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The Federal Funds Rate and the Conduction of the International Orchestra

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The Federal Funds Rate and the Conduction of the International Orchestra

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Abstract. In the first ten years of EMU, monetary policy choices of the European Central Bank (ECB) in setting the short-term interest rate have followed, systematically, monetary policy decisions made by the Federal Reserve System (Fed). For, despite the presence of variable lags with respect to Fed decisions, turning points of European short-term interest rates have been largely anticipated by movements in the federal funds rate. In this paper we show that, in the context of a bivariate cointegrated system, a clear long-run US dominance emerges. Moreover, the structural analysis reveals that a permanent increase in the federal funds rate causes a permanent one-for-one movement in the eonia rate.

JEL Classification: C32;E5

Keywords: Monetary policy; Identification; Structural Cointegrated VARs;

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1. Introduction

It is a widely shared idea that ECB and Fed, the two most important central banks, have pursued in recent years quite different monetary policy strategies, with the first paying much more attention to the goal of price stability and the latter, instead, also engaged in the business cycle stabilization. Indeed, this view is also consistent with the rhetoric of ECB members who, in their communication with the public, have continually emphasized the struggle for price stability.

Nevertheless, this interpretation of the conduct of monetary policy in the Euro area seems to be at odds even with simple anecdotal evidence. For, we know that as a consequence of the 2001 recession and of related fears of deflation, the Fed decided for an aggressive policy of repeated reductions in short-term interest rates which, starting in January 2001, would have led the federal funds rate to 1 per cent in the summer of 2003. The Euro area had a peak of the overnight rate (Eonia) in April 2001, at around 5 percent, and would have reached a plateau 20 months later at around 2 percent.

The same causal dynamics have been observed in the current recession since, although in this case with a larger delay, the ECB has followed the Federal Reserve action towards a sharp reduction in the policy rates.

Finally, note that also in the expansionary phase, following the 2001 recession and the subsequent jobless recovery, the Fed was once again the first mover.

In this paper we want to explore, by using structural econometric techniques, the hypothesis that there is a leading international role exerted by the Federal Reserve System, with respect to the European Central Bank, in the conduct of monetary policy.

To this end we study the joint dynamics of US and Euro area policy rates in the last ten years. We use the federal funds rate and the European overnight rate as indicators of the stance of monetary policy in the two economic areas and estimate a Vector Error Correction Model. We show that data support the identification of a causal structure with the federal funds rate ordered first.

The paper is organized as follows. In section 2 we present the econometric model and show the implications of the causal structure for the separation of a permanent from a transitory shock. Section 3 presents the results concerning the empirical investigation. Results show that the presence of a long-run one-for-one relation between the two interest rates cannot be rejected and, moreover, the US policy rate is the exogenous driving force of the dynamical system. Section 4 concludes.

2. Modelling the joint dynamics of US and European policy rates

Short-run and long-run interaction between the federal funds rate and Eonia can be well described in the framework of a cointegrated VAR. Hence, let us assume that the vector $x_t = (ffr_t, eonia_t)'$ includes I(1) variables, where ffr is the federal funds rate and $eonia$ is the European overnight interest rate.

We want to investigate the existence, for x_t, of the following Error Correction Model representation:

$$\Delta ffr_t = A_{11}(L)\Delta ffr_{t-1} + A_{12}(L)\Delta eonia_{t-1} + \epsilon_{1t} \qquad [1]$$

$$\Delta eonia_t = A_{21}(L)\Delta ffr_{t-1} + A_{22}(L)\Delta eonia_{t-1} - \alpha(ffr_{t-1} - eonia_{t-1}) + \epsilon_{2t} \qquad [2]$$

where $\Delta = I - L$ and L is the lag operator, $\epsilon_t = (\epsilon_{1t}, \epsilon_{2t})'$ is the (2x 1) vector of reduced-form disturbances such that $E(\epsilon_t) = 0$ and $E(\epsilon_t \epsilon_t') = \Omega_\epsilon$.

The dynamic relationship between the US and European policy rate implied by equations [1] and [2] allows the federal funds rate to be identified as the permanent component of eonia. This result descends from the assumptions that: (a) there is a one-for-one long-run relation between the two variables; (b) the error-correction term does not enter the federal funds rate equation, *i.e.* the US policy rate is weakly exogenous[1].

It is worth noting that this set of restrictions implies that only unexpected changes in the federal funds rate equation can modify the forecast of the European policy rate at long-run horizons, since we have:

$$\lim_{h\to\infty} \frac{\partial E_t(ffr_{t+h})}{\partial \epsilon_{1t}} = \lim_{h\to\infty} \frac{\partial E_t(eonia_{t+h})}{\partial \epsilon_{1t}} \neq 0 \qquad [3]$$

Hence, if the eonia at date t is higher than expected, this event will induce a revision of both the variables for short horizons, but the long-run forecast will be unchanged:

$$\lim_{h\to\infty} \frac{\partial E_t(ffr_{t+h})}{\partial \epsilon_{2t}} = \lim_{h\to\infty} \frac{\partial E_t(eonia_{t+h})}{\partial \epsilon_{2t}} = 0 \qquad [4]$$

Let us obtain the reduced-form Wold representation of the vector error correction model:

$$\begin{pmatrix} \Delta ffr_t \\ \Delta eonia_t \end{pmatrix} = \begin{pmatrix} C_{11}(L) & C_{12}(L) \\ C_{21}(L) & C_{22}(L) \end{pmatrix} \begin{pmatrix} \epsilon_{1t} \\ \epsilon_{2t} \end{pmatrix} \qquad [5]$$

We want to impose a structure in order to recover the structural disturbances of this dynamical system. In particular, we aim to separate a permanent from a transitory shock.

[1] In Ribba (2003) this set of conditions is utilized in the context of a bivariate VAR including the rate of change of CPI ex food and energy and the rate of change of CPI, in order to identify an indicator of trend inflation

To this end, we impose a Wold causal form with the federal funds rate ordered first in the causal ordering. Let H(0) be the unique lower triangular matrix such that $H(0)H(0)' = \Omega_\epsilon$. We obtain the following structural representation:

$$\begin{pmatrix} \Delta ffr_t \\ \Delta eonia_t \end{pmatrix} = \begin{pmatrix} H_{11}(L) & H_{12}(L) \\ H_{21}(L) & H_{22}(L) \end{pmatrix} \begin{pmatrix} \eta_{1t} \\ \eta_{2t} \end{pmatrix} \qquad [6]$$

where $H(L) = C(L)H(0)$, $\eta_t = H(0)^{-1}\epsilon_t$ and $E(\eta_t\eta_t') = I$. $\eta_t = (\eta_{1t}, \eta_{2t})'$ is a $(2x1)$ vector of structural disturbances. Under this structural representation a change in the nominal European overnight rate does not exert effects on the federal funds rate within the period. Yet, an important implied result is that such a change is also neutral in the long run and, as a consequence of the cointegration relation, has only a transitory effect on both variables.

Remark 1. Given orthonormal disturbances, we obtain exact identification by imposing a zero restriction for the contemporary effect of η_{2t} on ffr_t, that is we impose the restriction $H_{12}(0) = 0$. However, since the error correction term does not cause the federal funds rate at very low frequencies, it then follows that the second column of $C(1)$ contains zero elements. Since H(1)= C(1)H(0), by noticing that H(0) is lower triangular it then follows that $H_{12}(1) = H_{22}(1) = 0$. Thus the recursive VAR representation [6] allows a permanent shock to be separated from a transitory one, *i.e.* there is equivalence between long-run and short-run identifying restrictions (cf. Cochrane, 1994 and Ribba, 1997)[2].

Remark 2. As far as the long-run one-for-one movement between the US policy rate and the European overnight rate is concerned, the implication of the stationarity of interest rates differential is that the (log of) nominal exchange rate between the dollar and the euro is I(1) but the first difference is I(0).

Remark 3. Unidirectional causality at very low frequencies running from the federal funds rate to eonia, *i.e* the weak exogeneity of the US policy rate, is mainly explained by the role played by the US business cycle in shaping the evolution of the world business cycle and, in particular, of the European one. Indeed, when the current global downturn began, owing to financial shocks in the United States in the summer of 2007, some ECB members supported the thesis of a decoupling of the macroeconomic evolution in Europe with respect to United States. Unfortunately, we know that the hope of decoupling evaporated within a few months since, starting with the second quarter of 2008, the Euro area has witnessed a sharp contraction in real economic activity.

[2] In a recent article Fisher and Huh (2007) have proposed further generalizations of these equivalence results concerning VEC models which include more than two variables.

3. An empirical investigation

We use monthly data and the period of estimation is 1999:1 - 2008:12. We specify a bivariate VAR, x_t, with $x_t = (ffr_t, eonia_t)'$ and estimate a VAR with four lags[3].

On the basis of Johansen (1991) trace test, at the 5 percent level, it is not possible to reject the null hypothesis of cointegration between the federal funds rate and eonia (see table 1).

In table 2, the estimated (normalized) coefficients show a positive long-run relation between the two policy rates. We also report the adjustment coefficients.

Insert table 1 about here

Insert table 2 about here

The analysis of the cointegration space reveals that the joint restriction of a one-for-one long-run relation between the two variables and of one-way causality at frequency zero running from the federal funds rate to eonia is not rejected by data.

Hence we conduct an innovation accounting by imposing a recursive ordering, with the federal funds rate ordered first. It is worth recalling that this identifying restriction is: (a) supported by the cointegration analysis; (b) is equivalent to imposing a long-run identifying restriction (cf. Ribba, 1997).

Figure 1 and 2 report, respectively, the impulse-response functions and the decomposition of forecast-error variance (FEV).

The response of the federal funds rate to an unexpected increase in the European policy rate is insignificant at all horizons. Instead, the response of eonia to a US policy rate shock is nearly insignificant only for the first months following the increase in the federal funds rate. It requires around two years for a full adjustment of eonia to the US interest rate.

The FEV analysis is, of course, consistent with the impulse-response analysis and reveals that the permanent shock, *i.e.* the federal funds rate shock, explains much of the variability of eonia at medium-low frequencies whereas the contribution of the transitory, eonia shock, has negligible effects on the variability of the federal funds rate at all horizons.

Insert figure 1 about here

Insert figure 2 about here

[3]The series of federal funds rate is taken from FRED at the St. Louis Web site. The series of European overnight rate is taken from the ECB site. As for lag length selection, both the Hannan-Quinn and the Schwartz criterion suggest four lags for the VAR in levels.

4. Conclusions

Keynes used the expression 'conductor of the international orchestra' to emphasize the leading role of the UK during the classic gold standard.

In this paper we have shown that in the contemporaneous, global economic system, despite the emergence of an important economic and monetary aggregation represented by the Euro area, there is a persistency in the asymmetrical working of the international monetary system, with a leading role played by the US economy and, as a consequence, with a dominance of the US central bank in shaping both size and direction of monetary policy interventions by other central banks. In particular, we have empirically explored the ECB's role as follower in the first ten years of its activity.

In our opinion, the results obtained in this paper might also shed some light on some (apparently) paradoxical results which have been shown in some recent investigations, based on the estimation of monetary policy reaction functions for the ECB. For, consistently with the fed dominance hypothesis explored in the present paper, these studies find that in the first years of its activity the ECB has put more weight on the stabilization of the real activity rather than to the objective of price stability (see. *e.g.* Gerlach, 2007; Belke and Polleit, 2007).

References

Belke, A., Polleit, T., 2007. How the ECB and the US Fed Set Interest Rates. *Applied Economics*, 39: 2197-2209.

Cochrane, J.H., 1994. Permanent and Transitory Components of Gnp and Stock Prices. *Quarterly Journal of Economics*, 109: 241-265.

Fisher, L. A., Huh, HS., 2007. Permanent-Transitory Decompositions under Weak Exogeneity. *Econometric Theory*, 23: 183-189.

Gerlach, S., 2007. Interest rates settings by the ECB, 1999 - 2007: words and deeds. *International Journal of Central Banking*, 3: 1-46.

Johansen, S., 1991. Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica*, 59: 1551-1580.

Ribba, A., 1997. A Note on the Equivalence of Long-Run and Short-Run Identifying Restrictions in Cointegrated Systems. *Economics Letters*, 56: 273-276.

Ribba, A., 2003. Permanent-Transitory Decompositions and Traditional Measures of Core Inflation. *Economics Letters*, 81: 109-116

Table 1. Johansen's Cointegration Rank Tests

H_0: rank	Trace	90 % c.v.	95 % c.v.
$r = 0$	17.45	10.47	12.53
$r \leq 1$	1.66	2.86	3.84

Notes: Results for the period 1999:1 - 2008:12 are based on a reduced form model which includes the federal funds rate and the European overnight interest rate. The estimated VAR includes 4 lags in levels

Table 2. Parameter Estimates and Analysis of the Cointegration Space

	federal funds rate	eonia
Normalized cointegration vector	1	-1.096 (0.091)
Loading coefficients	0.014 (0.012)	0.039 (0.0095)
H_0: The cointegration space contains		
the cointegrating vector	1	-1
and		
the loading coefficients	0	α
$\chi^2_{(2)} = 1.53$ P-value 0.46		

Notes: The numbers in parentheses are standard errors. The likelihood ratio test of a cointegrating vector $(1, -1)'$ and of unidirectional long-run causality, (0, α), is distributed as a chi-squared with degrees of freedom equal to the number of restrictions tested.

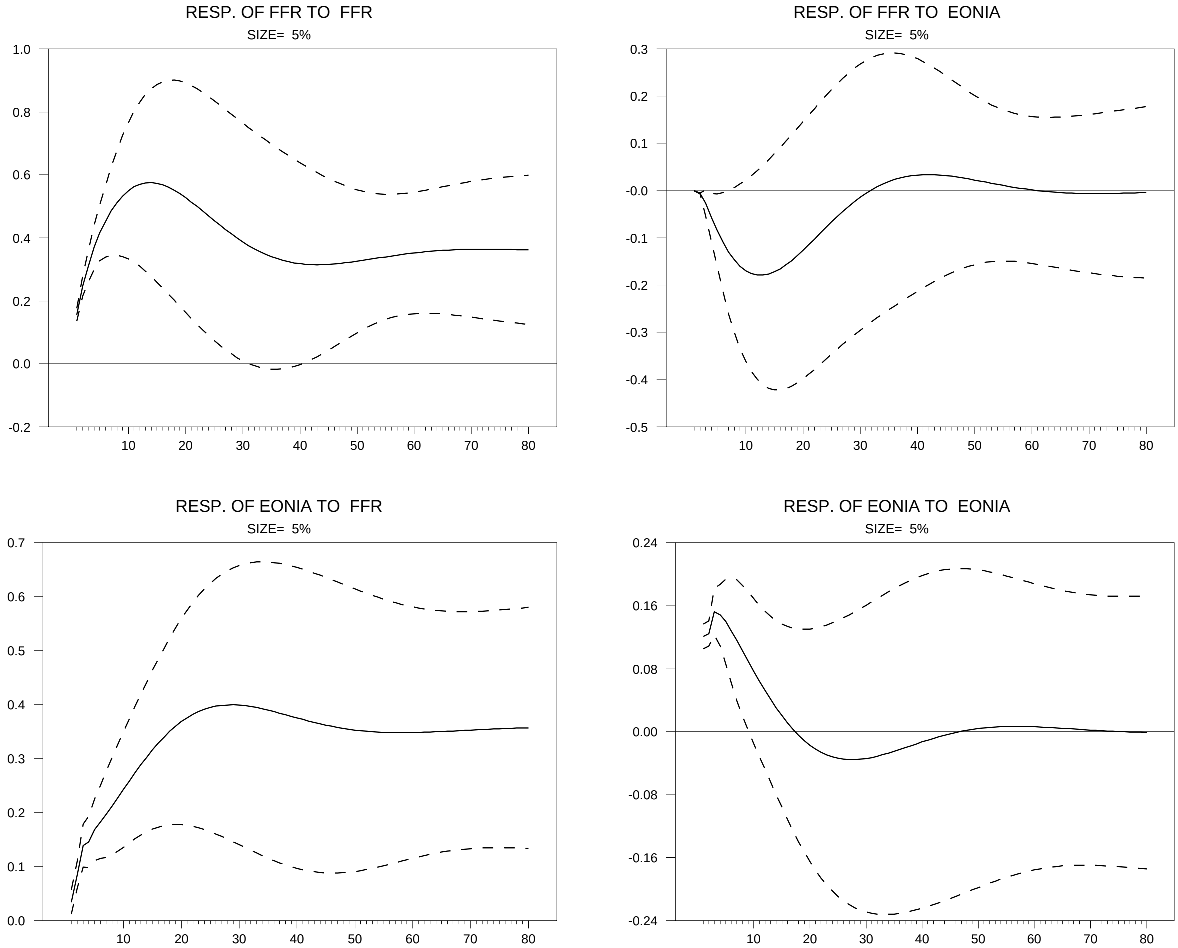

FIGURE 1 IMPULSE RESPONSE FUNCTIONS

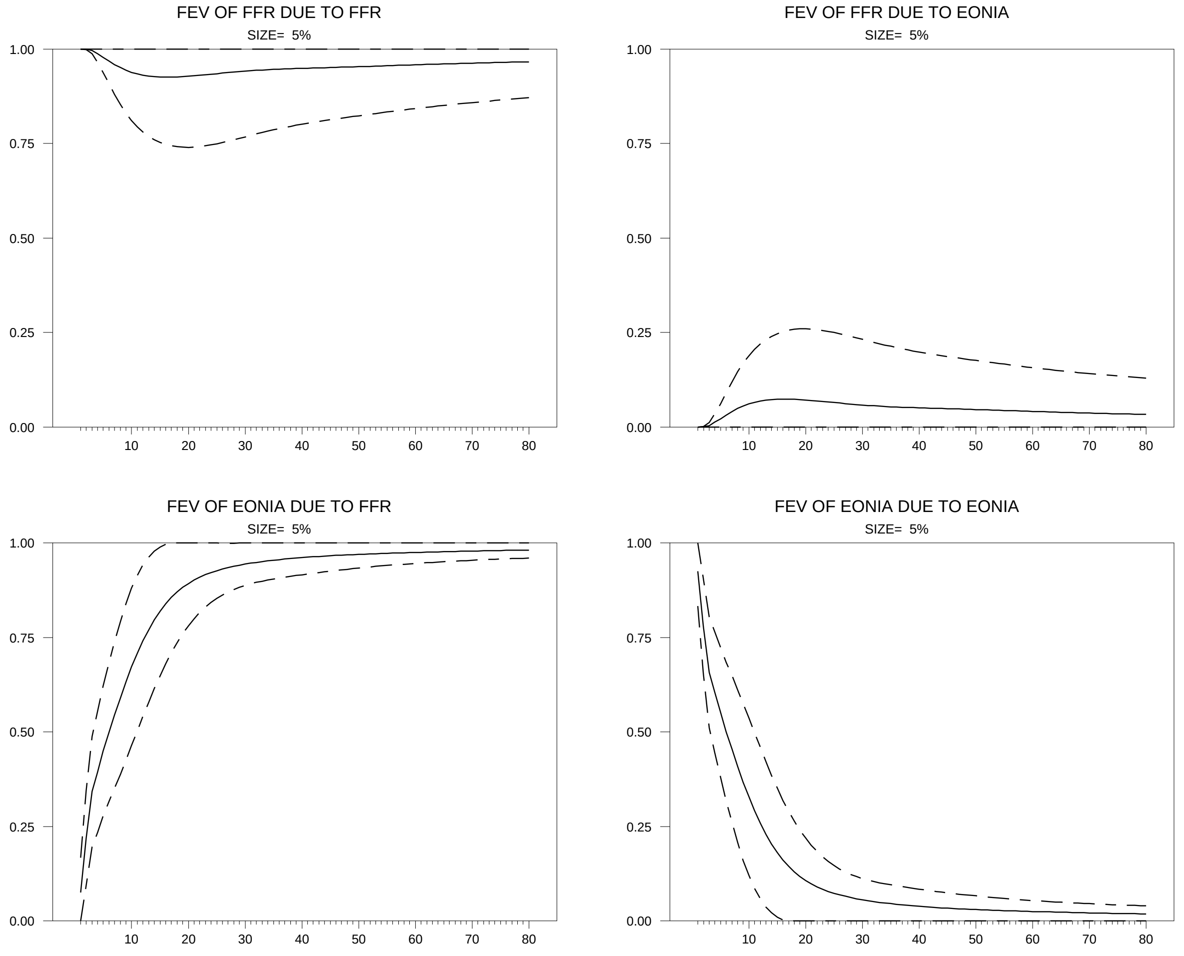

FIGURE 2 FORECAST ERROR VARIANCE (FEV) DECOMPOSITION

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