected by positive demand shocks. If we sort the other shocks by growing importance, we find labor shocks in the eurozone while they have virtually no effect in the U.S., where supply shocks are an important factor of output gap changes.

Similarly, wages are strongly impacted by demand shocks in the U.S.. As expected, positive demand shocks raise wages and vice versa. Labour shocks are the second determinant of unexpected wage changes. Demand shocks also have a strong influence on wages in the eurosystem but to a lesser extent than labour shocks.

Between 1999 and 2005, demand shocks were the main determinants of higher inflationary pressures in the euro area as already mentionned by Christiano, Motto & Rostagno (2005*b*). But this effect was mitigated by labour shocks, as a result of all European reforms (to a more flexible labour market). Their very irregular contribtution of supply shocks also accounts for their weakness. Conversely, supply shocks (associated with demand shocks) in the U.S. are a major source of inflation changes. But in the 2000's, those two shocks had opposite effects and contributed to improve inflation stability. Labour shocks also played an important role, especially by lowering inflation at the end of the period.

Finally, supply and demand shocks are the main determinants of U.S. interest rates as expected in a Taylor rule framework. Since negative demand shocks cut output gap, inflation and wages between 2001 and 2004, there is no surprise that they also have a negative impact on the interest rate. Similarly, negative supply shocks tended to moderate the increase in interest rates. Demand shocks are also important to explain interest rate changes in the euro area (with a positive influence especially in the early 2000's). But supply shocks (except labour shocks) do not mitigate this impact because of their very small magnitude. This result fits with ECB's press releases which very mention labour market evolutions. The Fed does not seem to pay so much attention to labour market. In all cases, shocks or monetary surprises have a very small impact on endogeneous variables.

To sum up, it is hard to admitt that shocks are of the same nature in the two regions. And even if they are, they have opposite effects. We observed no coincidence between the contributions of each shocks for any endogeneous variables. On this issue, we share Sahuc & Smets (2007)'s conclusions and Trichet (2006)'s statements.

But still, such a difference can not explain the smaller volatility of the European interest rate. European shocks should be smaller or less volatile. And it is not the case according to variance equality tests reported in table 4. In accordance with figure 8, this table indicates that shocks on long-term interest rates, on inflation and on labor market[18] are significantly larger in the eurozone. Only demand shocks are slightly higher in the U.S. over 1999-2005, as already shown by Sahuc & Smets (2007)[19]. Figure 8 however gives little evidence of a shock being favorable or not for a region. And obviously, these differences do not justify a stronger interest rate inertia (that is even the opposite). Eventually, as already mentionned table 9, only the equality of variances can not be rejected.

[18]The magnitude of labour market shocks in Europe can be explained by the adjustements made in reaction to structural reforms. Since the early 1990's, all Europan countries have been promoting reforms aiming at reducing the labor costs of low-skilled jobs, increasing the labor supply with tax credits, reducing the legislation on employment protection, revising the conditions for unemployement benefits, changing the legislation on length of work, the centralization level of wage negociations and the minimum wage, not to mention the reforms on the pension system. Meanwhile, the U.S. experienced almost no reforms except the implementation of the Earned Income Tax Credit and a higher age before having irght to pension benefits in 2002.

[19]Howerver we do not share Smets & Wouters (2005) conclusion: while they state that the euro area was more affected by negative supply shocks, the shocks we show here have the same variance in the two regions.

	$\frac{Var\left(\varepsilon_{\rho,t}^{EA}\right)}{Var\left(\varepsilon_{\rho,t}^{US}\right)}$	$\frac{Var\left(\varepsilon_{y,t}^{US}\right)}{Var\left(\varepsilon_{y,t}^{EA}\right)}$	$\frac{Var\left(\varepsilon_{w,t}^{EA}\right)}{Var\left(\varepsilon_{w,t}^{US}\right)}$	$\frac{Var\left(\varepsilon_{\pi,t}^{EA}\right)}{Var\left(\varepsilon_{\pi,t}^{US}\right)}$	$\frac{Var\left(\varepsilon_{i,t}^{EA}\right)}{Var\left(\varepsilon_{i,t}^{US}\right)}$
1985-2005	$3,53^{***}$	1.15	7.26^{***}	4.74^{****}	1.59^{*}
1999-2005	6.61^{***}	1.61^{*}	4.24^{***}	6.21^{***}	$(a)1.23$

*, **, *** : Rejection of the null hypothesis of variance equality at respectively 10, 5 and 1% level. (a) corresponds to $V\left(\varepsilon_{i,t}^{US}\right)/V\left(\varepsilon_{i,t}^{EA}\right)$.

Table 4: Tests of Variance equality

The shock series should not be able to explain the differences in interest rate volatility between the two regions. The results of conterfactual simulations based on equation (3), summarized in table 5, confirm these results. If European shocks would have been equal to U.S. ones, the European interest rate would have not be different of its actual value. Besides, we find that the U.S. interest rate would have been even more volatile if they had been determined by the same shocks as in Europe. Everything happens as if the U.S. was more sensitive to shocks than the euro area. Both regions do not similarly respond to shocks. So the interest rate differencial must stem from structural differences.

euro Area with the U.S. Shocks		
1999:1 - 2005:4	Variance	Variance Equality
Actual EA interest rate	0.92	YES
Simulated EA interest rate	1.21	(SL=0.24)
U.S. with the EA Shocks		
1999:1 - 2005:4	Variance	Variance Equality
Actual U.S. interest rate	3.72	NO
Simulated U.S. interest rate	18.8	(SL=0.00)

Table 5: Tests on counterfactual interest rate series - Shocks scenario

5 Comparing economic structures

5.1 Counterfactual exercice on economic structures

Firstly, figure 6 enables to compare the inertia degree of the two regions through the responses of real variables to idiosyncratic shocks. Table 6 offers a measure of this adjustment speed.

In the euro area, subsequently to a cost-push supply shock, inflation returns to the equilibrium level (or has no more significant fluctuations) after seven quarters. As shown in table 6, the inflation dynamics is more viscous in the short run in the euro area than in the U.S.. A shock on the European labor market has a strongly persistent effect on wages.

Reponse of	euro Area 6 months	1 Year	2 Years	United States 6 months	1 Year	2 Years
π to a shock on π	62%	81%	100%	49%	79%	100%
y to a shock on y	24%	43%	72%	35%	57%	75%
w to a shock on w	27%	36%	54%	53%	65%	80%

Table 6: Speed of adjustment of inflation (π), output gap (y) and wages (w)

It takes about two years for the wage impulse function to be cut by half in the Euroland. The wage growth is the most viscous variable of the system. Conversely, such a shock is quickly absorbed by the U.S. labor market (where more than half of the total effect is absorbed in the first six months, compared to only a fourth in the euro area). Finally, in the short run (until two years), the output gap has a weaker persistence in the euro area (24% of the total effect is reached within six months and 43% after a year) than in the U.S. (respectively 35 and 57%).

The counterfactual experience consists in simulating an European interest rate between 1995 and 2005 if, everything else equals, the European structure had been equal to the U.S. one (see relation (4)). Results are given in table 7. First, the European interest rate has a significantly higher variance under the U.S. structure than the effective European rate (3.68 against 0.92). The variance equality test even shows that the simulated European interest rate is statistically equivalent to the U.S. one (the null hypothesis of variance equality is accepted with 22% p-value). European inflation and output gap would also be more volatile if U.S. and European structures would match. The same results emerge in the U.S. case: the simulated interest rate with the European structure has a significantly lower variance than the effective rate (1.5 against 3.72). Furthermore, the variance equality between this simulated rate and the European effective rate is accepted (the p-value is equal to 10%). Finally, with the European structure, the variances of the U.S. output gap and inflation are significantly lower.

Therefore, differences in structure explain a large part of the differences in interest rate volatilities between the two regions. This result is in contradiction with previous studies. And yet, although the euro area itself is made of countries with quite dissimilar structures, it is not difficult to show that it differs from the United States if we consider the structure of financial and production sector, the price rigidity and the labor market.

5.2 Some key features about structural divergences

First, table 12 gives an insight on differences in financing structure. Direct financing is prevalent in the U.S. where the ratio of outstanding debt securities to GDP is four to five times higher than in the Eurosystem. European private bond outstandings hardly represent 2% of total financing of private companies but 25% of the GDP in the U.S. Another evidence lies in the market capitalisation which is twice as high as in the U.S..

euro area with the U.S. Structure		
1999:1 - 2005:4	Variance	Variance Equality
Actual EA interest rate	0.92	NO
Simulated EA interest rate	3.68	(SL=0.05)
	Variance	Variance Equality
Actual EA output gap	1.02	NO
Simulated EA output gap	9.45	(SL=0.00)
	Variance	Variance Equality
Actual EA inflation	0.76	NO
Simulated EA inflation	3.99	(SL=0.00)
Simulated EA output gap	9.45	(SL=0.00)
	Variance	Variance Equality
Actual U.S. interest rate	3.72	YES
Simulated EA interest rate	3.68	(SL=0.00)
U.S. with the EA Structure		
	Variance	Variance Equality
Actual U.S. interest rate	3.72	NO
Simulated U.S. interest rate	1.50	(SL=0.00)
	Variance	Variance Equality
Actual U.S. output gap	2.91	NO
Simulated U.S. output gap	0.76	(SL=0.00)
	Variance	Variance Equality
Actual U.S. inflation	0.53	NO
Simulated U.S. inflation	0.25	(SL=0.02)
	Variance	Variance Equality
Actual EA interest rate	0.92	YES
Simulated U.S. interest rate	1.50	(SL=0.10)

Table 7: Tests on counterfactual interest rate series - Structural scenario

European companies resort to indirect financing more frequently. Bank loans represent 42.6% of GDP in Europe and only 9.6% in the U.S. The importance of banks can be illustrated by the ratio of bank assets to GDP which is three times higher in Europe. One can count 0.55 bank branch for 1000 inhabitants in Europe and only 0.29 in the U.S. Also, the European banking system is caracterized by weak local competition and cross subsidies between services that prevent specialized companies to offer competitive services. Besides the euro area has a higher proportion of small companies that are particularly exposed to changing credit conditions (see last part of table 12). The U.S. is caracterized by a high proportion of variable interest rate loans and refinancing operations are more frequent, up to three fourth of new loans (Sellon (2002)). Conversely, in the euro area, loans are mainly based on fixed interest rates (except in Spain, Portugal and Finland). Besides, a large part of household savings and banks' resources are made of regulated vehicles whose returns do not necessarily follow the money market interest rates.

These differences must have an impact on monetary policy transmission mechanisms. The easier substitution between corporate financings and the more frequent changes of credit conditions make the transmission of monetary impulses faster in the U.S. Finally, because of the differences described above, the monetary policy is supposed to have a stronger influence on investment (through the credit chanel) in Europe but on consumption in the U.S. where the household indebtness has reached an unprecedent level (74% on average over 1985-2005) and where credit conditions can be easily renegociated.

The production structures are also very different, as shown by table 13. According to the computations of output gaps, potential growth tends to incrase in the U.S. (from 3.03% to 3.15% between 1990 and 2005) while it slowed down in Europe from 2.53 to 1.70%[20]. R&D investments offer an explanation for such differences since they represent a much lower share of GDP in Europe even we take into account R&D from public sector. Noteworthy, U.S. companies hire more researchers than European ones by a factor from 2 to 6. Obviously, this has an impact on innovation and production capabilities of firms. There is therefore no surprise that the diversification of high-tech exports is stronger in the U.S. than France, Italy and Germany. The last rows of table 13 indicate that European businesses have a slower development path: four years after its creation, the number of employees in a U.S. company has more than doubled. In France, Germany and Italy, the growth is more modest and does not exceed 30%. Furthermore, the gap keeps on widening after seven years. More generally, in accordance with a *liberal market economy* (LMEs) in the sense of Hall & Soskice (2001), the United States is characterized by a non-regulated product market. At the opposite, continental European countries, classified as *coordinated market economies* (CMEs), are more regulated. This implies less competitive pressures, and makes these economies less reactive to shocks (Nicoletti, Scarpetta & Boylaud (2000)). Consequently, supply inertia is certainly higher in Europe.

Price settings - an other important issue for monetary policy - also differ between the two regions. Table 14 gives Alvarez & Al. (2005)'s results in a micro-founded analysis framework. On average, only 15% of prices are revised each month in Europe against 25% in the U.S. A price remains constant for four to five quarters in Europe whereas only two in the U.S. Beyond that, the euro area is characterized by a susbtantial degree of heterogenity in the frequency of price changes across products: 95% of products keep the same price for one to thirty-two months in Europe, compared to one to twenty-two in the U.S.[21]. Whatever the product category considered, prices are far more inertial in Europe than in the U.S. Like Gali, Gertler & Lopez-Salido (2001)'s results on Phillips curve, macroeconomic models must reflect this stronger inertia of European prices. Note that this is precisely what is shown for the short term in table 6.

Differences on labor market are even more obvious. Table 15 shows that the employment and activity rates is 10% higher on average in the U.S. than in Europe. Labor force and

[20] OFCE (2006) finds exactly the same numbers.

[21] See Bils & Klenow (2004) for the U.S.

labor productivity growths are also higher in the U.S.. Furthermore, the unemployment rate reaches 9% on average in Europe over 1985-2005 but only 5.8% in the U.S. Whereas the U.S. unemployment rate is close to the NAIRU (5.6%), the European one is rather far (7.7%). European inflation is then less exposed to labor market pressures. Nevertheless, focusing on institutional features, one notes that the unionization rate and the proportion of employees under a collective agreement are higher on average in Europe. Following the updated classification[22] of the very influent contribution by Calmfors & Driffill (1988), some European coutries have a centralized wage bargainning system (Austria, Belgium, Finland) while Ireland is fairly centralized and all others are *intermediaries economies* (bargainning is made by industries). Both for the coordination between employer association and trade unions, and the weight of trade unions, the U.S. has a decentralized wage setting (mainly at the level of individual firms). According to Calmfors & Driffill (1988)'s conclusions, a decentralized wage setting (as in the U.S.) leads to more restrained wages because if the wage bargainning takes place at the firm level, the competition and some other subsitute products reduce the incitation for the company to transfer wage increases into higher prices. Then, trade unions internalize that employment is the only adjustment variable. Conversely, in an intermediate system (as in Europe), increases in wages can be more easily transmitted to prices since all prices of a same industry are concerned (competition plays no role). Thus, in the euro area, the market power of trade unions exists but their concentration is too weak for the inflation risk to be internalized in their objectives and claims. Finally, firing procedures and costs are very low in the U.S. and represent no constraints when compared with European standards (see last part of table 15). Thus, generally speaking, wage bargainning, the degree of employment protection, the size of replacement incomes and economic policies have very little in common between the two regions. It is therefore obvious that rigidity factors are more important on the European labor market (Siebert (1997)).

While the CME/LME classification is somewhat restrictive for several intermediate countries (like the Netherland and Ireland for instance), it is likely to characterize the differences of interest rate movements between the EA and the U.S.. This overview strengthens the conclusions of the counterfactual simulations.

6 Assessment and exercice on central banks preferences

Figure 10 represents the interest rate paths implied by the various scenarios considered. It is clear that the difference of interest volatility between the U.S. and the EA is mainly explained by differences of structures. The scenario in which European monetary authorities conduct their policy with the U.S. structures (everything else being equal) is the only case in which the variance of the European interest rate is comparable to the variance of the

[22]See OECD (1997).

U.S. rate[23]. On the contrary, the differences between the simulated and the actual interest rates are not significant in average when shocks or monetary policy rules are switched.

Assuming that central banks behave optimally, it can be theoretically demonstrated that their (estimated) monetary policy rule responds to the optimization of an objective function, subject to a given structural model and variance of shocks. Accordingly, it is not because monetary policy rules can not explain the difference in volatility that European and U.S. central banks have the same policy preferences. Constraints are not the same, in particular concerning the economic structures, as we have seen. In this way, the last exercice consists in determining the preference parameters of policymakers. This task is difficult to conceive for the euro area, as monetary policy was firstly national (how aggregating the national preference parameters?) then commonly conducted (on a consensus basis), whereas the model is estimated for the 1985-2005 period. On the other hand, it is possible to reveal the deep preference parameters of the Fed, then to apply them to the Euroland to determine the implied optimal monetary policy rule. Would the European interest rate be more volatile?

The following method is implemented. We assume the Fed had to minimize the following usual quadratic loss function for objective, where λ_y and λ_i represent respectively the preference parameter for output and interest rate variabilities:

$$Loss_t = \lambda_y Var(y_t) + (1 - \lambda_y) Var(\pi_t) + \lambda_i Var(i_t - i_{t-1}) \tag{6}$$

subject to a given structural model $Z_t = \Phi Z_{t-1} + U_t$, a variance-covariance matrix M associated to the innovation vector U, and a monetary policy rule $i_t = f(X)$. It can be demonstrated, following Svensson (1998) and Ball (1997) that the unconditional contemporaneous covariance matrix of Z, noted V is given in vector form by:

$$Vec(V) = [I - \Phi \otimes \Phi]^{-1} Vec(M) \tag{7}$$

So, the optimal monetary policy rule is given by the parameters of the vector f that minimize the weighted sum - based on the given preference parameters (λ_y, λ_i) - of the unconditional variances for the inflation rate, the output gap and the interest rate. These variances appear in $Vec(V)$, following (7).

This robust method can be used to reveal the U.S. preference parameters. To make the algorithm optimisation tractable, we reduce the previous U.S. model to three main variables: interest rate, inflation and output gap. This also allows to concentrate on the main usual targets of monetary policy rules. We note $\hat{i}$ the interest rate deduced from the U.S. estimated monetary policy rule (monetary policy shocks are ruled out). The effective preference parameters of the Fed, $(\lambda_y^*, \lambda_i^*)$, are those that allow to determine a monetary policy rule yielding an 'optimal' interest rate $\hat{i}^*$ which is the nearest to the estimated rate $\hat{i}$. The optimization program is then given by:

[23] In this case, the difference of level is in large part explained by the higher U.S. initial conditions used to start the simulation.

$$\begin{cases} \underset{\{\lambda_y,\lambda_i\}}{\text{Min}} \text{ distance} = \sum_{t=0}^{N} \left[\hat{i}_t^* \left(\lambda_y, \lambda_i\right) - \hat{i}_t\right]^2 \\ \text{with } \hat{i}_t^* = f^* Z \text{ such as } \underset{\{f^*\}}{\text{Min}} L = \lambda_y Var(y_t) + (1-\lambda_y) Var(\pi_t) + \lambda_i Var(\Delta i_t) \\ \text{with } Z_t = \Phi[f(\lambda_y, \lambda_i)] + U_t \text{ and } Z = [y_{t-1} \dots y_{t-5}, \pi_{t-1} \dots \pi_{t-5}, i_{t-1} \dots i_{t-5}] \end{cases}$$

Results are $\lambda_y = 0.42$ and $\lambda_i = 5.6$. These preference parameters generate an optimal monetary policy rule with an interest rate path that fits very well the estimated interest rate, as it is shown by figure 11 (distance=11.62). This result is consistent. On the one hand, the Fed has an explicit objective of output stabilization (while inflation stability is its main objective). On the other hand, a high value of λ_i is required to reproduce the interest rate inertia (Dennis (2001)). When these parameters are applied to the euro area, they generate an optimal interest rate path which is more volatile than it is in fact, as shown by figure 12. This is clearly confirmed by the variance equality tests in table 8.

1985:1 - 2005:4	Variance	Variance Equality
Estimated EA interest rate	8.88	NO
Optimized EA interest rate with U.S. preferences	26.54	(SL=0.00)
1999:1 - 2005:4	Variance	Variance Equality
Estimated EA interest rate	1.08	NO
Optimized EA interest rate with U.S. preferences	4.25	(SL=0.00)

Table 8: Tests on counterfactual interest rate series - Preference scenario

In fact, the European Policy would require a higher λ_i. This result can be interpreted twofold. Either it means that the European MP authorities are very cautious, in the sense they display a high preference for interest rate smoothing. This behaviour can be justified in the light of Brainard's arguments, because of the large uncertainty that surrounds the total effects of a common European monetary policy. Or, following Woodford (2003, chap. 6), it can be demonstrated that a loss function like (6) can be derived from the discounted sum of utility of a representative household. In this cas, parameters (λ_i, λ_y) do not represent the monetary authorities' preferences *per se* but convolutions implying some structural parameters of the underlying model. In this case, this result means that the difference of volatility between the U.S. and the EA interest rates is explained by structural divergences, what strengthens our conclusions.

Conclusion

Given the dissimilar variances of the European and U.S. interest rate, the ECB is often blamed for not being reactive enough in comparison with the Fed. But such a hasty appraisal forgets that monetary policy must be evaluated in its context, i.e. considering both the economic structures and the cyclical shocks. In this prospect, several studies searched to explain the reasons of such an apparent difference of reactivity. As a whole, they conclude that the cyclical shocks are mainly responsible. Beyond that, monetary policies and, more surprising, economic structures would be the same in both areas. But these conclusions are specious as they a priori assume that the U.S. and EA models are structurally identical, except the calibration.

So, in this paper, we analyse the reason why the ECB is comparatively and apparently passive, in the light of a VAR model, which precisely exempts from imposing theoretical structures a priori. Counterfactual simulations confirm that differences implied by monetary policy rules alone can not explain the dissimilarity of interest rates paths. In the same way, while cyclical shocks are different in each area, they do not suffice to explain the factual divergence. Finally, it is the structural dissimilarities which essentially explain the difference of interest rate variances. In line with the distinction widely agreed between liberal market economies and coordinated liberal economies, we explain the main structural features that render the EA more rigid than the U.S.. Institutionnal divergences appear so obvious that it would be difficult to assert that both economies share the same structures. This conclusion is corroborated by an ultimate exercice which consists in revealing the deep preference parameters of Fed's loss function, and then applying them to the European monetary policy. We demonstrate that with such preferences, the European interest rate would be more volatile. This can lead to think that the European monetary authorities are more cautious and more prone to interest rate smoothing than the American authorities. But in a welfare perspective of utility-based loss function, this result tends rather to confirm the structural divergences between both areas. In sum, a less reactive Central Bank is not necessarily an institution which is not prompt to act, nor *per se* an apathetic Central Bank. This means in this precise case that the ECB conducts the monetary policy of an inertial economy, which is not very sensitive to shocks.

Certainly, this exercice is a priori subject to the Lucas criticism. However, according to stability tests, parameters of the estimated models are stable over the 1985-2005 period, despite the transition from national monetary policies to a common one. Statistically, the turning point of 1999 is not a significant break point. This result agrees with the reserves of numerous studies which, without reviewing its theoretical logic, attenuate the practical significance of the Lucas criticism (cf. Altissimo, Sieviero & Terlizzese (2002), Estrella & Fuhrer (1999)). Moreover, the latter is here dampened by the uncertainty surrounding the ECB implementation and policy. Around 1999, economic agents were not able to formulate well-founded expectations about the European monetary policy. As a result, their attitude had probably not be different if the ECB chose to follow the Fed's rule for instance. As a whole, in this first time of ECB exercice, uncertainty (about monetary policy, structures and shocks), observation and learning would have be the same whatever the monetary policy rule.

Regarding existing research based on DGSE models, our conclusions plead for duly taking account for these structural and more generally this institutionnal differences in the modelling of U.S. and EA. Modelling both areas the same way, with only different calibration, as it is widelly done today is not satisfactory. Otherwise it comes to disregard their own institutionnal and structural particularities.

References

Altissimo, F., Sieviero, S. & Terlizzese, D. (2002), 'How Deep are the Deep Parameters?', *Annales d'Economie et de Statistiques* **67-68**, 207–226.

Álvarez, L., Dhyne, E., Hoeberichts, M., Kwapil, C., Le Bihan, H., Lünnemann, P., Martins, F., Sabbatini, R., Stahl, H., Vermeulen, P. & Vilmunen, J. (2005), 'Sticky prices in the euro area: a summary of new micro evidence', *ECB Working Papers* **563**.

Ball, L. (1997), 'Efficient Rules for Monetary Policy', *NBER Working Paper* **5952**.

Bils, M. & Klenow, P. (2004), 'Some Evidence on the Importance of Sticky Prices', *Journal of Political Economy* **112**, 947–985.

Calmfors, L. & Driffill, J. (1988), 'Bargaining Structure, Corporatism and Macroeconomic Performance', *Economic Policy* **6**, 14–61.

Christiano, L., Eichenbaum, M. & Evans, C. (2005*a*), 'Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy', *Journal of Political Economy* **113**(1), 1–45.

Christiano, L., Motto, R. & Rostagno, M. (2005*b*), 'A Model for Analysis of Monetary Policy in the US and the Euro Area', *mimeo* .

Christiano, L., Motto, R. & Rostagno, M. (2007), 'Shocks, Structures or Policies? A comparison of the EA and the US', *Journal of Economic Dynamics and Control* **forthcoming**.

Clarida, R., Gali, J. & Gertler, M. (1998), 'Monetary Policy Rules in Practice: Some International Evidence', *European Economic Review* **42**, 1033–1068.

Dennis, R. (2001), 'The Policy Preferences of the U.S. Federal Reserve', *Federal Reserve Bank of San Francisco, Working Paper in Applied Economic Theory* **2001-08, Revised July 2004**.

Ehrmann, M., Gambacorta, L., Martinez-Pagés, J., Sevestre, P. & Worms, A. (2002), 'Financial System and the Role of Banks in Monetary Policy Transmission in the Euro Area', *ECB Working Papers* **93**.

Estrella, A. & Fuhrer, J. (1999), 'Are Deep Parameters Stable? The Lucas Critique as an Empirical Hypothesis', *Federal Reserve Bank of Boston, Working Paper* **98-5**.

Estrella, A. & Fuhrer, J. (2002), 'Dynamic Inconsistencies : Counterfactual Implications of a Class of Rational Expectations Models', *American Economic Review* **92**(4), 1013–28.

Fagan, G., Henry, J. & Mestre, R. (2005), 'An Area-Wide Model (AWM) for the Euro Area', *Economic Modelling* **22**, 39–59.

Fuhrer, J. (1997), 'The (Un)Importance of Forward-Looking Behavior in Price Setting', *Journal of Money, Credit and Banking* **29**, 338–50.

Gali, J., Gertler, M. & Lopez-Salido, D. (2001), 'European Inflation Dynamics', *European Economic Review* **45**(7), 1237–1270.

Gerlach-Kristen, P. (2005), 'Too Little, Too Late: Interest Rate Setting And The Cost of Consensus', *Economics Letters* **88**, 376–381.

Hall, P. & Soskice, D. (2001), *Varieties of Capitalism: The Institutionnal Foundations of Comparative Advantage*, Oxford University Press, (dir).

Kashyap, A. & Stein, J. (1997), 'The Role of Banks in Monetary Policy: A Survey with Implications for the European Monetary Union', *Economic Perspectives* **21**(5), 2–18.

McCallum, B. & Nelson, E. (1999), *Monetary Policy Rules*, J-B. Taylor (eds), University of Chicago Press, Chicago, chapter Performance of Operational Policy Rules in an Estimated Semi-Classical Structural Model, pp. 15–45.

Nicoletti, G., Scarpetta, S. & Boylaud, O. (2000), 'Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation', *OECD Working Paper* **226**.

OECD (1997), Economic Performance and the Structure of Collective Bargaining, *in* 'Employment Outlook', chapter 3, pp. 70–100.

OFCE (2006), 'Croissance sans châtiment, perspectives 2006-2007 pour l'économie mondiale', *Revue de l'OFCE* **97**, 13–31.

Sahuc, J. & Smets, F. (2007), 'Differences in Interest Rate Policy at the ECB and the Fed: An Investigation with a Medium-Scale DSGE Model', *Journal of Money, Credit and Banking, Forthcoming* .

Sellon, G. (2002), 'The Changing US Financial System: Some Implications for the Monetary Transmission Mechanism', *Federal Reserve Bank of Kansas City, Economic Review* **97**(1), 5–35.

Siebert, H. (1997), 'Labor Market Rigidities: At the Root of Unemployment in Europe', *The Journal of Economic Perspectives* **11**(3), 37–54.

Smets, F. & Wouters, R. (2005), 'Comparing Shocks and Frictions in US and EURO Business Cycles : A Bayesian DSGE Approach', *Journal of Applied Econometrics* **20**, 161–183.

Svensson, L. (1998), 'Open-Economy Inflation Targeting', *CEPR Discussion Paper* **1989**.

Trichet, J. (2006), 'Activism and Alertness in Monetary Policy', *Conference on 'Central Banks in the 21st Century', organised by the Bank of Spain, 8 june* .

Woodford, M. (2003), *Interest and Prices, Foundations of a theory of Monetary Policy*, Princeton University Press.

7 Appendix

1999:1 - 2005:4	Mean	Variance	Mean Equality	Variance Equality
Actual EA interest rate	3.08	0.93	YES	NO
Actual U.S. interest rate	3.20	3.72	(SL=0.76)	(SL=0.00)
Estimated EA interest rate	3.11	1.01	YES	NO
Estimated U.S. interest rate	3.20	3.71	(SL=0.83)	(SL=0.00)
EA Monetary Policy shocks	-0.032	0.055	YES	YES
U.S. Monetary Policy shocks	0.006	0.068	(SL=0.57)	(SL=0.29)

Table 9: Tests on effective interest rate series

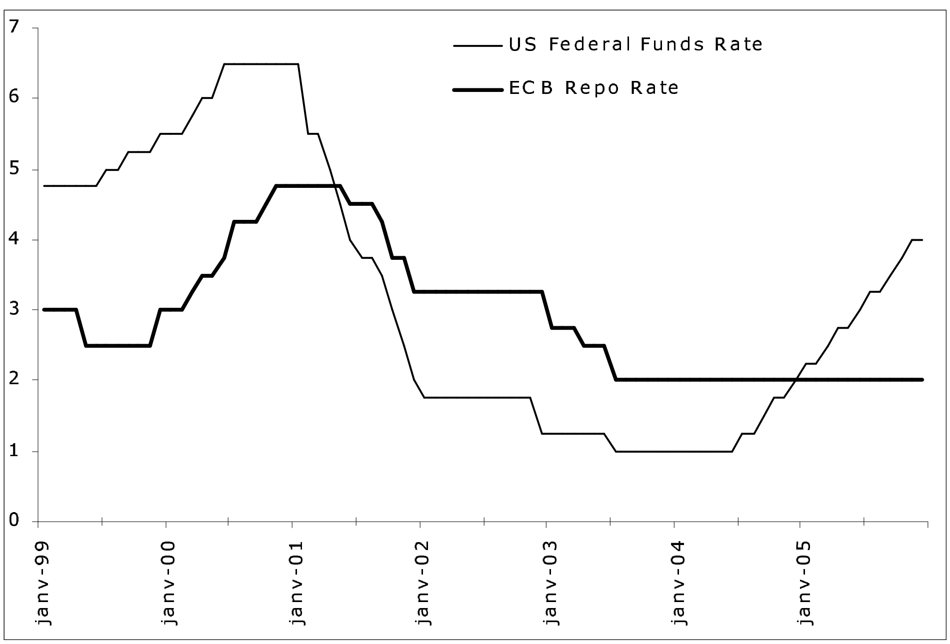

Figure 1: Fed Fund and ECB Repo Rates

	euro area			United States		
	Number of lags (p^*) = 3			Number of lags (p^*) = 5		
	Test	statistic	Signf. Level	Test	statistic	Signf. Level
Equation 1 (ρ)	Skewness (Sk=0)	0.010	0.969	Skewness (Sk=0)	0.298	0.276
	Kurtosis excess (Ku=0)	-0.293	0.606	Kurtosis excess (Ku=0)	0.420	0.453
	Jarque-Bera (JB=0)	0.292	0.864	Jarque-Bera (JB=0)	1.841	0.398
	Autocorrelation Q-Test ($\star$):			Autocorrelation Q-Test:		
	Ljung-Box Q(3)	0.049	0.997	Ljung-Box Q(3)	3.278	0.350
	Ljung-Box Q(6)	3.808	0.702	Ljung-Box Q(6)	7.619	0.261
	Ljung-Box Q(9)	8.266	0.507	Ljung-Box Q(9)	9.954	0.354
	Ljung-Box Q(12)	10.582	0.565	Ljung-Box Q(12)	17.124	0.145
Equation 2 (y)	Skewness (Sk=0)	0.094	0.733	Skewness (Sk=0)	-0.065	0.810
	Kurtosis excess (Ku=0)	0.325	0.567	Kurtosis excess (Ku=0)	-0.338	0.546
	Jarque-Bera (JB=0)	0.477	0.787	Jarque-Bera (JB=0)	0.455	0.796
	Autocorrelation Q-Test:			Autocorrelation Q-Test:		
	Ljung-Box Q(3)	0.987	0.804	Ljung-Box Q(3)	0.528	0.912
	Ljung-Box Q(6)	3.949	0.683	Ljung-Box Q(6)	0.972	0.986
	Ljung-Box Q(9)	8.008	0.533	Ljung-Box Q(9)	9.826	0.365
	Ljung-Box Q(12)	14.112	0.293	Ljung-Box Q(12)	16.007	0.190
Equation 3 (w)	Skewness (Sk=0)	0.054	0.844	Skewness (Sk=0)	0.535	0.057
	Kurtosis excess (Ku=0)	0.804	0.157	Kurtosis excess (Ku=0)	0.617	0.271
	Jarque-Bera (JB=0)	2.223	0.329	Jarque-Bera (JB=0)	5.276	0.071
	Autocorrelation Q-Test:			Autocorrelation Q-Test:		
	Ljung-Box Q(3)	0.431	0.933	Ljung-Box Q(3)	0.660	0.882
	Ljung-Box Q(6)	0.798	0.992	Ljung-Box Q(6)	2.846	0.828
	Ljung-Box Q(9)	6.206	0.719	Ljung-Box Q(9)	11.30	0.255
	Ljung-Box Q(12)	9.287	0.678	Ljung-Box Q(12)	21.46	0.044
Equation 4 (π)	Skewness (Sk=0)	-0.054	0.844	Skewness (Sk=0)	-0.139	0.609
	Kurtosis excess (Ku=0)	-0.384	0.498	Kurtosis excess (Ku=0)	0.258	0.645
	Jarque-Bera (JB=0)	0.538	0.764	Jarque-Bera (JB=0)	0.500	0.778
	Autocorrelation Q-Test:			Autocorrelation Q-Test:		
	Ljung-Box Q(3)	0.198	0.977	Ljung-Box Q(3)	0.380	0.944
	Ljung-Box Q(6)	4.761	0.575	Ljung-Box Q(6)	5.156	0.523
	Ljung-Box Q(9)	8.448	0.489	Ljung-Box Q(9)	17.513	0.051
	Ljung-Box Q(12)	14.297	0.282	Ljung-Box Q(12)	20.386	0.060
Equation 5 (i)	Skewness (Sk=0)	-0.006	0.980	Skewness (Sk=0)	-0.042	0.877
	Kurtosis excess (Ku=0)	0.731	0.198	Kurtosis excess (Ku=0)	0.238	0.670
	Jarque-Bera (JB=0)	1.804	0.405	Jarque-Bera (JB=0)	0.222	0.894
	Autocorrelation Q-Test:			Autocorrelation Q-Test:		
	Ljung-Box Q(3)	2.469	0.480	Ljung-Box Q(3)	0.345	0.951
	Ljung-Box Q(6)	4.273	0.639	Ljung-Box Q(6)	3.062	0.801
	Ljung-Box Q(9)	6.078	0.732	Ljung-Box Q(9)	5.989	0.741
	Ljung-Box Q(12)	10.380	0.583	Ljung-Box Q(12)	10.757	0.549

($\star$) : *Q-Test* describes the test for the joint significance of the first k ($k = \{3, 6, 9, 12\}$) autocorrelation coefficients as defined by Ljung & Box. H0 = nullity of these first k coefficients.

Table 10: Elementary statistics on VAR residuals

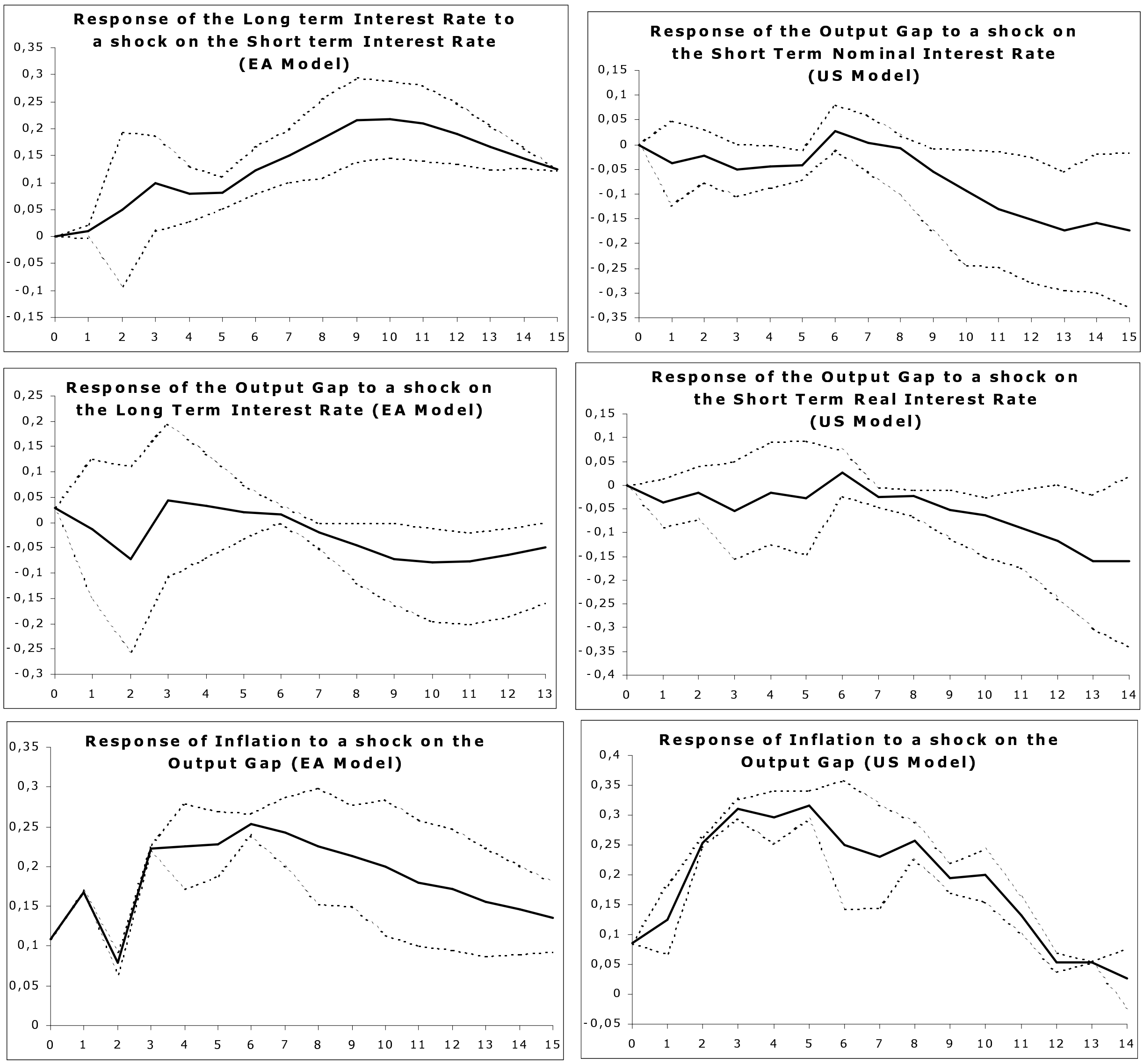

Figure 2: Monetary Policy Transmission Channels in euro area and United States

Figure 3: The relation between prices and wages

$H0$: stability	Hansen Test (1991)[(a)]	Chow Predictive Test[(b)]
	p-value	p-value
Long-Term interest rate	0.25	0.09
output gap	0.26	0.60
Wages	0.37	0.86
Inflation	0.15	0.29
Short-Term interest rate	0.14	0.97

(a) Tests the joint constancy of the coefficients and the variance.

(b) Break point in 1999:Q1. Equality of variances is confirmed beforehand.

Table 11: Parameter stability of the EU VAR model

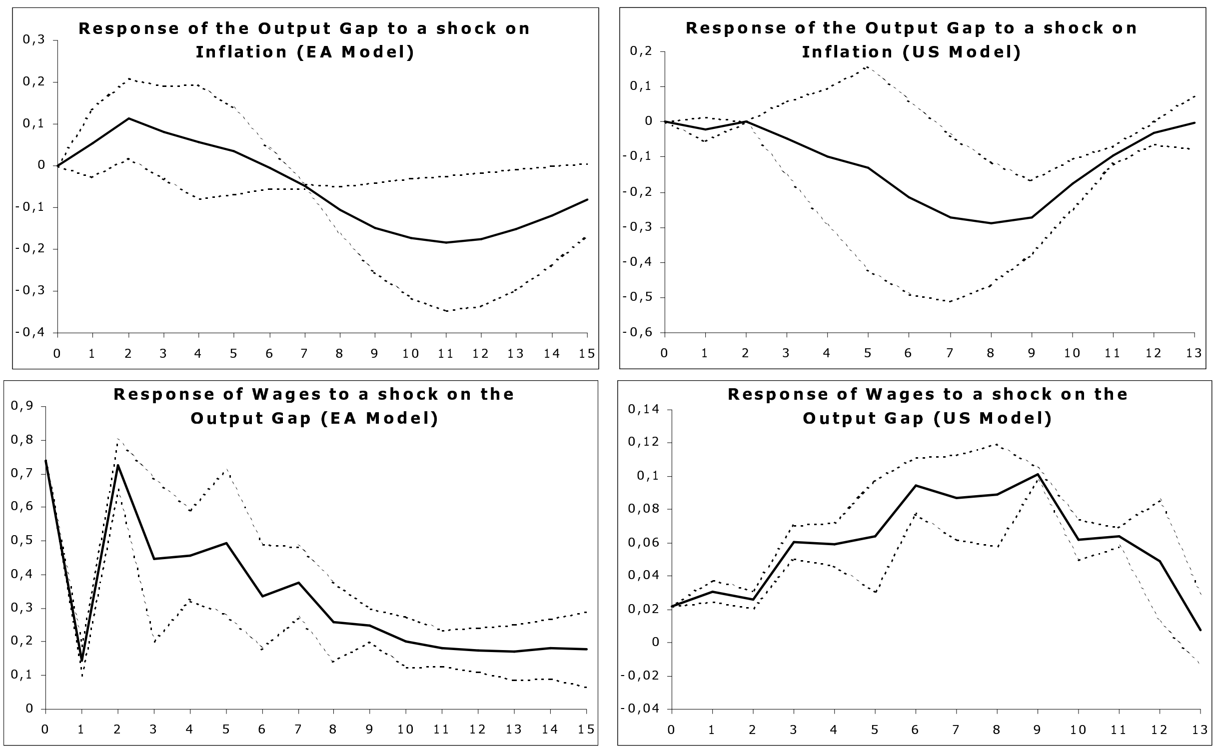

Figure 4: Relations between prices, wages and output

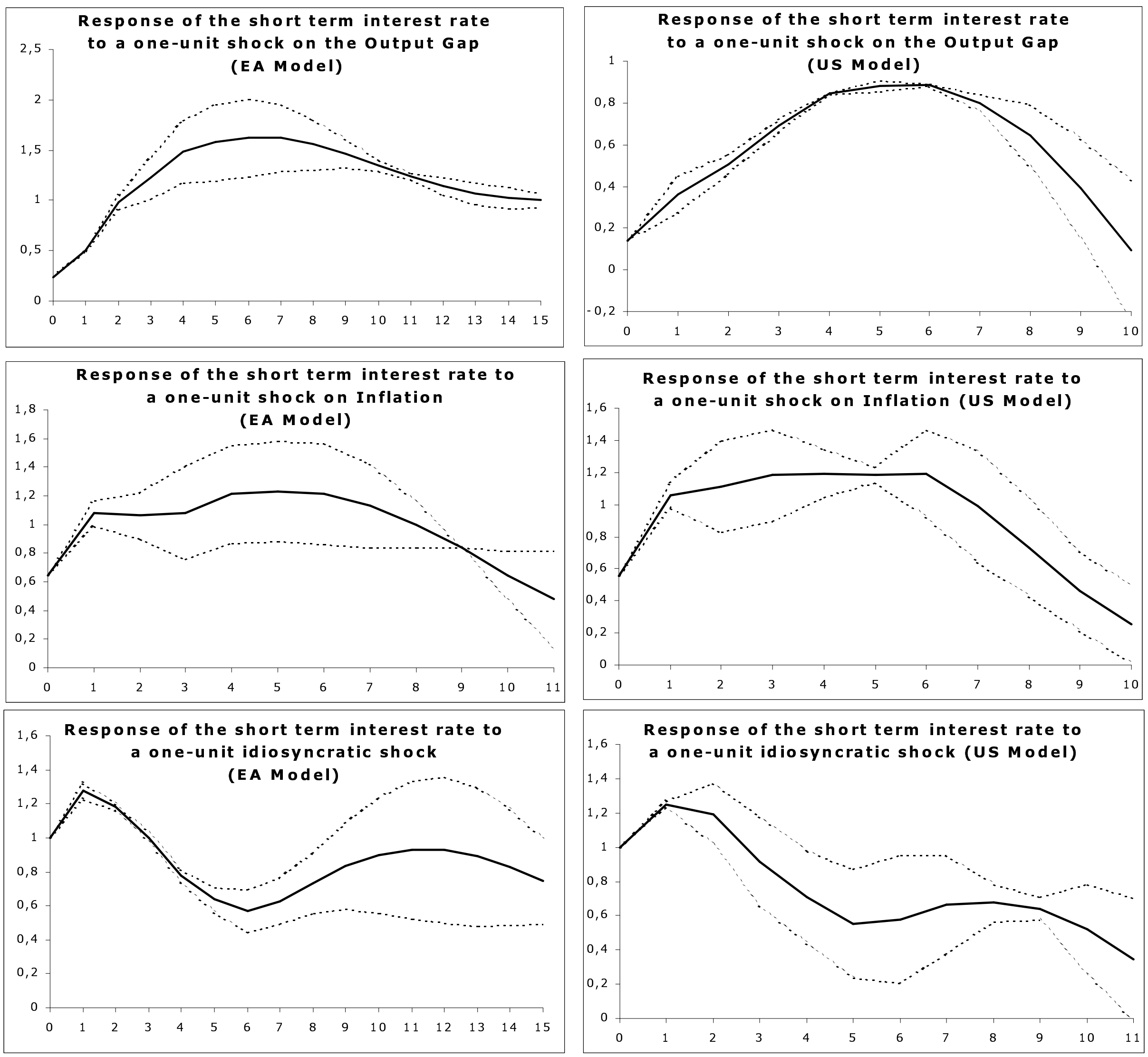

Figure 5: Monetary Policy reactions

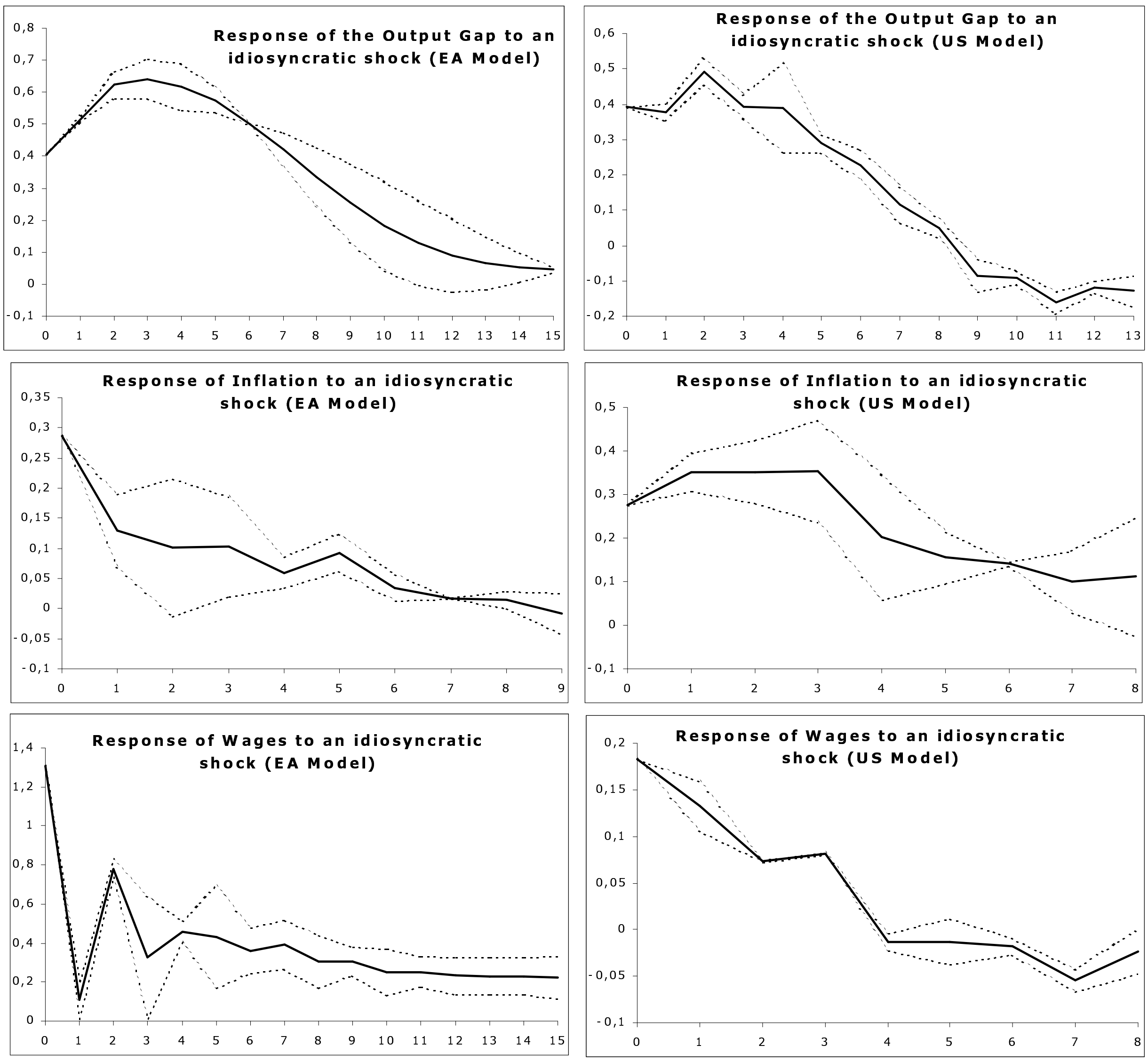

Figure 6: Responses of variables to idiosyncratic shocks

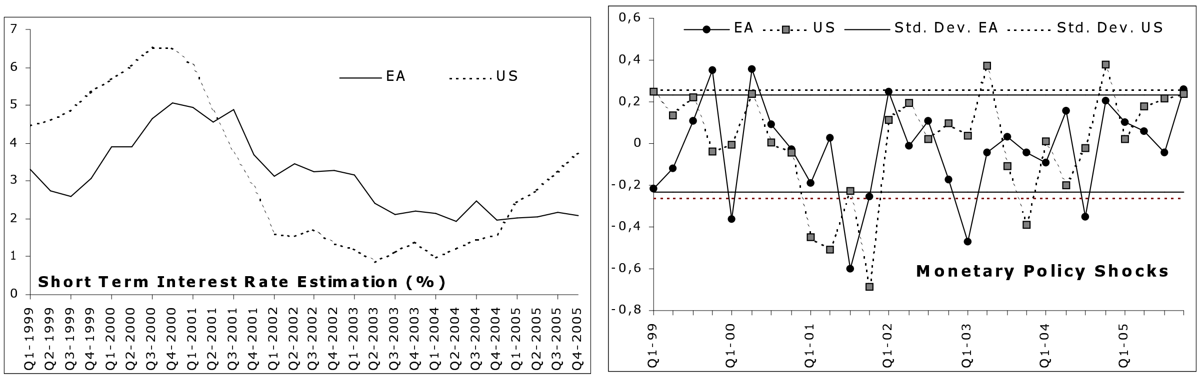

Figure 7: Estimated Interest Rates and Monetary Policy Shocks

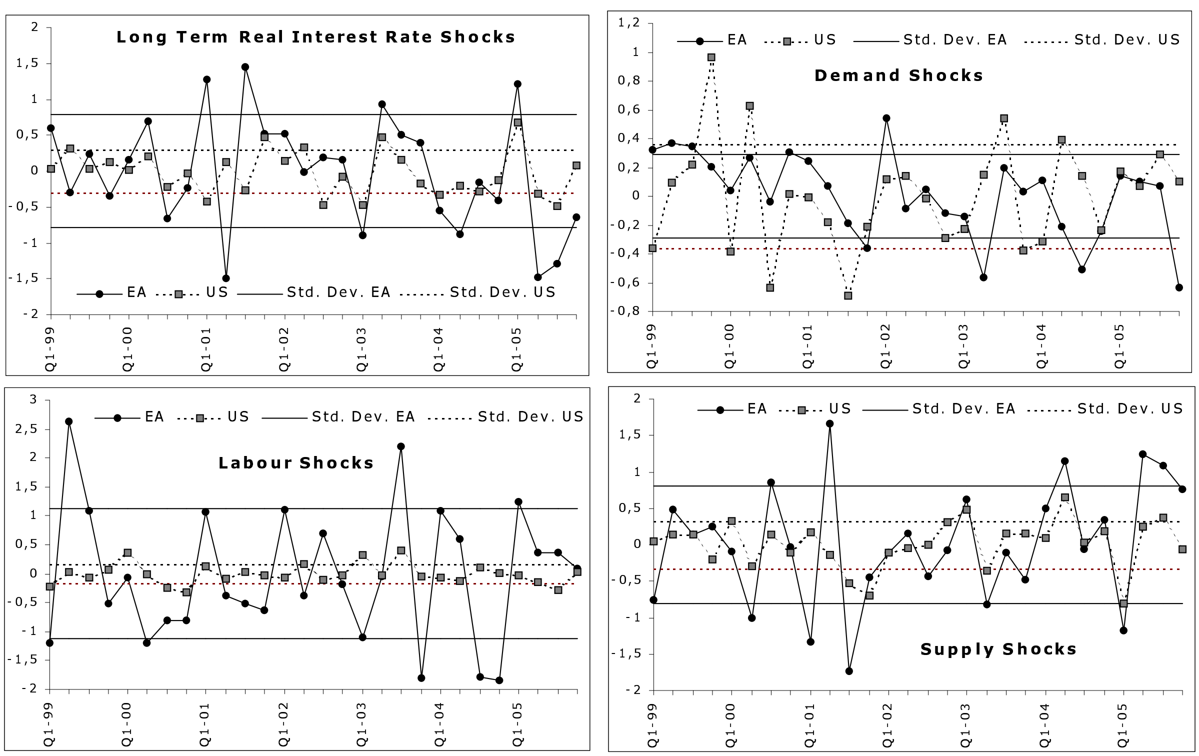

Figure 8: Historical shocks

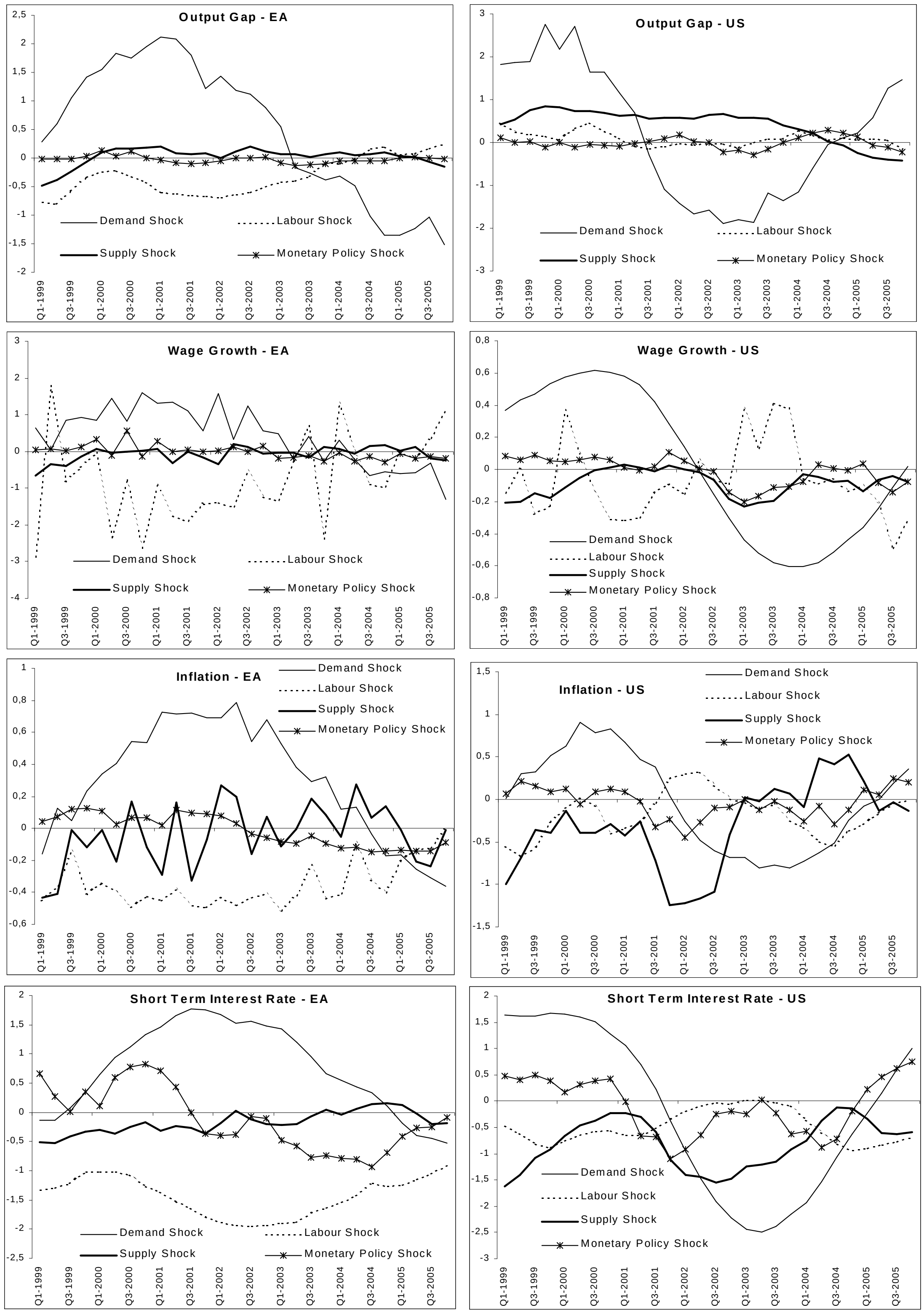

Figure 9: Historical Decomposition

	Bank total assets on PIB (%)[a]	Bank loans to corporate sector on PIB (%)[a]	Outstanding debt securities of non-financial corporate sector on PIB (%)[a]
United States	78	9.4	28.9
Euro area	267.1	42.6	6.5
France	276.7	35.7	17.0
Germany	304.3	38.9	2.8
Italy	154.4	42.3	2.4
	Stock Market capitalisation[b]	**Number of bank branch offices per 1000 inhabitants[c]**	**Household debt / PIB [d]**
United States	115%	0.29	74%
Euro area	50%	0.55	-
France	-	-	41%
Germany	-	-	66%
Italy	-	-	26%
	Number of firms with less than 10 employees (% total)[e]	**Number of firms with [10;499] employees (% total)**	**Number of firms with more than 500 employees (% total)**
United States	12	41.4	46.6
Euro area	30.3	39.4	30.3

Source : Eurosystem, Ehrmann & Al. (2002), BIS Annual Report (2000) n. 70.

(*a*) in 2001. (*b*) in 2006. (*c*) in 1998. (*d*) 1985-2005 average. (*e*) Source : Kashyap & Stein (1997).

Table 12: Key statistics on financial structures

	Potential Growth[(a)] in 1990	Potential Growth in 2000	Potential Growth in 2005
United States	3.03%	3.10%	3.15%
Euro area	2.53%	2.00%	1.70%
	Gross private R&D expenditure (% of GDP)[(b)]	Gross total R&D expenditure (% of GDP)	Number of scientists in firms for 10.000 employees
United States	1.94	2.66	73.78
France	1.38	2.18	35.01
Germany	1.71	2.46	39.22
Italy	0.53	1.11	12.86
	Total Factor Productivity[(c)]	Employment in % of firms entering employment[(d)] After 4 years	After 7 years
United States	+1.4%	215	226
France	+0.9%	115	107
Germany	+0.9%	120	122
Italy	-0.5%	128	132

(*a*) Authors' calculations based on the output gap series used in the VAR models.
(*b*) Source : OECD, Main Science and Technology 2005. (*c*) 1995-2005 average.
(*d*) Source : OECD, Employment Outlook.

Table 13: Key statistics on productive structures

Frequency of price changes by product type (% by month)			
	Unprocessed food	Processed food	Energy
United States	47.7	27.1	74.1
Euro area	28.3	13.7	78
	industrial goods	Services	**Total**
United States	22.4	15	24.8
Euro area	9.2	5.6	15.1

Source : Alvarez & Al. (2005). Interpretation : In the euro area, only 9.2% of industrial prices are revised each month, against 22.4% in the United States.

Table 14: Key statistics on price formation

	Employment rate$^{(a)}$	Activity rate$^{(a)}$	Working Population growth$^{(a)}$
United States	70.6%	75.0%	1.3%
euro area	61.2%	67.7%	0.83%
	Unemployment rate$^{(a)}$	Labour Productivity growth$^{(b)}$	NAIRU$^{(c)}$
United States	5.8%	1.73%	5.6%
Euro area	9.0%	1.17%	7.7%
	Trade union density$^{(d)}$	Bargaining Coverage$^{(d)}$	Degree of centralisation$^{(e)}$
United States	15%	18%	Decentralised
France	10%	90%	Intermediate
Germany	31%	80%	Intermediate
Italy	39%	80%	Intermediate
		Employment Protection Indices$^{(f)}$	
	Total	Regular employment	Temporary employment
United States	0.2	0.2	0.9
France	3.0	2.3	3.6
Germany	2.2	2.6	1.8
Italy	3.3	2.8	3.8

(a) Source : OECD, Economic Outlook n.80, 2006. 1985-2005 average in %.

(b) 1990-2003 average. Source : OECD Employment Outlook 2004.

(c) 1980-200 average. Source : OECD, Economic Outlook n. 68, chap. 5.

(d) Source : Employment Outlook 2004

(e) Source : Employment Outlook 1997, chap. 3, pp. 70-100. The classification did not change between 1980 and 1994.

(f) Source : OECD. 1990s. The higher the index, the more protected the employment

Table 15: Key statistics on Labour markets

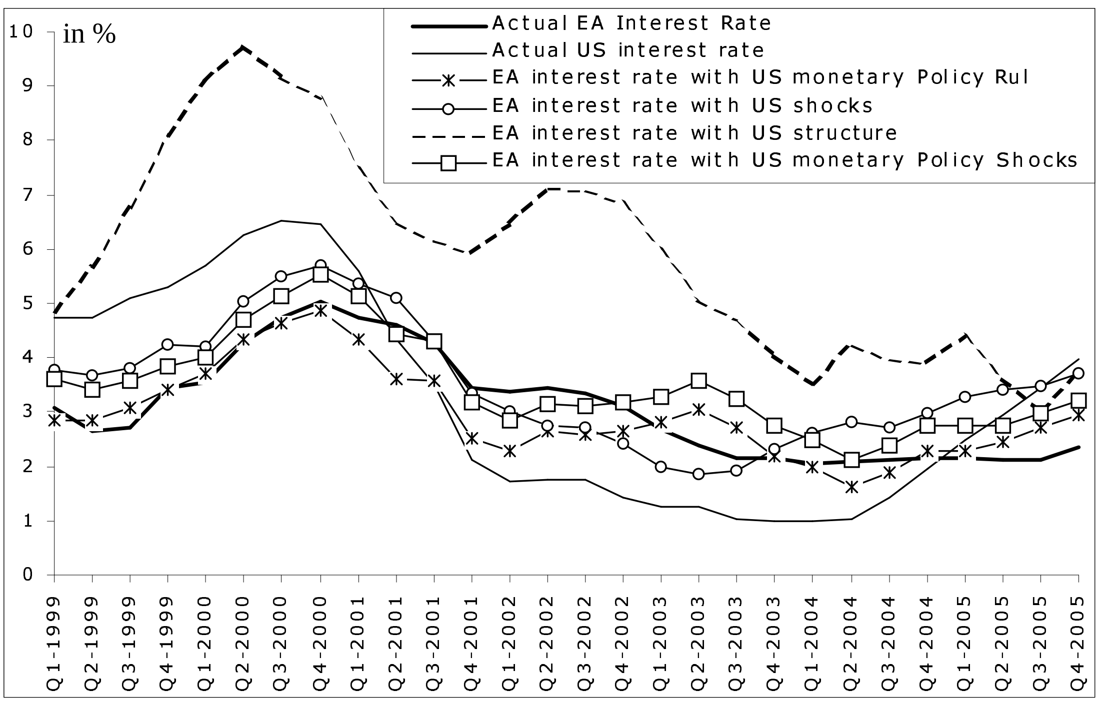

Figure 10: Simulated EA interest rates

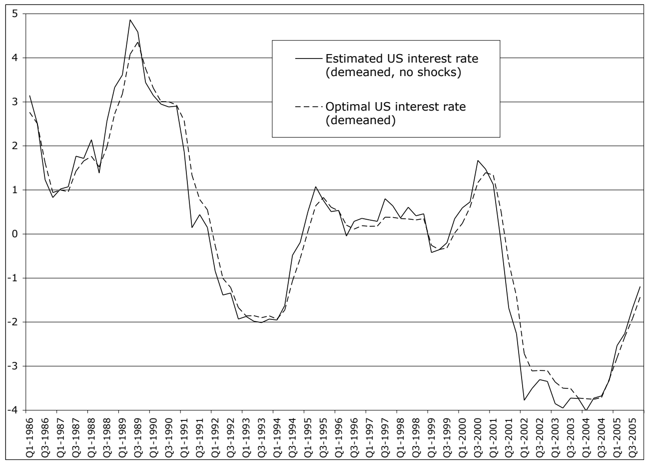

Figure 11: U.S. optimal and actual interest rates

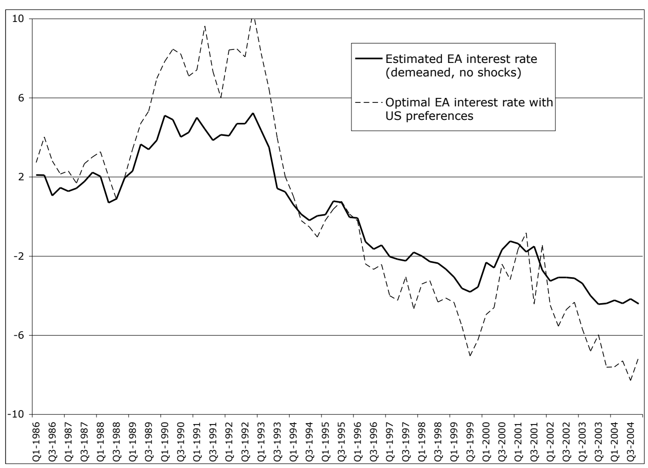

Figure 12: Simulated EA optimal interest rate with U.S. preferences