REGIONAL EFFECTS OF MONETARY POLICY: TURKEY CASE

DURAN, Hasan Engin[1],
ERDEM, Umut[2]

Abstract
Monetary policy is primarily designed for national purposes, say price stability. However, its impact may vary significantly across regions. Why some regions respond more strongly to monetary policy is a challenging topic both theoretically and empirically. Indeed, three main hypothesis on this issue have been put forward: (i) regions with high share of manufacturing, (ii) regions that include higher proportion of small-scale firms and banks, (iii) regions which are more open to trade are likely to respond more strongly to changes in monetary policy. Although these hypotheses have been thoroughly and heatedly discussed by a strand of scholars, far little attention has been paid to the role of geographical factors and spatial spillovers. In fact, we precisely address this issue. Aim of the present paper is to examine the validity of three hypotheses and, additionally, the role of spatial spillovers in regional monetary transmission mechanism in Turkey. Our analyses indicate three major results: First, provinces respond quite heterogeneously to unexpected changes in monetary policy. Second, spatial spillovers and geographical proximity clearly matter in monetary transmission such that neighboring regions are likely to exhibit similar reactions to monetary policy. Third, among the hypothesis above *bank size* and **trade** *openness* are found to be significant.
Keywords Monetary Policy, Spatial Spillovers, Monetary Transmission
JEL Codes E32, E63, R11

1. Introduction

The issue of how monetary policy affects real economic activity and output has been heatedly debated within a large body of literature. (Taylor, 1995; Mishkin, 1996) Although, monetary policy is primarily designed for national purposes, say price stability, its impact may vary significantly across regions and sectors. (Carlino and DeFina, 1999; Anagnostou and Papadamou, 2012; Goodness and Ragan, 2012) In other words, monetary policy decisions may have strong effects in some regions and little or no effects in others depending on the region's industrial structure, productive capacities, techology, and institutional features (Carlino and DeFina, 1998; Carlino and DeFina, 1999; Owyang and Wall, 2009).

The reasons of why some regions may respond more strongly to the changes in monetary policy is a challenging topic both theoretically and empirically. Indeed, three main hypothesis on this issue have been put forward in the literature.

[1] Assistant Professor of Economics, Izmir Institute of Technology, City and Regional Planning Department, Vice Dean of Faculty of Architecture, Head of Engineering Management Master Programme. Email: enginduran@iyte.edu.tr, Adress: Izmir Yüksek Teknoloji Enstitüsü, Gülbahçe Köyü, Izmir-Turkey
[2] Research Assistant, Izmir Institute of Technology, City and Regional Planning Department, Email: umuterdem@iyte.edu.tr, Adress: Izmir Yüksek Teknoloji Enstitüsü, Gülbahçe Köyü, Izmir-Turkey

The initial hypothesis is the *interest rate channel* according to which responsiveness of a region to a monetary policy shock depends on its industrial structure. (Carlino and DeFina,1998; Carlino and DeFina,1999) Some industries, such as construction and manufacturing, are known to be credit dependent and particularly sensitive to changes in interest rate (Taylor, 1995; Mishkin, 1996). Hence, regions that include high proportion of manufacturing and construction industries are likey to exhibit excessive output reactions to the tightenning of monetary policy (Carlino and DeFina, 1998; Carlino and DeFina, 1999, Ridhwan et al. 2010)

Second hypothesis is known as *Credit Channel* which indicates the fact that regional sensitivity to monetary policy is related to its firm size *(Broad Credit Channel)* and bank size *(Narrow Credit Channel)* (Bernanke and Gertler, 1995). Larger firms generally have greater access to external financial resources while small firms are conventionally bound to bank loans (Gertler and Gilchirst, 1993; Oliner and Rudebusch; 1996). In a similar vein, larger banks have more alternative resources than small banks that resort mostly to local financial markets. Hence, during the periods of monetary contraction, small scale firms and banks are likely to suffer more from monetary policy since they have higher information and transaction costs for obtaining alternative funding sources. (Kashyap and Stein, 2000; Anagnostou and Papadamou, 2012) Accordingly, regions that include high proportion of large-scale firms and banks are likey to suffer less from monetary policy tightenning.

The third channel concerns the transmission of monetary policy via *exchange rate channel* which is relevant for open regional economies (Anagnostou and Papadamou, 2012; Ridhwan et al. 2011) For a national economy, an increase in interest rate induces capital inflows that, in turn, cause the exchange rate to appreciate. In such an instance, economy looses its competitiveness since the demand for export-goods will decline. Appreciation of the currency would cause a further decline in domestic price level and mark-ups, which directly worsens the competitive position of domestic firms. These circumstances naturally influence open regional economies more than relatively closed ones. Hence, regions that include high proportion of export and import oriented industries are likely to be affected more from changes in interest rate and exchange rate (Hayo and Uhlenbrock, 2000). A counter argument to this hypothesis has been developed by Ber et al. (2001) according to whom export-intensive firms may be even less prone to monetary policy. Such that when domestic interest rates are increased, exporting firms may find more easily credit in foreign financial markets (where they have built a network and reputation with local lenders abroad) and thus do not have to reduce the investment (Ber *et al*. 2001).

Although the hypotheses above have been thoroughly and heatedly discussed by a strand of scholars, far little attention has been paid to the role of geographical factors and spatial spillovers in the regional transmission of monetary policy. In fact, we precisely address this issue. We argue that neighboring regions are likely to exhibit similar reactions to monetary policy and transmit their responses to each other. This may happen through bilateral intense trade and financial linkages, substantial input-output relationships and transfer of production factors (capital and labor).

Commonly adopted tool in testing the three channels above is employing the cross sectional regression analysis but none of the papers, has, so far, taken into account possible spatial autocorrelation and spillovers in their regression models. Failing to do so might, in fact, lead to distorted results.

Aim of the present paper is to examine the importance of spatial spillovers in regional transmission of monetary policy using annual data for 67 Turkish provinces between 1975 and 2000. We believe that Turkey is a relevant place for study in which there exist sizable socio-economic and demographic imbalances across provinces (Gezici and Hewings, 2007; Yildirim et al. 2009; Duran (2013)). Indeed, to the best of our knowledge, this paper is a first attempt to study monetary transmission mechanisms at the regional level for Turkey. Our set of research questions is summarized below:

i. Do Turkish provinces respond heterogenously to the monetary policy shocks?

ii. What are the economic reasons for high responsive provinces? Do spatial spillovers play an important role in regional transmission of monetary policy?

Organization of the paper is as follows: In section 2, we implement our empirical analysis in two sub-sections. In 2.1, we adopt a time series Vector Autoregression (VAR) model to estimate the impulse-response functions (IRF) of each provincial economy to monetary policy shocks and demonstrate the extent of the heterogenous responses among provinces. Sub-section 2.2 is devoted to analysing the economic reasons of why some provinces are more responsive to monetary shocks using spatial regression models. Finally, we conclude our study in section 3.

2. Empirical Analysis

2.1 Heterogenous responses of provinces to monetary policy shocks

A first step in our empirical analysis is to estimate the output response of each provincial economy to an unexpected change in monetary policy. Following what’s commonly done in the literature, we adopt the following reduced form VAR model (Carlino and Defina, 1999; Ridhwan et al., 2011; Owyang and Wall, 2009):

$$y_t = c + \sum_{j=1}^{J} A_j y_{t-j} + \mu_t \tag{1}$$

y_t is the nx1 vector of n endogenous variables, c is constant, A_j is the nxn matrix of coefficients, j is the number of time lags determined according to Akaike Information Criterion, μ_t is the vector of random error terms, uncorrelated with past values of y_t. Set of endogenous variables that are used in VAR system is summarized below:

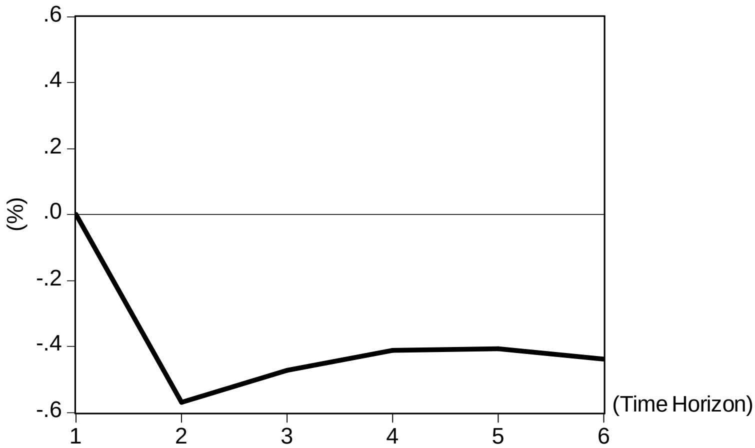
$$y_t = \{\Delta gdp_t, \Delta cpi_t, \Delta energy_t, \Delta int_t, \Delta exch_t, \Delta grp_{p,t}\} \tag{2}$$

where *gdp* stands for national real gdp (in 1987 prices), *cpi* is the consumer price index, *energy* is the percentage share of energy prices in total wholesale price index that represents the relative importance of energy prices, *int* denotes the interest rate on Central Bank discount as a measure of monetary policy, *Exch* is the exchange rate of Turkish lira againts US dollar. Finally, grp_i is the real gross product for province *i*.[3] All variables cover the period of 1975-2000. They are logged and first differenced in order to maintain stationary series.

VAR methodology directly estimates the co-variates of all endegenous variables using time lags of all variables. We perform VAR estimations for 67 provinces and the national economy.

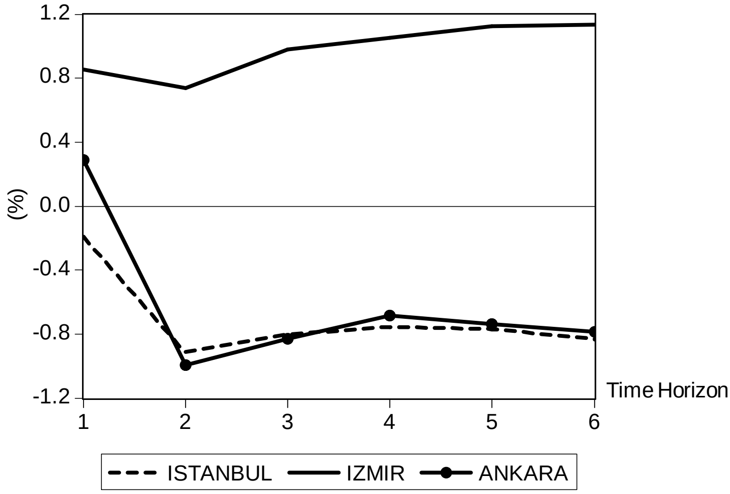
In order to understand, specifically, the provincial output reactions to monetary policy shocks, we estimate the impulse response functions (IRF) for each province. Specifically, IRF summarizes responses of one variable over time to an unexpected change in another variable. In our case, we estimate the cumulative IRF function of GDP in response to an unexpected 1 % increase in interest rate. Cumulative IRF functions of national economy and three biggest provinces have been depicted in Figures 1 and 2 respectively.

Figure 1 Cumulative Impulse Response of national economy to 1 % interest rate shock, Impulse: Δinterest rate, response: Δ GDP



[3] In terms of data sources, we obtained regional GDP series from Karaca (2004) and Kasman and Turgutlu (2009), who constructed and used a dataset using resources from former SPO (State Planning Organization) and Turkish Statistical Institute TUIK. I am grateful to them for sharing their dataset with me. I obtained CPI and energy price series from (TUIK) and the interest rate data and exchange rate from former SPO.[3]

Figure 2 Cumulative Impulse Response of 3 biggest provinces to 1 % interest rate shock, Impulse: Δinterest rate, Response: Δ GDP



At a glance, it is observed that 1 % unexpected increase in interest rate lowers national GDP by 0.45 % in 6 years and GDP of Ankara and Istanbul by 0.9 %. However, Izmir responds quite differently from others by increasing its gdp by 1.2 % approximately.

To be able to have a more general idea, we summarize in Table 1 the cumulative IRF of each province for the 2nd , 4th and 6th years. The responses seem to be strongly heterogenous that range between -2.28 % and 1.16 % for 2nd year, -2.27 % and 1.14 % for 4th year and -2.15 % and 1.05 % for 6th year.

Average response is -0.49 % , -0.41 % and -0.44 % for 2nd , 4th and 6th years respectively while standard deviation is quite high (0.80, 0.84 and 0.87). One may, therefore, argue that responses of provincial economies to monetary policy shocks are quite heterogenous that some of provinces are over-reactive while others remain almost irresponsive.

This fact is consistent with the findings in the literature in which scholars report differential responses of regional economies to monetary policy shocks. Some examples of these studies are Carlino and DeFina (1999) who analyze income responses of 48 U.S. States to Federal Funds rate, Crone (2007) who studies economic responses of BEA regions to monetary policy in US, Owyang and Wall (2009) who estimate the impulse responses of U.S. regions to monetary policy, Arnold and Vrugt (2002) who study regional differential effects of monetary policy in Netherlands, Anagnostou and Papadamou (2012) who analyze the differential spatial impact of monetary policy in Greece, Ridhwan et al. (2012) and Svensonn (2012) who performs similar analysis for Indonesian and Swedish regions

Table 1 Cumulative Impulse Responses of provinces to 1 % interest rate shock, Impulse: Δ % interest rate, Response: Δ % GDP

Provinces	2nd Year	4th Year	6th Year	Provinces	2nd Year	4th Year	6th Year
Adana	-1,58 %	-1,27 %	-1,14 %	Kayseri	-0,48 %	-0,11 %	-0,24 %
Adıyaman	-1,27 %	-1,39 %	-1,25 %	Kırklareli	-0,68 %	0,15 %	0,14 %
Afyon	-0,39 %	-0,37 %	-0,57 %	Kırşehir	-0,90 %	-0,64 %	-0,68 %
Ağrı	-0,89 %	-0,98 %	-1,11 %	Kocaeli	0,52 %	0,79 %	0,69 %
Amasya	-0,41 %	-0,49 %	-0,69 %	Konya	-0,44 %	-0,33 %	-0,37 %
Ankara	-0,99 %	-0,69 %	-0,79 %	Kütahya	0,77 %	1,01 %	0,99 %
Antalya	-0,27 %	-0,04 %	0,04 %	Malatya	-1,27 %	-0,88 %	-0,79 %
Artvin	0,12 %	0,24 %	0,31 %	Manisa	-1,41 %	-1,06 %	-1,10 %
Aydın	-0,32 %	-0,05 %	0,08 %	K.Maraş	0,56 %	0,74 %	0,92 %
Balıkesir	-0,10 %	-0,02 %	0,05 %	Mardin	-0,03 %	0,06 %	-0,09 %
Bilecik	0,78 %	0,71 %	0,75 %	Muğla	0,05 %	0,51 %	0,61 %
Bingöl	0,28 %	0,44 %	0,20 %	Muş	-0,47 %	-0,84 %	-0,99 %
Bitlis	-2,22 %	-2,09 %	-2,17 %	Nevşehir	-0,10 %	-0,20 %	-0,09 %
Bolu	-1,80 %	-1,55 %	-1,72 %	Nİğde	-1,16 %	-1,36 %	-1,27 %
Burdur	0,59 %	0,62 %	0,43 %	Ordu	-0,61 %	-1,19 %	-0,98 %
Bursa	-0,41 %	-0,23 %	-0,14 %	Rize	-0,83 %	-0,68 %	-0,52 %
Çanakkale	0,02 %	0,29 %	0,52 %	Sakarya	-0,50 %	-0,70 %	-0,82 %
Çankırı	-0,73 %	-0,96 %	-0,92 %	Samsun	0,09 %	0,06 %	0,03 %
Çorum	-1,53 %	-1,25 %	-1,39 %	Siirt	1,16 %	0,51 %	0,02 %
Denizli	0,46 %	0,48 %	0,56 %	Sinop	0,31 %	0,34 %	0,38 %
Diyarbakır	-0,94 %	-1,07 %	-0,87 %	Sivas	-1,24 %	-1,03 %	-1,24 %
Edirne	0,17 %	0,39 %	0,29 %	Tekirdağ	0,28 %	0,50 %	0,40 %
Elazığ	0,12 %	0,36 %	0,45 %	Tokat	0,09 %	0,03 %	-0,18%
Erzincan	-0,08 %	-0,21 %	-0,18 %	Trabzon	-0,52 %	-0,68 %	-0,53 %
Erzurum	-1,78 %	-1,64 %	-1,78 %	Tunceli	-0,09 %	-0,02 %	-0,04 %
Eskişehir	-0,31 %	-0,14 %	-0,18 %	Şanlıurfa	-1,37 %	-0,80 %	-1,14 %
Gaziantep	-2,28 %	-2,15 %	-2,18 %	Uşak	0,71 %	0,60 %	0,69 %
Giresun	-1,41 %	-2,14 %	-2,12 %	Van	-2,01 %	-2,01 %	-2,16 %
Gümüşhane	-0,55 %	-0,73 %	-0,97 %	Yozgat	-0,66 %	-0,16 %	-0,24 %
Hakkari	-0,18 %	0,13 %	0,06 %	Zonguldak	-1,63 %	-2,06 %	-2,27 %
Hatay	-1,03 %	-0,99 %	-0,91 %				
Isparta	0,07 %	0,17 %	0,22 %				
İçel	0,51 %	0,83 %	0,72 %	**Minimum**	**-2,28** %	**-2,15** %	**-2,27** %
İstanbul	-0,91 %	-0,76 %	-0,84 %	**Maximum**	**1,16** %	**1,05** %	**1,14** %
İzmir	0,74 %	1,05 %	1,14 %	**Mean**	**-0,49** %	**-0,41** %	**-0,44** %
Kars	-1,46 %	-1,62 %	-1,82 %	**Std. Dev.**	**0,80** %	**0,84** %	**0,87** %
Kastamonu	-0,66 %	-0,74 %	-0,96 %	**Std/Mean**	**-1,65** %	**-2,07** %	**-1,96** %

With regard to the geographical distribution of provincial responses, Figure 3, in the Annex, presents maps that illustrate the cumulative impulse response of each province at three different time horizons; 2nd, 4th and 6th years. Some interesting features appear to emerge: First, it is immediate to note that Western provinces (especially those which are close to coast of Aegean, Medditeranean and Marmara Sea) seem to be less sensitive and positively responding to monetary policy shocks while East and Nothern Anatolian provinces look excessively sensitive and negatively reponding to monetary policy shocks. Hence, an unanticiapted increase in interest rate considerably lowers GDP in Eastern and North Eastern provinces.

Second, the responses seem to follow a spatially correlated pattern that geographically close provinces visually display similar responses. In other words, neighboring provinces exhibit similar reactions to monetary shocks since they are likely to transmit each other the shocks via intense trade and financial relationships, substantial input-output movements and exchange of production factors (capital and labor).

To support this finding from an inferential point of view, in Table 2 we perform a Moran I's test to cumulative impulse responses of provinces adopting row standardized Binary Contiquity Matrix as a spatial weights matrix.

Table 2 Spatial Autocorrelation in Cumulative Impulse Response Functions of provinces (Moran I's Test)

	Moran I's Statistic	P-value
2-Year CIRF	0,13**	0,026
4-Year CIRF	0,24***	0,0004
6-Year CIRF	0,28***	0,00005

*** indicates significance at 1 %, ** at 5 %, * at 10 %

Results provide a confirmatory evidence in support of our argument that provincial responses are found to be spatially (positive) autocorrelated at all time horizons. P-Values of Moran I's test are significant at 1%-5 % for each time point.

Consequently, geographical proximity and spatial spillovers may be considered as an important factor in the regional transmission of monetary policy. Ignoring this, might, in fact, fall short from providing an adequate account of possible reasons behind the heterogenous responses of provinces. Examining this issue is, however, the subject of next section.

2.2 Determinants of Heterogenous Responses: Role of Spatial Factors

As anticipated earlier, three major hypotheses (interest rate, credit, exchange rate channels) on why some regions are more reactive to monetary policy have been extensively discussed in the literature. (Carlino and DeFina, 1999; Owyang and Wall, 2009; Anagnostou and Papadomou, 2012).

In this section, we aim at testing these hypothesis by allowing for, additionally, the spatial spillovers among provinces in their monetary transmission mechanism. In order to do so, we consider the following regression model:

$$CIRF_i = \alpha + \beta_1 Bank_{size_i} + \beta_2 Trade_{openess_i} + \beta_3 pop_i + \beta_4 Firm_{size_i} + \beta_5 manuf_i + \epsilon_i \quad (3)$$

$CIRF_i$ stands for cumulative impulse response function of province *i* estimated in section 2.1. This variable generally takes negative values as provincial economies tighten the output growth in response to an increase in interest rate. So, lower values of *CIRF* indicates greater negative response of provincial GDP to the monetary policy shock. We use *CIRF* at three different time points, i.e. at 2nd, 4th and 6th years.

With regard to independent variables, $Bank_{size_i}$ is the average number of employees per bank and financial intermediary firms, $Firm_{size_i}$ is the percentage of firms that have more than 10 employees in province *i (*for year 2002). [4] Greater values for these two variables indicate larger bank and firm size in that province. *manuf* represents the percentage share of manufacturing sector's GDP in total GDP (average of 1987-2001). *Trade_openess* is the share total exports and imports within GDP of the province ($\frac{Imports_i + Exports_i}{GDP_i}$) (as an average of 1996-2001 period). Finally, *pop* is the population of the province (in logs), used as a control variable. (average of 1975-2000 period).

We run the cross sectional regression equation (3) using simple OLS. Results are summarized in Table 3.

Table 3 Regression Results: OLS

	Dependent Variable: Cumulative Impulse Response Function (CIRF)		
Independent Variables:	2 year CIRF	4 year CIRF	6 year CIRF
Bank_size	0.02	0.03	0.02
Trade_openess	0.13	0.12	0.12
population	-1.21***	-1.16**	-1.16**
Firm_size	-0.01	0.03	0.06
manuf	0.02**	0.02*	0.02*
Spatial Autocorrelation tests:			
LMerr	10.72***	20.47***	25.02***
LMlag	5.51**	12.77***	16.75***
RLMerr	13.90***	16.23***	15.39***
RLMlag	8.68***	8.52***	7.12***
SARMA	19.40***	29.00***	32.15***

*** indicates significance at 1 %, ** at 5 %, * at 10 %

[4] Bank size, firm size, manufacturing and population data for provinces have been obtained from TUIK and only available for year 2002.

An important point should be noted from results that none of the variables, except population and manufacturing, is significant. However, this may be due to a neglected spatial autocorrelation that might have biased the results. So, we perform 5 different spatial autocorrelation tests and report the results in the bottom part of Table 3. All of the tests are significant at 1 % which indicates the presence of strong spatial autocorrelation in regression models which is ignored and needs to be considered in our analysis.

A first way of incorporating spatial factors in our analysis is adopting the following Spatial Lag Model (Anselin, 1988):

$$CIRF_i = \alpha + \rho W CIRF_i + \beta_1 Bank_{size_i} + \beta_2 Trade_{openess_i} + \beta_3 pop_i + \beta_4 Firm_{size_i} + \beta_5 manuf - \epsilon_i$$

where ρ (rho) is the spatial parameter that captures the spillovers of responses among neighbouring provinces. *W* represents the spatial weights which is in the form of row standardized binary contiquity matrix. An alternative way of examining the importance of spatial factors is employing the Spatial Error Model which estimates the spatial dependence among the unobserved/error component of neighbouring regions:

$$CIRF_i = \alpha + \beta_1 Bank_{size_i} + \beta_2 Trade_{openess_i} + \beta_3 pop_i + \beta_4 Firm_{size_i} + \beta_5 manuf_i + \epsilon_i$$

$$\varepsilon_i = \lambda \mathbf{W} \varepsilon_j \qquad (5)$$

where λ captures the spatial dependence in the error terms of neighbouring provinces *i* and *j*.

We estimate both Spatial Lag (Equation 4) and Spatial Error Models (Equation 5) using Maximum Likelihood technique. The results are presented in Table 4.

Table 4 Regression Results: Spatial Regression Models

	Dependent Variable (CIRF): Cumulative Impulse response of provincial GDP to1 % interest rate shock					
	Spatial Error Model			Spatial Lag Model		
Independent Variables:	2 year CIRF	4 year CIRF	6 year CIRF	2 year CIRF	4 year CIRF	6 year CIRF
Spatial Spillover (λ or ρ)	0.52*** (λ)	0.65*** (λ)	0.69*** (λ)	0.37** (ρ)	0.53*** (ρ)	0.57*** (ρ)
Bank_size	0.06**	0.07***	0.07***	0.04	0.05*	0.05*
Trade_openess	0.27**	0.22**	0.22**	0.18	0.16	0.16
population	-1.57***	-1.66***	-1.84***	-1.29***	-1.28***	-1.37***
Firm_size	-0.14	-0.13	-0.05	-0.11	-0.13	-0.10
manuf	0.03***	0.03***	0.03***	0.03***	0.03***	0.03***

*** indicates significance at 1 %, ** at 5 %, * at 10 %

It is immediate to note that both ρ **and** λ are positive and significant at 1 % in all regressions which constitutes a strong set of evidence in favour of the presence of spatial spillovers in the regional monetary transmission mechanism. So, highly sensitive provinces to monetary policy are likely to influence neigbouring regions' responses and, hence, they exhibit a similar pattern of output reactions to monetary shocks. As argued before, this may happen trough intense bilateral trade and financial linkages, input-output relationships, labor and capital movements across neigbouring provinces.

Apart from spatial factors, bank size, trade openess, share of manufacturing and population seem to be the important explanatory variables. Bank size has positive and significant coefficient in Spatial Error Model and insignificant coefficient in Spatial Lag model. Thus, one may argue that provinces that include high share of large banks and financial firms tend to have sluggish responses and suffer less from monetary shocks compared to provinces with smaller banks. This seems plausible since larger banks can have better access to alternative financial resources during the periods of tight monetary policy in both domestic and international markets. In a similar vein, relatively more open provincial economies, that include high share of exports and imports within GDP, tend to suffer less from a monetary policy contraction since these provinces may be able to find alternative financial oppourtunities and credit easily in international environment using their networks and reputation. These results seem to be consistent with the findings in the literature in this field.

However, in contrast to the common view and theoretical explanations, we find that share of manufacturing has a significant coefficient with positive sign. So that provinces with high level of manufacturing do not seem to be negatively responding to unanticipated monetary tightenning and suffer less from an increase in interest rate.

Finally, population size of provinces is also a significant variable with negative coefficient which indicates the fact that provinces with large population (market size) tend to exhibit excessive output responses and suffer more from an unexpected tightenning of monetary policy.

Overall, Among the possible hypotheses tested, narrow credit channel and exchange rate channel seem to be the relevant ones for Turkey case. Above all, spatial spillovers of output responses to monetary contraction among neighbouring provinces seem to be unignorably important.

3. Conclusions

This paper has investigated the local impacts of monetary shocks and role played by spatial factors and spillovers in the regional transmission of monetary policy. Our results can be summarized in three parts.

First, provinces respond quite heterogenously to monetary policy shocks. Such that some of provinces are over-reactive while others remain almost irresponsive. Western provinces in Marmara and Ege regions seem to be less vulnerable and positively responding while East and Nothern Anatolian provinces look excessively sensitive and negatively reponding to monetary policy shocks.

Second, among the several hypothesis tested, the relevant ones seem to be the *narrow credit* and *exchange rate* channel which indicates the fact that provinces that include high share of small-scale banks and relatively closed economies are found to be highly (negatively) responsive and suffering from the unanticipated increases in interest rate.

Third, spatial spillover of monetary shocks is found to be critically important. Thus, neighbouring provinces are likely to exhibit similar reactions to changes in interest rate and share their responses via trade and financial linkages.

Overall, the lesson that we get from our analysis is that ignoring the spatial factors would create bias both for the economic analysis and fall short from providing an adequate understanding of regional transmission of monetary mechanism.

References

Anagnostou, A. and Papadamou, S. (2012). The effects of Monetary Policy shocks across the Greek Regions. In ERSA conference papers (No. ersa12p507). European Regional Science Association.

Anselin, L. (1988). In Spatial econometrics: Methods and models, Dordrecht: Kluwer.

Ber, H., Blass, A. and Yosha, O. (2001). Monetary transmission in an open economy: The differential impact on exporting and non-exporting firms. Bank of Israel Discussion Paper

Bernanke, B. S. and Gertler, M. (1995). Inside the black box: the credit channel of monetary policy transmission. *Journal of Economic Perspectives*, 9(4), 27-48

Carlino, G. and DeFina, R. (1998). The differential regional effects of monetary policy, *Review of Economics and Statistics*, Vol.80, 572-87.

Carlino, G. and DeFina, R. (1999). The differential regional effects of monetary policy: Evidence from the US states. *Journal of Regional Science*, 39(2), 339-358.

Crone, T. M. (2007). A pattern of regional differences in the effects of monetary policy. *Business Review*, (Q3), 9-19.

Duran H.E. (2013) Convergence of Regional Economic Cycles in Turkey, *Review of Urban and Regional Development Studies*, 25 (3), 152-175

Gertler, M. and Gilchrist, S. (1993). The role of credit market imperfections in the monetary transmission mechanism: Arguments and evidence. *Scandinavian Journal of Economics*, 95(1), 43-64.

Gezici, F. and Hewings, G. J. (2007). Spatial analysis of regional inequalities in Turkey. *European Planning Studies*, 15(3), 383-403

Goodness A. C. and Rangan Y. (2012). The effects of monetary policy on real farm prices in South Africa, *Regional and Sectoral Economic Studies*, 12(1), 127-151

Hayo, B. and Uhlenbrock, B. (2000). Industry effects of monetary policy in Germany. In: Von Hagen, J. and Waller, C. (eds), Regional Aspects of Monetary Policy in Europe. Boston: Kluwer.

Karaca, O. (2004). Turkiye'de Bolgeler Arasi Gelir Farkliliklari: Yakinsama Var Mi. Turkiye Ekonomi Kurumu Tartisma Metni, 7.

Kashyap, A. K. and Stein, J. C. (2000). What do a million observations on banks say about the transmission of monetary policy?. *American Economic Review*, 90(3), 407-428.

Kasman, A. and Turgutlu, E. (2009). Testing Stochastic Convergence Among the Regions of Turkey. *The International Journal of Emerging and Transition Econom*ies, 2(1), 81–98.

Mishkin, F. S. (1996). T The Channels of Monetary Transmission: Lessons for Monetary Policy, Banque de France Bulletin: Digest, Vol. 27, 33-44.

Oliner, S. D. and Rudebusch, G. D. (1996). Is there a broad credit channel for monetary policy? (pp. 3-13). Board of Governors of the Federal Reserve System.

Owyang, M. T., & Wall, H. J. (2009). Regional VARs and the channels of monetary policy. *Applied Economics Letters*, 16(12), 1191-1194.

Ridhwan, M.M., De Groot, H. L., Nijkamp, P. and Rietveld, P. (2011). The Regional Impact of Monetary Policy in Indonesia (TI 2011-081/3). Tinbergen Institute Discussion Paper

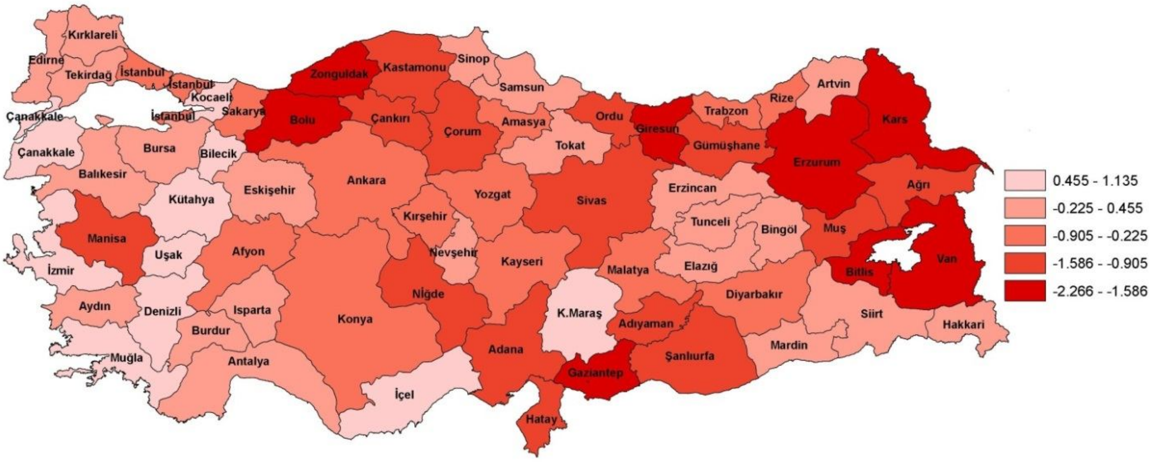
Svensson, L. E. (2012). Regional Effects of Monetary Policy in Sweden, Working Paper 2012:9, Lund University

Taylor, J. B. (1995). The monetary transmission mechanism: an empirical framework. *The Journal of Economic Perspectives*, 9(4), 11-26.

Yildirim, J., Öcal, N. and Özyildirim, S. (2009). Income inequality and economic convergence in Turkey: a spatial effect analysis. *International Regional Science Review*, 32(2), 221-254.

Annex on line at the journal Website: http://www.usc.es/economet/rses.htm

FIGURES



(3.1) 2nd Year Cumulative IRF

(3.2) 4th Year Cumulative IRF

(3.3) 6th Year Cumulative IRF

Figure 3 Distribution of Cumulative Impulse Response of provincial GDPs to 1% unanticipated increase in interest rate