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**Conference Paper**

## Local responses to a global monetary policy: The regional structure of financial systems

38th Congress of the European Regional Science Association: "Europe Quo Vadis? - Regional Questions at the Turn of the Century", 28 August - 1 September 1998, Vienna, Austria

**Provided in Cooperation with:**

European Regional Science Association (ERSA)

*Suggested Citation:* de Lucio, Juan Jose (1998) : Local responses to a global monetary policy: The regional structure of financial systems, 38th Congress of the European Regional Science Association: "Europe Quo Vadis? - Regional Questions at the Turn of the Century", 28 August - 1 September 1998, Vienna, Austria, European Regional Science Association (ERSA), Louvain-la-Neuve

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**Local responses to a global monetary policy:  
The regional structure of financial systems**

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**and**

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**FEDEA**

**June 1998**

Preliminary Version.  
Please do not quote.

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## Abstract

This paper contrasts the existence of different regional effects of an homogeneous monetary policy and study the local characteristics that underlie these differential responses. To this purpose we use regional data and estimate a structural vector autoregression model using SURE techniques to characterize the different regional responses. Afterwards, we use this estimated responses to analyse if they depend on the regional characteristics of the financial system, like industry composition, firm size or banking sector composition. The results provide preliminary evidence of different regional responses of real variables to monetary policy shocks. The intensity of these responses of regions depends on the share of manufacturing sectors ( interest sensitive sector) and on the net lending position of the regional governments.

**Keywords:** VARs, monetary policy, regional shocks

**JEL Codes:**

## 1.- Introduction

On January 1999 an European Central Bank (ECB) will be created. This institution will drive a single monetary policy for all the European Monetary Union (EMU) members. This process will establish a single currency in a wide area of Europe. Although there is debate on the benefits of this process and lots of work has been done on this topic, much less effort has been done in order to know the differential country effects of a common monetary policy.

There is evidence for the United States that shows different regional effects of a single monetary policy (Carlino and deFina, 1996) but surprisingly this question has been avoided in the European Union countries. Two reasons can explain this lack, first the difficulty to establish country comparisons and second political pressures that restrict economic analysis on the inequalities deriving from the integration process. Due to the new paradigm for the national central banks in Europe and the availability of regional data sets to perform this kind of study it seems that the study of the differential effects of a common monetary policy at the regional level cannot be delayed anymore. This will allow regional governments to face the single monetary policy more efficiently and will provide to the ECB a better knowledge of the effects of its decisions.

Lately, researchers have perceived the importance of this kind of studies and it exists an increasing number of studies that try to find out the differences across country responses. The evidence provided is mixed; Dornbush, Favero y Giavazzi (1997) make an effort to review this literature and conclude that wage setting and financial structure derive on unequal cost among countries of disinflation episodes.

This paper quantified the reaction of the Spanish regions to monetary shocks and tries to provide an explanation for these responses. The evidence presented suggests the existence of regional specific responses that depends on the balance sheet composition of the different agents, the sectoral structure and the sectoral distribution.

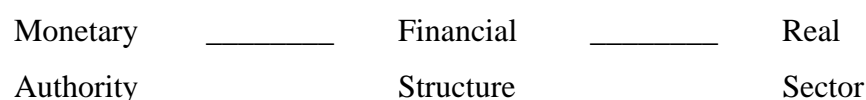
The paper is organized as follows. Section 2 addresses the theoretical features underlying the estimations. Section 3 is the empirical core of the paper; first presents the data, then using Vector Autoregression techniques (VARs) obtains the responses to monetary policy shocks of the different Spanish regions and finally explain why these differences exist. Section 5 presents some concluding comments.

## 2.- Why could regions react asymmetrically to monetary shock? A theoretical view.

There are many arguments on why we could observe differences in the monetary policy transmission mechanism across regions and consequently different responses to a common monetary shock.

The theoretical and empirical literature has presented several reasons that could explain why we observe different regional effects of a single monetary policy. The sectoral composition of the economy, the structure of the financial sector, the wage determination process, etc. could affect the transmission mechanism of monetary shocks.

We can consider two different stages in the monetary policy transmission mechanism and consequently two links that can affect the response to a monetary shock, the first is the financial environment and the second correspond to the real economy. Figure 1 represents the two stages of the mechanism we are studying.



Starting from the end of this chain, we consider that real sectors have imperfections in the monetary policy absorption because differences on both micro and macro structures. Concerning micro structures we observe that a restrictive monetary policy reduces equity and physical assets prices, it also varies the marginal value of wealth and has income effects increasing the income of the borrowers and decreasing the rent of those with a credit (Barran, Coudert and Mojon, 1997) All these effects will affect households' consumption decisions.

Increases in consumption will be associated with net creditor financial positions, specially when bonds are the assets owned, and will produce a positive response to this restrictive monetary policy.

Concerning macro structures, we observe that different real sector composition, with different shares of monetary policy sensitive sectors across regions, will provoke different regional responses to a homogeneous monetary policy (Carlino and define 1997), being, this response, more intense in those regions with higher percentage of manufacturing and construction sectors, which seem to be interest sensitive. The size of the companies is an indicative of the ability to reach wider credit channels, in most of the cases not linked to regional fund sources. In contrasts to small companies that depend directly on narrower credit opportunities, large companies can appeal to stock or international markets. Similarly, the internal structure and size of the financial sector in a region transmit differently monetary shocks. As large banks have better access to international funding options than small ones (See Kashyap and Stein, 1994) the effects of a monetary policy will be lower in those regions with more presence of large banks. Besides low number of financial institutions and small financial sectors are highly correlated with lack of competence (Oline and Rudebusch, 1995). Lack of competition in the banking industry will try to keep their monopoly benefits, for instance slowing the transmission process of an interest decrease to the credits. Empirical evidence of rigidities on the bank interest rate when modifying the official interest rate and on different effects of the monetary policy on firms and households can be found for the Spanish case in Sastre (1991) and Escrivá y Haldane (1994)

Also the kind of wage bargaining affects the macroeconomic performance, both because firm and national bargaining seem to be correlated with lower wage increases than industry bargaining (Calmfors and Driffill, 1988) and because nominal wage contracts allow for persistent effects on output of monetary shocks (Gottfries and Westermarck, 1998). Finally the degree of openness determines the effects of a thigh monetary policy as an appreciation increases real income but damage exports and therefore output and employment (Dornbush, Favero and Giavazzi, 1997).

The other link of the transmission channel is the financial structure. The monetary policy affects the balance sheet of banks both changing the lending rate, and consequently moving the

efficient short and long rate composition of the balance sheet, and modifying the ability of funding. The distribution of contracts between short and long term interest rates and the frequency of adjustments do also make differences when the central bank alters this structure (BIS, 1995). A restrictive monetary policy will affect the bond-loans ratio of the banks; as they are imperfect substitutes, and firms will have a higher external finance premium, supply of loans will be reduced (Bernanke and Gertler, 1995 and Bernanke and Blinder, 1992) and consequently we would observe a shift in firms' external financing. On the other hand an expansive monetary policy reduces the market value of collateral (Kiyotaki and Moore, 1997) being more difficult for the companies to obtain loans. Finally Hanson and Waller (1996) find a significant correlation between the policy of the regions banks and the growth rate of the region, Amos, Kermani and Wingender (1986) argues that regional growth is slow down when regional credit is constrained and Moore, Hill (1982) mentions local banks have less cost to monitor local investment than bank in other regions and some studies suggest that the informal lending channel (non-bank forms) are basically local (OECD, 1995). If regions differ on any of these characteristics we might observe different regional responses to the monetary policy. Local banks would act as regional stabilizers of monetary policy.

Due to that some elements remain constant through regions in a nation, not all of the presented characteristics can be analysed using regional data, but far from being a shortcoming of the data, this characteristic allows us to obtain more deep insights on the other elements.

According the previous survey, we have selected some variables. First we want to test if regions more affected by credit constrains are more sensible to monetary shocks, second we study the effects of the presence of larger firms, then we contrast the theories that suggest that manufacturing and construction sector are more sensitive to monetary shocks and therefore the industrial composition matters for monetary shock response. Finally we are interested in the effects of other variables like household saving rate and percentage of collective bargaining. The values of these variables for the 17 Spanish regions are presented in table 1.

	Net Lending p o s i t i o n %/GDP	Firms +50 emp. %	Industrial GDP %	Construction GDP %	Saving rate %	Collective bargaining %
Cantabria	2.9	1.2	25.7	7.9	11.8	34.1
Murcia	-2	1.7	24.4	9	7	39.2
Canarias	-2	1.8	11.3	8.4	14.8	51.4
Madrid	-6	2.7	17.9	9	10.7	36.4
Asturias	-4	1.4	28	9.8	10.5	41.3
Aragón	-1.8	1.4	28.2	7.9	16.3	42.3
Galicia	-2	1.2	26.6	10.2	8.3	26.8
Navarra	-2.9	2.5	36.2	8.3	13.5	29.8
Com. Valenciana	-4	1.5	28.5	8	6.8	33.3
País Vasco	-5	1.8	41.4	7	14.5	41.2
Cataluña	-1.5	2	31.9	7.6	10.3	42.4
Castilla-León	-7	1	26.8	10	9.9	39.6
Baleares	-2	1.2	8.8	7.3	14.7	55.5
Extremadura	-1.1	1	15.9	13.3	13.2	57.6
La Rioja	1	1.5	44.7	5.7	16.2	35.1
Cast. Mancha	-0.8	1	29.5	10.8	11.3	30.7
Andalucía	-1.1	1.2	19.5	9.9	7.1	59.9
Average	-0.7	1.535	26.2	8.8	11.6	41
Standard Dev.	1.21	0.501	9.6	1.7	3.2	9.9
Maximum	2.9	2.7	44.7	13.3	16.3	59.9
Minimum	-2.9	1	8.8	5.7	6.8	26.8

### 3.- How do regions react to monetary shock? Why? An empirical approach.

Although there is an important lack of studies concerning the regional effect of a single monetary policy, two different approaches allow us to shed some light on the



question, national macroeconomic models and small models mainly using Vector Autoregressive techniques.

In the first case, the effect of a monetary policy using large national econometric models have been compared by the Bank for International Settlements (1995), although the international comparisons are very hard when using these kind models not prepared to do this type of exercise, its study provides some evidence of differential national effects of monetary policy.

Concerning the second type of models, Vector Autoregressive models perform relatively well. VARs models used to evaluate the impact of monetary policy shocks across countries have been implemented by Gerlach and Smets (1995), Barran, Couydart and Mojon (1997) and Britton and Whitley (1997). These papers provide evidence on cross-country differences in the monetary shocks response among European countries. Although they differ in the identification restrictions, they can be used to analyse similarities and differences. In general, VARs models show that monetary policy is endogenous in the sense that moves to accommodate the macroeconomic imbalances and second monetary policy shocks explain less than 20% of output variations (Bernanke Gertler and Watson, 1997) but these shocks have significant and persistent real effects that seem to be different across countries.

Dornbusch, Favero and Giavazzi (1997) prefer central banks reaction functions to address statistically differences among six countries when measuring the effect of monetary policy on output. They find significant asymmetries across European countries

On the regional level there is much less done. Garrison and Chang (1979) and Carlino y define (1995 and 1997), using VARs techniques, find regional differences in the effects of monetary policy for the United States. Although VARs techniques are frequent when analysing national data with regional information is much less common. VAR techniques will be increasingly used in regional analysis as they are parsimonious in the use of data, provide a flexible accommodation of economic theory and perform relatively well (Carlino and define 1995 and 1997).

Our methodological proposal is a simultaneous VAR estimation for the seventeen Spanish regions. The error terms of the equations for the seventeen regions are likely correlated, so if we use OLS techniques, we would obtain inefficient estimations because we would be ignoring the information contained in the contemporaneous covariances of the regional error terms. Seemingly Unrelated Regression (SUR) techniques include these contemporaneous correlations, and can improve the quality of estimations. Besides, with this technique, as we are estimating jointly equations across regions we can test if some parameters in the system do not vary across regions and we can estimate them as constant across regions. In table 2, we see that we accept that the parameters of employment and money in price equation and and money parameters in

	Employment equation	Price equation	Interest rates equation	Money equation
Employment	0	0.24	0	0
Price	0	0	0	0
Interest rate	0	0	0	0
Money	0	0.24	0.99	0.99

In the estimation we include one real variable, employment, and three other variables, the consumer price index, the amount of money (M3) and nominal interest rate. Tests show that they are integrated and that first differences, of logarithms, are needed except for interest rate that is included in levels. Notice that M3 and interest rate do not have regional desegregation. We let each region to react differently to these national variables. The variables are quarterly from 1980:1 to 1995:4. We use four lags of each variable with quarterly time dummies in the constant term.

Employment series come from the Spanish Labour Force Survey. As price

indicator we use regional consumer prices indexes from the National Statistics Office (INE) and monetary policy variables are from Bank of Spain. As nominal interest rate we use quarterly average of ten day auctions of Central Bank interest rate and as amount of money we use Liquid Assets in Held by the Public (ALP).

As we have said, we estimate by SUR a system of these four variables for the seventeen Spanish regions imposing the restrictions across regions accepted in table 2. After estimating this reduced form of the model, we need to impose some restrictions to get structural shocks and to analyse impulse response functions (IRF) to these shocks. We only consider short run restrictions and we organize the variables in a way that restrictions can be written in a lower triangular matrix and so we can use the Cholesky decomposition of the variance-covariance matrix of residuals to get structural shocks. We can resume our short run restrictions in the following equation:

$$\begin{pmatrix} \mu_L \\ \mu_P \\ \mu_R \\ \mu_M \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ x_{L,R} & 1 & 0 & 0 \\ x_{L,R} & x_{P,R} & 1 & 0 \\ x_{L,M} & x_{P,M} & x_{R,M} & 1 \end{pmatrix} \begin{pmatrix} e_L \\ e_P \\ e_R \\ e_M \end{pmatrix}$$

Where  $L$  corresponds to employment,  $P$  stands for prices,  $M$  for amount of money and  $R$  is the interest rate.

In line with similar assumptions for the Spanish economy we consider that there are not contemporaneous effect on employment of any other variable in the model. We are assuming a price stickiness in the short run. We consider that real variables do not react either to monetary policy within a quarter and finally we suppose monetary variables can react contemporaneously to the rest of variables as result of accommodating monetary policy, but interest rate do not react in the same quarter when the amount of money is moving. We have used some similar specifications that let prices to react within the month to real variables and the results don't change significantly.

### **3.- Results**

After estimating the VARs we decompose the residuals into structural shocks using the previous matrix of restrictions as it is explained above and then we calculate the impulse response functions of real variables to a standard deviation shock in M3 or interest rate error term.

Results, see table 3, suggest that Spanish regions do not react in the same manner to monetary policy. An increase in M3 increases employment and output in almost every region but the size of the effect is different. For instance the effect on employment in regions like Andalucia, Extremadura or La Rioja is more than twice the effect in Madrid or Murcia. These differential effects reproduce in output and very similarly in the effect of a rise in interest rate.

<b>Table 3</b>		
<b>Regional responses to a monetary shock*</b>		
Response of employment in each region after 8 quarters to a standard deviation shock in each variable		
Shock to	Amount of money	Interest rate
Cantabria	0.23	-0.15
Murcia	0.57	0.18
Canarias	0.64	-0.74
Madrid	0.67	-1.89
Asturias	0.73	-1.35
Aragón	0.77	-1.22
Galicia	0.77	0.14
Navarra	0.78	-0.98
Com. Valenciana	0.83	-1.26
País Vasco	0.85	-0.21
Cataluña	0.86	-1.22
Castilla-León	0.86	-0.47
Baleares	0.90	-0.94
Extremadura	1.07	-0.57
La Rioja	1.07	-1.25
Cast. Mancha	1.10	0.13
Andalucía	1.61	-1.27
Average	0.841	-0.769
Standard Dev.	0.286	0.620
Maximum	1.608	0.180
Minimum	0.226	-1.887

We can see these differences more precisely in graphs 1 and 2. In these graphs we present regional impulse responses to a one standard deviation shock in M and R respectively. We can see like there are quite differences across regions.

Now, our interest is to try to identify some possible sources, according the theories of previous section, that explains these different reactions across regional to the same monetary policy shock. A first exercise to illustrate where these differences

come from is to make some simple regressions of the responses by region against some variables identified in section 2 as elements that can explain the different responses. The results using as dependent variable the shocks of table 3 and as independent variable some variables of table 1 and a constant are presented in table 4.

	Dependent Variable: Employment response after 2 years to a shock in M							
	Coeff.	T.stat	Coeff.	T.stat	Coeff.	T.stat	Coeff.	T.stat
Net lending pos.	-0.0013	-2.50	-0.0013	-2.66	-0.0010	-2.10	-0.0011	-2.59
%Emp +50	-0.0024	-1.94	-0.0019	-1.58			-0.0018	-1.66
%Collect. Barg.			0.0111	1.89	0.0205	2.87	0.0181	2.65
%Ind. sector					0.0121	1.64	0.0119	1.72
Adjusted R2	0.27		0.38		0.39		0.46	

The results show that regions with regional governments with greater lending constrains are more sensitive to monetary policy as expected because both release the debt constraint and makes cheaper the debt refunding. The manufacturing percentage have also the expected effect. A greater ratio of monetary policy sensitive industries make the region as these sectors use more intensely the credit channels. And finally those regions with a larger percentage of collective bargaining are more sensitive to monetary policy reflecting, probably, the greater real effect of monetary policy when nominal wages are negotiated.

#### **4.- Concluding comments**

This paper uses quarterly data for the period 1980:1 to 1995:4 for Spanish regions to study the different regional effects of a common monetary policy. We use a joint estimation across regions of a VAR that includes real and monetary variables to identify the responses of employment to monetary variables (interest rate and amount of money).

Our results provide first evidence that employment respond to interest rate and M3 shocks as expected but can be observed diverse sizes on these responses across regions according to the regional credit constrains.

We test the presence of these credit constraints using variables like net lending-borrowing position of the regional government, percentage of manufacturing activities. We find evidence of different credit constraints across regions depending on these variables.

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Tablas:

Orden de integración de las variables a nivel nacional

Phillips-Perron unit root test						
	I(2) vs. I(1)			I(2) vs. I(1)		
Variable						
Employment						
Prices						
Amount of money						
Interest rate						

Test de las 4\*4 restricciones.

Restrictions test					
		Employment	Prices	Amount of money	Interest rate
Constant					
Employment					
Prices					
Amount of money					
Interest rate					

Javier Rodriguez Fuentes

El sistema financiero es responsable de la provisión de crédito. A mayor desarrollo más disponibilidad de crédito

Efectos de los costes financieros de cada región

Preferencia por la liquidez y aversión al riesgo de bancos inversores y ahorradores

Ineficiencias en los mercados financieros

Kashyap y Stein 94

Lending channel. Cuando el banco central varía la pm los grandes y pequeños bancos reaccionan diferente (los pequeños son más sensibles). Lo haen con datos de bancos.

Bernanke y Blinder (92) lo confirman con datos agregados

Barran Coudert Mojon

Las estructuras financieras son diferentes, los sistemas financieros son más o menos "desintermedias" las economías son más o menos abiertas los sistemas bancarios tienen más o menos competencia.

Mecanismos de transmisión

- efecto de los tipos de interés

  - substitución de la demanda final (consumo-inversión)

  - substitución a activos menos líquidos y más remunerados

  - renta de los acreedores deudores

  - efecto riqueza

- canal de crédito

  - limitar los créditos a los más fiables

  - disminución del valor del colateral

- tipo de cambio

The model is built on the IS-LM framework. We have a real and a financial sector. We consider our framework as a variant of the Blanchard and Quah (1989)<sup>1</sup>. On the IS side we consider a production function that with a productivity level equal to  $\theta_t$  and using labor,  $N_t$ , produce under CRS the aggregate supply,  $Y_t^s$ , equation (), our aggregate demand,  $Y_t^d$ , is a function of the real balances,  $M_t - P_t$ , where  $M_t$  is the amount of money and  $P_t$  is the price level, we also allow productivity term to affect aggregate demand through the parameter "a", equation (). The price level is set using the traditional mark-up price setting rule on the unit labour cost, equation (), where  $w_t$  correspond to nominal wages that depends on the level of employment, equation (). Finally on the financial sector side we consider that the money supply on real terms is only affected by a shock,  $\zeta_t$ , and wage level depends on the employment level, equation ().

$$Y_t^d = M_t - P_t + a\theta_t$$

$$Y_t^s = N_t + \theta_t$$

$$P_t = W_t - \theta_t + \mu_t$$

$$M_t - P_t = \zeta_t$$

$$W_t = -dN_t$$

To close the model we consider, as customary, that the exogenous shift factors evolves as random walks:

$$\Delta\theta_t = \xi_{st}$$

$$\Delta\mu_t = \xi_{dt}$$

$$\Delta\zeta_t = \xi_{mt}$$

Solving the model

$$N_t = M_t - P_t + (a-1)\theta_t$$

$$N_t = \zeta_t + (a-1)\theta_t$$

$$\Delta N_t = (a-1) \xi_{st} + \xi_{mt}$$

---

<sup>1</sup> They based their model on the Fisher (1977) paper.

$$P_t = -dN_t - \theta_t + \mu_t$$

$$P_t = -d\zeta_t - d(a-1)\theta_t - \theta_t + \mu_t$$

$$P_t = -d\zeta_t - (d(a-1) + 1)\theta_t + \mu_t$$

$$\Delta P_t = - (d(a-1) + 1)\xi_{st} + \xi_{dt} - \xi_{mt}$$

$$M_t + d\zeta_t + (d(a-1) + 1)\theta_t - \mu_t = \zeta_t$$

$$\Delta M_t = - (d(a-1) + 1)\xi_{st} + \xi_{dt} + (1-d)\xi_{mt}$$

permite establecer comparaciones internacionales  
diseño de políticas regionales

Temas para incluir:

Integradas (relacion a LP)

Variance decompositions

El empleo responde menos que el GDP porque bajan los inventarios (Bernanke  
Getler 1995

Comprobar que sean significativamente diferentes las respuestas

Autoridad	_____	Estructura	_____	Economía
Monetaria		Financiera		Real

## SECTOR REAL

### MACRO

Tamaño de la construcción y manufacturas

Tamaño del sector financiero

Tamaño de las empresas

Centralización de la negociación colectiva

### MICRO

Varia el precio de los activos

Valor marginal de la riqueza

Efectos riqueza (positivos sobre los prestamistas)

Por lo tanto tiene efectos sobre el consumo.

## **SECTOR FINANCIERO**

Composición de préstamos a corto y a largo

Composición de bonos y préstamos

Mayor external finance premium

Reduce el valor del colateral

Tipo fijo vs variable

## **DEBREMOS HACER**

**A simple monetary model of regional dynamics**

**Regional response dynamics**

## PRESENTACIÓN COMENTARIOS

INVERSIÓN

% CONVENIOS CONVENIOS/ASALARIADOS

URBANIZACION DENSIDAD

NIVEL CULTURAL

%TURISMO (SECTOR ABIERTO)

DESFASE DE RESPUESTA DE L

TIPOS DE INTERES LIBERALIZADOS A MEDIADOS DE LOS 80

MEDIAS DEL PERIODO PARA LAS VARIABLES

ESTUDIAR EL SHOCK NACIONAL E INCLUIRLO EN LAS ECUACIONES REGIONALES

RETARDO MEDIO

%DEL SHOCK ABSORBIDO

RESPUESTAS DE LOS PRECIOS