FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH IN TURKEY: A SPATIAL EFFECT ANALYSIS[†‡]

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Abstract

This paper analyses the issue of financial development-economic growth across provinces of Turkey for the time period 1991-2001. Two alternative sub-periods, 1991-1995 and 1996-2001 are also considered to investigate if the financial crisis of 1994 has any structural change effects on the financial development- economic growth relationship. In addition to the traditional cross – sectional analysis, a spatial data analysis, controlling for fixed-effects to remove the effect of spatial dependence from that of spatial heterogeneity and of omitted variables, improves the performance of the models. Empirical evidence indicates that financial development has a positive effect on economic growth in Turkey.

JEL codes: G20, O18, C21, C23, R11.

Keywords: Financial development; economic growth; spatial data analysis; Turkey.

I. Introduction

There has been a continuous debate on the issue of financial development and economic growth. It has been argued that the pace of regional or national economic growth is influenced by the ability of financial firms to select the intermediaries that would utilize nation's savings. Hence financial intermediaries may affect productivity growth and technological change. Additionally, they may enhance economic growth by raising domestic savings and attracting foreign capital. An expected corollary to this proposition has been that competitive financial markets would improve this intermediation process. Recent empirical evidence on this issue suggests that financial development contributes to economic growth (Demetriades et al., 1998; Beck et al., 2000a). Some studies on the other hand argue that, even though economies with a well developed financial system mostly have high economic growth rates, this may not be caused by financial development. Rather, financial development may be a leading indicator of growth (Beck et al., 2000b); or financial development may follow economic growth as a result of increased demand for financial services (Robinson, 1952).[1]

Although the bulk of the studies investigate the issue using cross-country data, there is little evidence on the growth effects of financial development within the regions of a single country. Cross-country studies examine the financial development- economic growth relationship independent of differences in legal structures and cultural environments across countries (as these differences are difficult to specify accurately). However, a country's legal structure, economic history, and cultural environment may have a powerful influence on the effectiveness of the financial sector in facilitating economic growth. As legal, cultural and economic backgrounds are much more homogeneous among regions within a single country, an interregional analysis may reflect better the underlying relationship between financial development and economic growth than one using a cross-country framework. Moreover, one

[1] Friedman and Schwartz (1963) express similar views for the demand for money.

of the arguments in favour of financial development in a country has been to expand access to capital for smaller businesses, which are often innovators, in addition to their role in contributing to regional employment and output expansion. Additionally, results of a regional analysis of competition and economic growth can be viewed as indirect test of the apparent importance of financial sector competition found in cross-country studies

Even though there has been a consensus about the importance of spatial effects in convergence analysis, this aspect has been ignored in financial development-economic growth literature. Beta convergence analysis taking spatial dimension into account claims that rates of economic growth may be interdependent across regions due to spillover effects. In cases where regions pursue their own growth promoting policies, there may be spillover effects from that regions to the adjacent regions. Similarly, financial development in one region/province may have spill-over effects for neighboring regions/provinces such that financial development in one region/province may have growth and employment promoting effects in neighboring regions/ provinces. Even though economic theory assumes that capital is mobile among regions/ provinces, recent empirical analysis gives contrary evidence, implying that there are spatial effects to be taken into account. Thus, incorporating spatial effects into the analysis may impact significantly on any estimated convergence effects and provide a better understanding of financial development-economic growth effect.

The aim of this study is to investigate the effects of financial development-economic growth effect taking spatial dimension into account for the time period 1991-2001 using provincial level data for Turkey. The main contribution of this study is twofold: The first is that this study is a regional effect analysis rather than a cross-country analysis. Secondly, rather than using cross-section data analysis, as many convergence studies do, this study employs panel data spatial effect analysis. For this end, this study employs the methods formulated by Elhorst (2003) to estimate spatial panel data models. The rest of the paper is organized as

follows: Next section reviews the existing literature. Section 3 gives a brief account of the financial developments and regional development issues in Turkey. Econometric methodology is summarized in Section 4, whereas empirical results are presented in Section 5. Finally, Section 6 concludes.

II. Literature Review

Financial intermediaries are considered to reduce the information and transaction costs through their influences on savings rates, investment decisions and innovations. According to Wallich (1969) the impact of financial developments on economic growth is cyclical in the short run, but in the long run it affects the level of investment and its composition through two broad channels. First, improved financial intermediation can efficiently mobilize investments thus leading to an increase in the level of investment. The other channel emphasizes that financial development improves efficiency of investment rather than increasing the level of investment. Recent endogenous growth theory emphasizes the importance of financial intermediaries in enhancing economic growth through its various functions that influence savings and investment decisions, such as clearing and settling of payments, producing and analyzing information of alternative investment projects, allocating funds to the projects with higher expected returns, monitoring firms, trading, diversification and management of risk (Merton and Bodie, 1995).

Empirical studies emphasize some essential functions of financial intermediaries in promoting economic growth. One strand of the literature argues that financial intermediaries reduce information costs and improve resource allocation and allocate the funds to the projects with higher expected returns (Boyd and Prescott, 1986; Allen, 1990; Greenwood and Jovanovic, 1990; King and Levine, 1993b). Moreover financial intermediaries may improve corporate governance by influencing investors to act in the best interests of savers. Improvements in corporate governance, in turn, may reduce credit rationing (Bencivenga and Smith, 1993) and

improve credit allocation among competing technology producers (De la Fuente and Marin, 1996) leading to higher productivity, capital accumulation and economic growth.

An important function of intermediaries that contribute to economic growth is risk diversification, which enables savers who dislike risk to invest in riskier projects with higher expected returns in aggregate. More efficient resource allocation and greater risk sharing can, in turn, affect economic growth (Greenwood and Jovanovic, 1990; Devereux and Smith, 1994) and may also enhance technological progress by making more capital available to innovators and holding a diversified portfolio of innovation projects reduces risk and promotes investment (King and Levine, 1993c). Additionally, liquid financial markets transform the instruments that savers hold such as equity, bonds and demand deposit, into long term capital investments. Thus financial markets eliminate liquidity risk leading to an increase in investments in high return, illiquid assets, which in turn accelerate economic growth (Diamond and Dybvig, 1983; Levine, 1991; Bencivenga et al., 1995). Furthermore, better savings mobilization may increase capital accumulation and improve resource allocation leading to specialization, technological innovation and increase in economic growth (Greenwood and Smith, 1997).

Empirical evidence regarding the financial development - economic growth issue generally comprise of cross country growth models, panel data analysis, or studies at firm or industry level. Cross country studies that employ a growth model such as Goldsmith (1969), King and Levine (1993a), Levine and Zervos (1998) and Beck et al. (2000a) give empirical evidence supporting the hypothesis that financial development enhances economic growth. Rajan and Zingales (1998, 2001), Demirgüç-Kunt and Maksimovic (1998) and Wurgler (2000), Beck et al. (2005) on the other hand, employ firm level data and report that financial development accelerates economic growth by removing growth constraints on small firms.

Even though the bulk of empirical work using cross country data agree that financial development enhances economic growth, Demetriades and Hussein (1996), Manning (2003) and Driffil (2003) argue that these studies may not properly consider the role of country heterogeneity. Instead these cross section finance - growth nexus studies treat countries with different experiences in both economic growth and financial development in addition to different institutional characteristics as homogenous entities. Demetriades and Hussein (1996) argue that the patterns and direction of causality between financial development and economic growth vary across countries. Similarly Ram (1999) report huge parametric heterogeneity when the data sample is split into three subgroups according to the growth experience, showing a negligible or negative financial development economic growth relationship. Moreover, Andersen and Tarp (2003) also report that while a positive and significant relationship is found in the full sample cross section studies, the correlation is negative for the poorest countries. Additionally, Manning (2003) and Driffil (2003) claim that when dummy variables controlling for some subset of countries either according to the continent they belong to or their extraordinary growth performances are included in the analysis, the effect of financial development on economic growth disappears. Overall empirical evidence indicates that different causal patterns between financial development and economic growth are observed for both individual and cross country studies and empirical results are sensitive to the type of the estimator used, the sample periods and country subgroups covered.

One of the solutions to overcome the problems associated with the cross country studies is to investigate financial development - economic growth relationship in a regional analysis framework. Valverde and Fernandez (2004) point out that the benefits of regional perspective come from two sources: First, it appears that the heterogeneity across regions within a single country is lower and more easily controlled for than across countries. Secondly, the

exogenous factors of financial development that affect economic growth, such as the degree of liberalization and the nature of the legal and institutional framework, may be more efficiently controlled at the regional level than in cross country studies. Recently, the financial development - economic growth issue has been investigated in a regional framework for Italy (Gusio et al, 2004), China (Hao, 2006), and Spain (Valverde and Fernandez, 2004).

The scarcity of empirical work at regional framework can be attributed to the hypothesis that financial capital is perfectly mobile among regions and thus financial development- economic growth issue cannot have a spatial dimension. Under this assumption financial intermediaries ensure a perfect allocation of capital between firms and across the space economy, leading to a perfectly integrated financial market across regions within a country. However, Hutchinson and McKillop (1990), Harrigan and McGregor (1997), Greenwald et al. (1993) and Klagge and Martin (2005) argue that financial capital is not perfectly mobile among regions/provinces and that financial activities have a spatial dimension. Klagge and Martin (2005) further argue that the spatial structure of the financial markets is caused by imperfect competition, high transaction costs, asymmetric information between investors and savers and pervasive risk and uncertainty. Moreover this spatial structure of the financial system contribute to geographical biases in the allocation of funds to firms and hence uneven regional development.

Even though the issue of regional differences and economic development of Turkish economy have been investigated, there is limited empirical evidence regarding growth effects of financial development. Kar and Pentecost (2000) investigate the financial development-economic growth relationship for Turkey employing Granger causality tests for the time period 1963-1995. Their empirical analysis cannot reach a clear conclusion as the direction of causality is sensitive to the choice of proxy used for financial development. Ardic and Damar (2006), using provincial level data for the time period 1996-2001, report a strong negative

relationship between financial development on economic growth for Turkey. Ozyildirim and Onder (2006), on the other hand, examine the relationship between provincial banking activities and economic growth for the time period 1990-2001. In order to account for the spatial dimension of the issue, the distance between headquarters and the local branches is argued to affect the role of financial intermediation in the provincial economic growth. Their empirical findings indicate a significant positive effect of banking activities on provincial economic growth.

III. Financial Development and Regional Disparities in Turkey

Turkish financial system has been experiencing an intense structural transformation, aiming a free market economy, keeping primary emphasis on the banking sector since the early 1980s. Even though the size of the banking sector is relatively small in Turkey compared to developed economies, banks dominate every aspect of financial activity. Denizer et al. (2000) argue that the financial system and the banking system are synonymous in Turkey. Akçaoğlu (1998) points that the banking sector still keeps its dominant position, although the capital markets and non-bank financial institutions such as insurance companies have developed to some extent following the financial liberalization efforts. Among the main characteristics of Turkish financial system are strong networks linking the state to the banking sector and the banking sector to non-financial companies and the market domination by just a few banks.

State-owned banks have wide networks of branches throughout the country and have a substantial share in banking sector. Besides commercial banking transactions, they have been used by governments for a number of noncommercial objectives such as agricultural support, income redistribution, and industrial, urban, and physical infrastructure development. These activities performed on behalf of the government have lead to distortions in the banking system in 1990s. In order to cover their financing needs, state-owned-banks resorted to borrow at very high interest rates and at short maturities, leading to further increases in

interest rates. Moreover, the direct subsidies to farmers and small businesses from the state banks were shown on state banks' balance as duty losses, rather than in the government budget figures. High public sector deficits, which led to increases in real interest rates on government bonds, have also added to the problems of banking sector. As the financing of public deficits have been increasingly profitable, the share of government domestic securities in total assets of domestic banks increased considerably. For this purpose the banks started to borrow funds from abroad during the 1990s, which led to an increased vulnerability not only to changes in interest rates but also to changes in the exchange rate.

The fragility of the banking system, coupled with expansionary fiscal policies under an appreciating exchange rate regime, was one of the main contributors to the financial crisis of 1994, after which the authorities introduced a full deposit insurance scheme to save the economic system from collapse. Since, banks have offered higher interest rates to depositors this system have led to the development of an unhealthy banking sector. Moreover, due to the problems related to the legislative framework of the banking sector, Turkey lacked competent supervisory authorities, a regulatory framework and legal and institutional infrastructure during the 1990s. In 1999 the Parliament passed a new banking law, by which a new independent Banking Regulatory and Supervisory Agency (BRSA) has been established, responsible for bank regulation and supervision. Moreover, higher minimum capital requirements for new banking licenses have been introduced. Despite of these improvement efforts during 1990s, a healthy financial system cannot be achieved, and the fragile banking system together with a worsening current account led to a banking crisis in early 2001.

During the period 1991-2001 nearly half of the existing public banks in 1991 were privatized, and 15 banks failed. As of December 2001, there were 6908 domestic bank branches in the sector, 2725 of which belonged to the state-owned banks. The spatial distribution of banking activities reflects the persistent disparities in aggregate growth and the large differences in

wealth of Eastern and Western regions. It appears that in the comparatively developed Western provinces of Turkey, the average real value of deposits and credits are higher than those of relatively underdeveloped provinces of East and North (Figures 1 and 2) for the time period under consideration. A similar pattern can be observed for the average real GDP values (Figure 3). According to the real GDP figures East Anatolia is the poorest region whereas North-West Anatolia (Marmara region) is the richest. It emerges from the analysis that the highest banking activities were recorded in Marmara Region, with the financial center Istanbul providing the highest credits.

Moreover, there has been an increase in total deposits which is greater than that of credits. This led to a decrease in credits to deposits ratio from 74% in 1991 to 30% in 2001. The spatial distribution of credits to deposits ratio does not reveal a clear pattern relating to the regional development levels of the provinces (Figure 4). Some of the lower income provinces in the East part of Turkey do have high credit to deposits ratio since deposits in these provinces are lower than the national average. Whereas some Western and Southern provinces where agricultural or industrial production is concentrated need credits that is higher than the national average. Even though these provinces do not have high population and deposit levels, they have higher credits to deposits ratios. Provinces with higher (lower) income and population levels in addition to those with low production levels (thus not in need of credits) do have low credits to deposits ratios. Thus Turkey has a poor performance to channel deposits to credits, which has been further deteriorated due to the financial crisis of 2001. Even though there has been a 5% increase in the number of branches across Turkey for the time period 1991-2001, the highest loss of branches has been recorded in the Shouthern and South Eastern provinces (Figure 5). Furthermore population per branch is higher in the South Eastern and East Anatolian provinces compared to the more developed Western provinces (Figure 6). It appears that the provinces with a lower population per branch than Turkey

average are concentrated in the Western part of Turkey where the real per capita income is higher than the national average.

Overall the spatial distribution of banking activities reflect the regional income inequalities in Turkey as well as degree of economic activity. The highest level average of credits is achieved in the Marmara Region, whereas the South Eastern Anatolia has the lowest level of average level of credits. A similar pattern is observed when deposits per branch is considered. Additionally, credit creation by banks through deposits is quite limited, which is reflected by a higher increase in deposits compared to credits for the time period under consideration. One of the main reasons for the limited ability of banks to channel deposits to credits can be banks' preference to hold government securities which earned high interest rather than give credits to public.

IV. Econometric Methodology

The issue of economic convergence at sub-national level has attracted a lot of attention in recent years. With the seminal work of Romer (1986) and Barro and Salai-Martin (1991) a large number of studies has been devoted to investigating variations in economic performance of countries. Beta convergence analysis has generally been employed in order to investigate convergence across economies or regions using cross-sectional data, implementing the following equation:

$$\ln(y_{it}/y_{i0}) = \alpha + \beta \ln y_{i0} + \lambda \ln X_{i0} + u_i \qquad (1)$$

where y_{it} denotes income or GNP per capita at time t, y_{i0} denotes income or GNP per capita at some initial time 0; X_{i0} denotes the control variables at some initial time; α is the intercept term, which may incorporate any rate of technological progress; u is random error term distributed iid$(0,\sigma^2)$, which may represent random shocks to technology or tastes. A negative value of β signifies the beta convergence. However, this approach assumes that all regions or

economies under consideration have the same steady state income path. But this is a highly restrictive assumption and may induce significant heterogeneity bias in estimates of convergence coefficient.

It is important to investigate the spatial patterns that may indicate the spillover effects among regions. Even though the neoclassical model assumes perfect mobility of factors of production between economies, there may be significant adjustment costs or barriers to mobility for labour and possibly for capital. In cases where regions produce similar goods for consumption in the global market, when the demand for the certain product changes, employment and output changes tend to occur in several neigbouring regions. Moreover, when regions pursue their own growth promoting policies, there may be spillover effects from these regions to the adjacent regions which may affect economic growth. Cheshire and Gordon (1998) point that economic rents from research and development and other sources may more likely to accrue locally, where regions are more self-contained. Moreover, Fagerberg *et al*. (1996) claim that rates of technological diffusion may follow a spatial pattern as regions may have different capacities to create or absorb new technologies. Thus, incorporating spatial effects into the analysis may impact significantly on any estimated convergence effects.

Spatial dependence can be handled in beta convergence in alternative ways:[2] The first approach, spatial error model, assumes that the spatial dependence operates through the error process, where any random shock follows a spatial pattern, so that shocks are correlated across adjacent regional economies, such that the error term in equation (1) may reveal a significant degree of spatial covariance, which can be represented as follows:

$$\ln\left(y_{it}/y_{i0}\right) = \alpha + \beta \ln y_{i0} + \lambda \ln X_{i0} + u_i$$

$$u_i = \mu W u_i + \varepsilon_i \qquad (2)$$

[2] For a detailed analysis of spatial econometric techniques and methods please see Anselin (1988) and Henley (2005).

Where μ is the spatial error coefficient, measuring the degree of spatial autocorrelation between error terms of neighboring regions. ε_i is a white noise error component and W is a spatial weighting matrix. W may be constructed using information on physical distance between pair wise combinations of economies in the sample or may be defined such that element w_{ij} = 1 if i and j are physically adjacent and 0 otherwise. In this paper the latter approach is preferred.

Alternatively, spatial autoregressive (SAR) model examines the extent to which regional growth rates depend on the growth rates of adjacent regions, conditioning on the level of initial income:

$$\ln(y_{it}/y_{i0}) = \alpha + \beta \ln y_{i0} + \lambda \ln X_{i0} + \rho W \ln(y_{it}/y_{i0}) + u_i \qquad (3)$$

where ρ denotes the spatial autoregressive parameter, which measures the degree of spatial autocorrelation between error terms of neighboring regions. The error term is assumed to be normally distributed and independently of $\mathbf{\ln y_{io}}$ and of $\mathbf{W \ln(y_{it}/y_{io})}$ under the assumption that all spatial dependence effects are captured by the lagged term. The spatial lag model attempts to quantify how the rate of growth in a region is affected by the one in its surrounding regions, where the parameter ρ can be interpreted as a measure of spatial interaction across contiguous regions.

Recent empirical studies claim that, instead of a cross-section analysis, using panel or longitudinal data may overcome the problem of heterogeneity bias, as it considers both the temporal and the individuals dimension (Baltagi, 2001). Moreover, using panel data is more informative compared to the time series or cross-sectional data, presenting more variability and less collinearity among variables, more degrees of freedom and more efficiency. However, data collection problems are more complicated then in the case of time series or cross-sectional data.

The panel data equivalent of equation (1), the most general formulation of the panel data model, can be expressed as follows:

$$\ln(y_{it+k}/y_{it}) = \alpha_i + \beta \ln y_{it} + \lambda \ln X_{it} + u_{it} \quad (4)$$

Where the dependent variable is the growth rate of per capita income for region i; y_{it} denotes income or GNP per capita at time t and $\mathbf{X_{it}}$ denotes the control variables for region i at time t. α_i is time invariant and captures any individual-specific effect that is not included in the regression equation. Two different basic models can be classified according to how α_i is interpreted. Equation (4) is a fixed effect panel data model if the α_i's are assumed to be fixed parameters to be estimated. The fixed effects estimator allows the intercept to differ across countries/ regions, and thus ignores all information in the cross sectional relation and where the α_i represent the country/ region specific effects.[3] Alternatively, when you assume that some omitted variables may be constant over time but vary between cases, and others may be fixed between cases but vary over time, then α_i's are assumed to be random and the model is termed as the random effect panel data model.

The fixed effects models are common choice for macroeconomists, as it is generally more appropriate than a random effects model for many macro datasets for two reasons. First, if the individual effect represents omitted variables, it is highly likely that these country/region specific characteristics are correlated with the other regressors. Second, it is also fairly likely that a typical macro panel will contain most of the countries of interest and, thus, will be less likely to be a random sample from a much larger universe of countries.[4] Accordingly, as our sample covers the provinces of Turkey, a fixed effect panel model is employed in this study.

[3] However, if the number of countries is likely to be large, there may be degrees of freedom problems. In that case we can apply within regression in which we partition regression analysis.
[4] For an elaborate analysis of panel data models see Judson and Owen (1999), Baltagi (2001).

Elhorst (2003) surveys the specification and the estimation of panel data models taking spatial dimension into account in order to overcome spatial heterogeneity and spatial dependence that may exists between observations at each point in time. He derives the relative likelihood for alternative models using panel data, such as the spatial fixed effect model, the spatial random effect model, the fixed effect and random coefficient spatial error models.[5] In cases where spatial error autocorrelation is present, the OLS estimation is inappropriate as the parameter estimates are inefficient even though they are unbiased. Elhorst (2003) extends the fixed effect panel data model to spatial autocorrelation as follows:

$$\ln\left(y_{it+k}/y_{it}\right)=\alpha_i+\beta\ln y_{it}+\lambda\ln X_{it}+u_{it} \tag{5}$$

Where

$$u_{it}=\delta W u_{it}+\xi_{it}$$

where δ is the scalar spatial autocorrelation coefficient, ξ_{it} is error component assumed to be independent, identically distributed with zero mean and finite variance. W is a spatial weighting matrix. W may be constructed using information on physical distance between pair wise combinations of economies in the sample or may be defined such that element w_{ij} = 1 if i and j are physically adjacent and 0 otherwise.[6] The parameters of the fixed effect spatial error model can be estimated by the maximum likelihood method.

An alternative way to incorporate spatial effects in the classical fixed-effect panel data model is by including a spatially lagged term of the dependent variable, which can be expressed as follows:

$$\ln\left(y_{it+k}/y_{i,t}\right)=\alpha_i+\beta\ln y_{it}+\lambda\ln X_{it}+\gamma W\ln\left(y_{it+k}/y_{it}\right)+u_{it} \tag{6}$$

[5] See for example Elhorst (2003), Baltagi and Li (2006), and Arbia et al. (2005) for applications of spatial panel data analysis.

[6] See Anselin (1988) and Elhorst (2003) for the derivation of the maximum likelihood and for the LM tests for this model.

Where γ is the spatial autoregressive coefficient and u_{it} is the classical zero mean error term which is assumed to be independent under the hypothesis that all spatial dependence effects are captured by the spatially lagged variable term. Equation (6) can be estimated by maximum likelihood.

V. Empirical Evidence

In this section empirical evidence regarding the financial development - economic growth relationship for Turkey is presented. Both cross sectional and panel data analysis, taking spatial dimension into account, are performed employing provincial level annual data, relating to 67 provinces of Turkey[7]. Due to the unavailability of the data time period under consideration is restricted to 1991 - 2001. In order to proxy for financial development, logarithms of real credits per branch (credits) and real deposits per branch (deposits) are used in addition the two control variables for the general determinants of economic growth which are the logarithm of the initial level of real GDP per capita (income) and inflation rate (inflation).[8] All variables are obtained from State Institute of Statistic of Turkey. Moreover, two alternative sub-periods are considered, namely 1991-1995 and 1996-2001, in order to capture the possible differential effects of changes in the financial environment following the financial crisis in 1994.

Empirical analysis start with the investigation from the OLS cross-sectional estimates of the beta-convergence model which are presented in Table 1. The OLS coefficient on the initial GDP per capita for the entire period is highly significant and negative, suggesting beta convergence throughout the period under consideration with an annual rate of convergence of 0.6 per cent. However, when the sub-periods are considered, contradictory results are

[7] From 1990 onwards the number of provinces has been increased from 67 to 81. But the original 67 provinces have been included in our analysis, as the data relating to new provinces do not cover the time period under consideration.

[8] A wider set of explanatory variables are considered initially, including schooling ratio and provincial number of branches. However inclusion of these variables did not yield meaningful parameter estimates.

obtained. Even though empirical analysis suggests a beta convergence for the time period 1996-2001, there appears to be a divergence in per capita incomes for the time period 1991-1995, where both coefficients are statistically significant. This finding supports the hypothesis that there have been two different paths in the growth of per capita income of Turkish provinces, which is mainly brought by the financial crisis at the end of 1994. When banking activity variables are considered, empirical findings indicate that credits per branch variable has a negative impact on economic growth of provinces, whereas deposits per branch variable has a positive impact. Additionally, inflation appears to enhance economic growth for the time period under consideration, as well as for the both sub-periods.

Table 1 also reports some diagnostics to identify misspecifications in the OLS cross-sectional model. The value of the Jarque-Bera test is not statistically significant, indicating that OLS errors can be considered normally distributed. Additionally, the value of the Breusch-Pagan statistics indicates that there is no heteroscedasticity. The model selection criteria, the value of the log likelihood and the values of the Schwartz and AIC criterion, show that the OLS model fits much better to the data of the second sub-period compared to the overall sample period as well as the first sub-period. Table 1 also reports three different tests statistics to investigate the presence of spatial dependence in the error term: the Moran's I and two different versions of the Lagrange Multiplier tests. Although the first version does not allow to discriminate between the two alternative forms of misspecifications, it is very powerful against spatial dependence both in the form of error autocorrelation and spatial lag. Empirical evidence indicates significant spatial dependence for the time period under consideration as well as for both sub-periods, with an edge towards the spatial lag specification. Overall, previous analysis indicate that the OLS estimates suffer from a misspecification due to omitted spatial dependence, proposing alternative specifications in order to remove residual spatial dependence.

Tables 2 and 3 present the results of the maximum likelihood estimates of the spatial error and spatial lag models, respectively. Model selection criteria indicate that spatial lag model is marginally better than the spatial error model. Empirical results suggest beta convergence for the time period under consideration as well as for the second sub-period for both types of models. Whereas a divergent trend is indicated for 1991-1995 period, which could be due to the severe economic crisis of 1994. Even though the beta convergence parameters are statistically significant for both sub-periods, it is not the case for the entire time period. The results obtained with the error model are much more in line with the OLS regression results compared to the spatial lag model, even though the spatial error term is statistically significant for the entire period and the two sub-periods. The spatial autoregressive parameter, measuring the strength of the interregional spillover effects such as technological spillovers or factor mobility, is statistically significant indicating that the growth rate of a province is related to those of its neighbour provinces after conditioning for the starting levels of income. Thus any shock in a particular region will impact on all other regions through the spatial transformation (Anselin, 2003). Additionally, the coefficients of credit per branch are statistically insignificant in both specifications and for all time periods, whereas the coefficients of deposits per branch are positive and statistically significant for the time period under consideration as well as for the second sub-period. Inflation, on the other hand, enhances economic growth in both specifications. Furthermore, the Wald, LM and Morans I tests for spatial autocorrelation indicate the presence of spatial dependence, though marginally in spatial error specification presented in Table 2. Even though the value of the Breusch-Pagan statistics indicates that there is no heteroscedasticity, the statistical insignificance of the credits per branch variable can be due to the omitted variable and heterogeneity bias inherent in the cross-sectional analysis.

In order to overcome the possibility of spatial heterogeneity, the fixed effects panel data analysis as specified in equation (4) has been carried out and the results are reported in Table 4. In Table 4 Wald 1 denotes the Wald test of joint significance of the estimated coefficients which is asymptotically distributed as chi-squared under the null of no relationship. Wald 2 is the Wald test of joint significance of the time dummies. Moreover, AR(1) and AR(2) are the test of first and second order of autocorrelation of residuals, respectively, which are asymptotically distributed as standard normal N(0,1) under the null of no serial correlation. Empirical results indicate a statistically significant divergencent process for 1991-2001 period and for two sub-periods. Additionally, contrary to the previous cross-sectional results, credits per branch together with inflation enhances economic growth whereas deposits per branch variable hinders it. Moreover, all diagnostics are satisfactory.

Baltagi (2001) argues that panel data models taking spatial autocorrelation into account may lead to more reliable estimates of the parameters by controlling for omitted variables and heterogeneity. Accordingly, in this section spatial panel data analysis has been implemented in order to investigate the effects of financial development on regional economic growth of Turkey for the time period 1991-2001. First the empirical results relating to the spatially lagged fixed effects model are presented in Table 5. Empirical evidence indicates a slight decrease in the convergence parameter estimate compared to the panel data estimates, which could be due the fact that it is now cleaned from the influence of both omitted variables and spatial autocorrelation. This further suggests the presence of spill-overs on regional convergence as well as the positive effect of factor mobility and trade relationships. Moreover, it appears that there is a divergent trend in the provincial per capita income for the time period under consideration and for both sub-periods. Contrary to the findings of the cross-sectional analysis credits per branch variable has a positive and highly significant effect on economic growth, except for the second sub-period. The deposits per branch variable on

the other hand has a statististically significant negative effect on income growth. Moreover inflation appears to enhance economic growth. Several alternative specifications of the spatial fixed effects model are also considered in Table 5. First of all, effects of financial crises of 1994, 1999 and 2001 on economic convergence are investigated by incorporating dummy variables d94, d99 and d01 which take the value 1 in 1994, 1999 and 2001, respectively, in the regression analysis. Empirical evidence indicates that financial crises have statistically significant negative effect on economic growth except that of 2001. Inclusion of these dummy variables improves the overall explanatory power of the models as indicated by increases in the adjusted coefficient of determination. The estimation results of fixed-effect spatial error model, which are presented in Table 6, indicate that the parameter estimates do not particularly differ from those obtained with the fixed effect spatial lag model.

VI. Conclusion

The limited empirical evidence concerning the convergence of income in Turkey, usually employ cross sectional and/or panel data analysis. Moreover, only few of them investigate the financial development-economic growth relationship taking spatial dimension into account. However, the presence of omitted variables and heterogeneity bias necessitates the reformulation of the cross-sectional regressions. This paper is an attempt to examine the financial development-economic growth relationship for Turkey, using provincial panel data for the time period 1991-2001, taking spatial dimension into account. Since the banking sector dominates every aspect of financial activity, credits per branch and deposits per branch are employed as the financial development indicators. Furthermore, in order to explore if the financial crisis of 1994 had any impact on this relationship the entire sample period is divided into two sub-periods: 1991-1995 and 1996-2001.

Traditional cross sectional conditional beta convergence analysis has been the starting point, where the presence of spatial effects have been detected, suggesting alternative estimates using the two different specifications of cross sectional spatial econometric models, represented by the spatial lag and the spatial error models. Even though the spatial error and spatial lag coefficients are found to be statistically significant in all specifications, model selection criteria indicate that spatial lag model outperforms the spatial error model. Empirical evidence indicates a divergent trend with a negative effect from credits per branch and positive effects from deposits per branch and inflation for the entire time period and for the second sub-period.

In order to overcome the possible omitted variable bias and heterogeneity bias, and to strengthen cross-sectional results, a panel data analysis has also been implemented. Inclusion of the spatial lag or spatial error term improves the overall explanatory power of the regression suggesting that the explicit treatment of the spatial dependence in the panel data models remove the omitted variable bias and solve the heterogeneity problem. All specifications point to a divergent trend in per-capita income. Whereas credits per branch and inflation have positive effects on economic growth, deposits per branch hinders it. A statistically significant effect of credits per branch variable indicates that the increase availability of credits to public and investors helps economic growth. However, for the time period under consideration, the increase in deposits per branch was higher than that of credits per branch, suggesting the inefficiency of the financial intermediaries to raise credits out of deposits. This could help explain the negative effect of deposits per branch on economic growth. During the period under consideration it was more profitable for banks to finance public deficits instead of giving credits to private enterprises. Moreover the financial crises of 1994 and 1999 have negative impact on economic growth.

Overall empirical analysis indicate the importance of geographic components and the spatial dimension appears to plays a crucial role in the convergence process through the channels of factor mobility, trade relationships and knowledge spill-over effects. Moreover financial development has a statistically significant effect on economic growth. It appears that credits per branch helps economic growth.

REFERENCES

Akçaoğlu E (1998) Financial innovation in Turkish banking. Capital Market Board Publications, Publication No: 127.

Allen F (1990) The market for Information and the origin of financial intermediaries. *Journal of Financial Intermediation* 1: 3-30.

Andersen TB, Tarp F (2003) Financial liberalization, financial development and economic growth in LDCs. *Journal of International Development* 15 (2): 189-209.

Anselin L (1988) *Spatial econometrics: methods and models.* Kluwer, Dordrecht.

Anselin L (2003) Spatial externalities, spatial multipliers and spatial econometrics. *International Regional Science Review* 26, 153-166.

Arbia G, Basile R, Piras G (2005) Using spatial panel data in modelling regional growth and convergence. Working paper ISAE.

Ardic OP, Damar HE (2006) Financial sector deepening and economic growth: evidence from Turkey. Bogazici University Department of Economics Working Paper.

Baltagi BH (2001) *Econometric analysis of panel data.* 2nd edition. Chichester, UK: Wiley.

Baltagi BH, Li D (2006), Prediction in the panel data model with spatial correlation: the case of liquor. *Spatial Economic Analysis* 1(2): 175-185.

Barro R, Sala-i-Martin X (1991) Convergence across states and regions. *Brookings Papers on Economic Activity* 1: 107-182.

Bencivenga VR, Smith BD (1993) Some consequences of credit rationing in an endogenous growth model. *Journal of Economic Dynamics and Control* 17: 97-122.

Bencivenga V R, Smith BD, Starr RM (1995) Transactions costs, technological choice, and endogenous growth. *Journal of Economic Theory* 67: 53-177.

Beck T, Levine R, Loayza N (2000a) Finance and the sources of growth. *Journal of Financial Economics* 58: 261–300.

Beck T, Demirgüç-Kunt A, Levine R (2000b) A new database on financial development and structure. *World Bank Economic Review* 14: 597-605.

Beck T, Demirguc-Kunt A, Maksimovic V (2005) Financial and legal constraints to firm growth: does size matter? *The Journal of Finance* 60 1(02): 137-177.

Boyd JH, Prescott EC (1986) Financial intermediary-coalitions. *Journal of Economic Theory* 38: 211-232.

Cheshire PC, Gordon I (1998) Territorial competition: some lessons for policy. *Annals of Regional Science* 32: 321 – 346.

De la Fuente A, Marin JM (1996) Innovation, bank monitoring, and endogenous financial development. *Journal of Monetary Economics* 38: 269-301.

Demetriades PO, Devereux MP, Luintel KB (1998) Productivity and financial sector policies: evidence from South East Asia. *Journal of Economic Behavior and Organization* 35: 61-82.

Demetriades P, Hussein K (1996) Does financial development cause economic growth? time series evidence from 16 countries. *Journal of Development Economics* 51: 387-411.

Demirgüç-Kunt A, Maksimovic V (1998) Law, finance, and firm growth. *Journal of Finance* 53: 2107-2137.

Denizer C, Iyigun MF, Owen A L (2000) Finance and macroeconomic volatility, Board of Governors of the Federal Reserve System, International Finance Discussion Paper 670.

Devereux MB, Smith GW (1994) International risk sharing and economic growth. *International Economic Review* 35: 535-550.

Diamond, DW, Dybvig PH (1983) Bank runs, deposit insurance, and liquidity. *Journal of Political Economy* 91: 401-419.

Driffill J (2003) Growth and finance. *The Manchester School* 71(4), Special Issue: 363-380.

Elhorst P (2003) Specification and estimation of spatial panel data models. *International Regional Science Review* 26: 244-268.

Fagerberg J, Verspagen B, Marjolein C (1996) Technology, growth and unemployment across European regions. *Regional Studies* 31: 457-466.

Friedman M, Schwartz AJ (1963) *A Monetary history of the United States*. Princeton: Princeton University Press.

Gezici F, Hewings GJD (2001) Regional convergence and the economic performance of peripheral areas in Turkey, *REAL Discussion Papers* No: 01-T-13.

Goldsmith RW (1969) *Financial structure and development.* New Haven, CT: Yale University Press.

Greenwald BC,. Levinson A, Stiglitz JE (1993) Capital market imperfections and regional economic development. In Giovannini A (ed) *Finance and Development: Issues and Experience* 65-98,Cambridge University Press.

Greenwood J, Jovanovic B (1990) Financial development, growth, and the distribution of income. *Journal of Political Economy* 98: 1076-1107.

Greenwood J, Smith B (1997) Financial markets in development, and the development of financial markets. *Journal of Economic Dynamics and Control* 21: 145-181.

Guiso L, Sapienza P, Zingales L (2004) The role of social capital in financial development. *American Economic Review* 94: 526-556.

Hao C (2006) Development of financial intermediation and economic growth: The Chinese experience. *China Economic Review* 17(4): 347-362.

Harrigan FJ, McGregor PG (1997) Interregional arbitrage and the supply of loanable funds: a model of intermediate financial capital mobility. *Journal of Regional Science* 27: 357-67.

Henley A (2005) On regional growth convergence in Great Britain. *Regional Studies* 39(9): 1245-60.

Hutchison RW, McKillop DG (1990) *Regional financial sectors in the British Isles.* Aldershot: Avebury.

Judson RA, Owen AL (1999) Estimating dynamic panel data models: a guide for macroeconomists. *Economics Letters*. 65:145-150.

Kar M, Pentecost E (2000) The direction of causality between financial development and economic growth in Turkey: Further evidence. Loughborough University, Department of Economics, Economic Research Paper No: 00/27

King RG, Levine R (1993a) Financial intermediation and economic development. In Mayer C, Vives X (eds) *Capital Market and Financial Intermediation*. New York: Cambridge University Press, 156 - 196.

King RG, Levine R (1993b) Finance, entrepreneurship, and growth: theory and evidence. *Journal of Monetary Economics* 32: 513-542.

King RG, Levine R (1993c) Finance and growth: Schumpeter might be right. *Quarterly Journal of Economics* 108: 717-738.

Klagge B, Martin R (2005) Decentralised versus centralised financial systems: is there a case for local capital markets? *Journal of Economic Geography* 5: 387-421.

Levine R, Loayza N, Beck T (2000) Financial intermediation and growth: causality and causes. *Journal of Monetary Economics.* 46: 31-77.

Levine R, Zervos S (1998) Stock markets, banks, and economic growth. *American Economic Review* 88: 537-558.

Levine R (1991) Stock markets, growth, and tax policy. *Journal of Finance* 46: 1445-1465.

Levine R (1997) Financial development and economic growth: views and agenda. *Journal of Economic Literature* 35: 688-726.

Manning MJ (2003) Finance causes growth: can we be so sure? *Contributions to Macroeconomics* Vol. 3 : Iss. 1, Article 12.

Merton RC, Bodie Z (1995) *A Conceptual framework for analyzing the financial environment, the global financial system - a functional perspective*, Harvard Business School Press.

Ozyildirim S, Onder Z (2006), Impact of banking activities on local output growth: does distance from centre matter? Bilkent University Department of Management Working Paper.

Robinson J (1952) *The rate of interest and other essays.* London: McMillan.

Rajan RG, Zingales L (1998) Financial dependence and growth. *American Economic Review* 88: 559-586.

Rajan RG, Zingales L (2001) The influence of the financial revolution on the nature of firms. CRSP Working Paper No. 525.

Ram R (1999) Financial development and economic growth: additional evidence. *Journal of Development Studies* 35(4): 164-74.

Romer P (1986) Increasing returns and long-run growth. *Journal of Political Economy* 94: 1002-1037.

Wallich HC (1969) Uses of financial accounts in monetary analysis. *The Review of Income and Wealth* Series 15: 321-334.

Valverde CS, Fernández RF (2004) The finance-growth nexus: a regional perspective. *European Urban and Regional Studies* 11(4): 339-354.

Wurgler J (2000) Financial markets and the allocation of capital. *Journal of Financial Economics* 58: 187–214.

Figure 1: Spatial Distribution of Average Real Deposits per capita 1991-2001

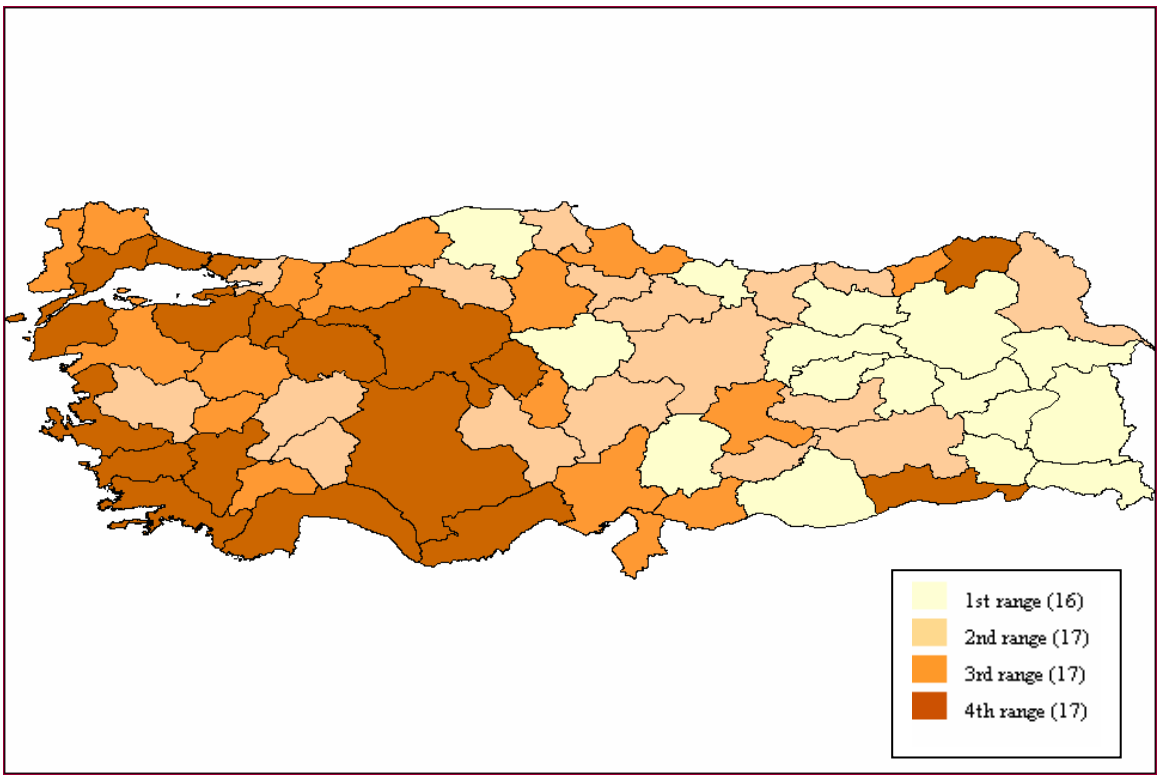

Figure 2: Spatial Distribution of Average Real Credits per capita 1991-2001

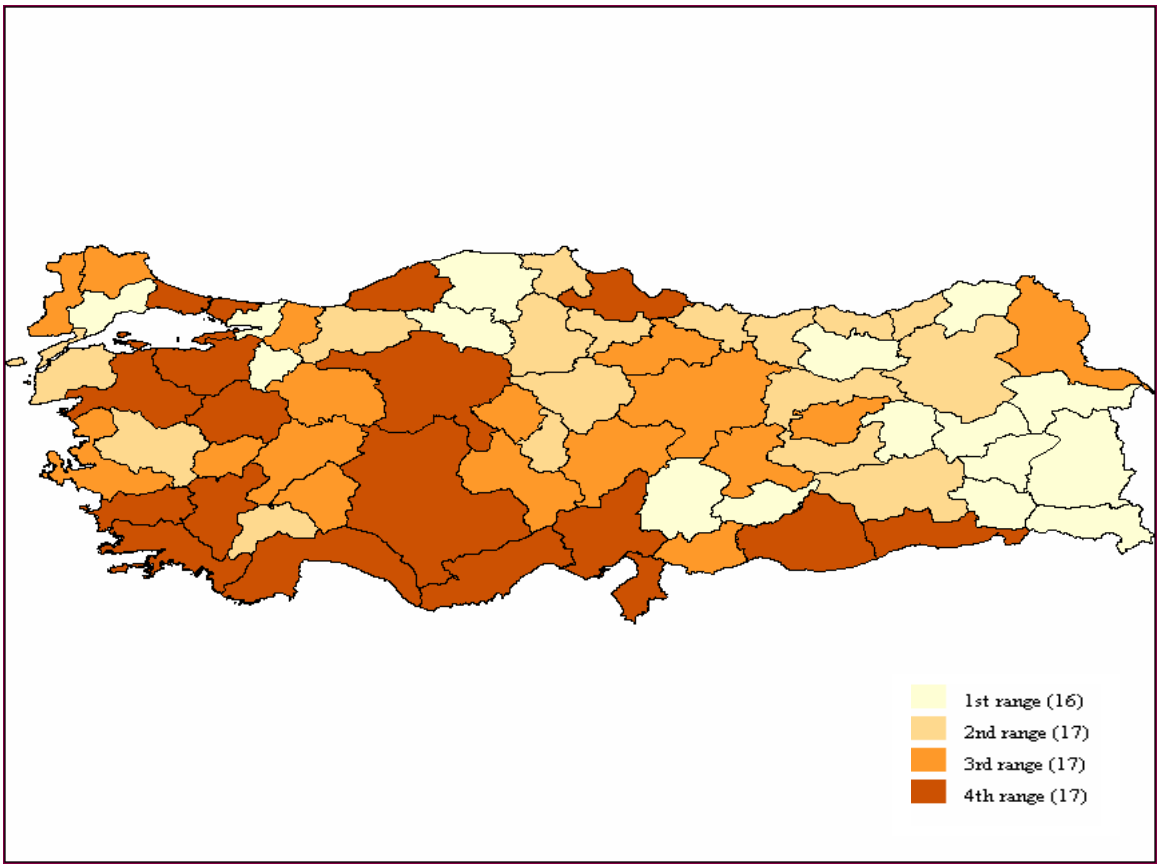

Figure 3: Spatial Distribution of Average Real GDP per capita 1991-2001

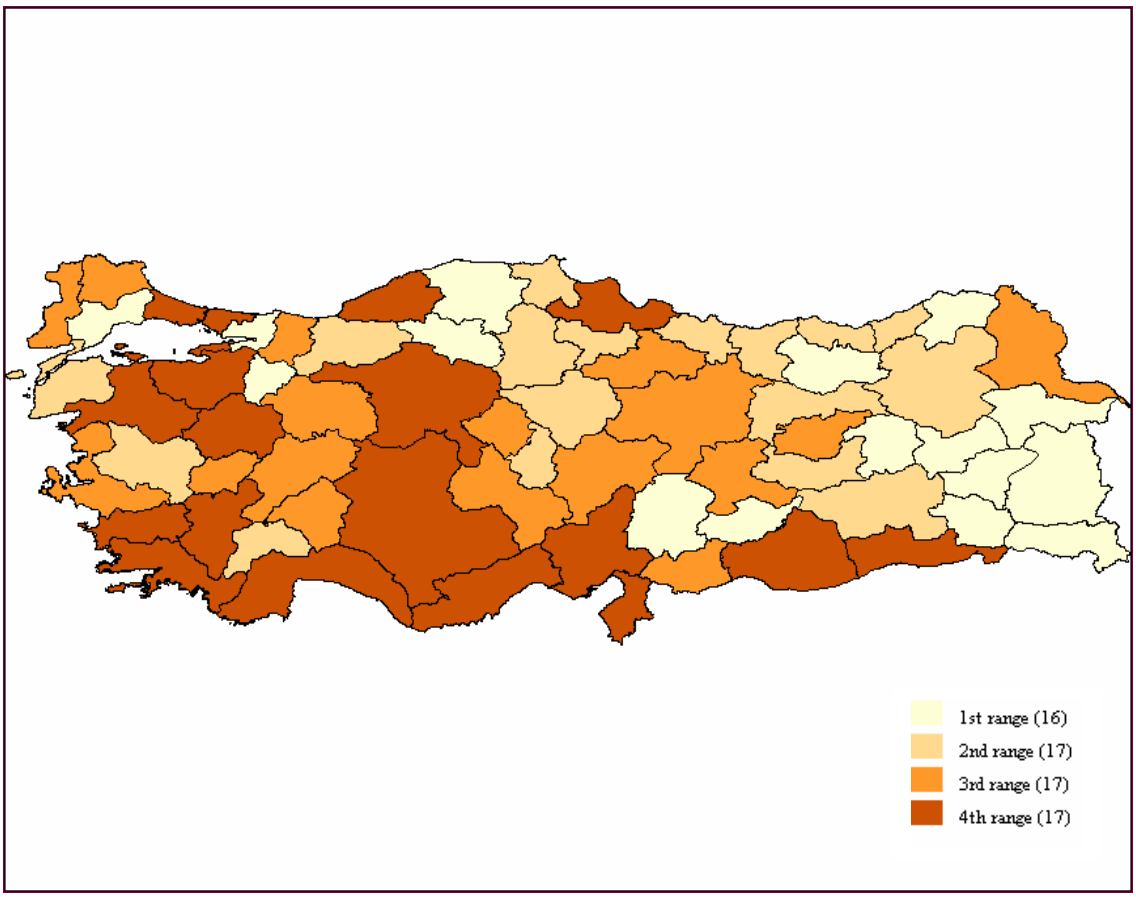

Figure 4: Spatial Distribution of the Ratio of Credits to Deposits 1991-2001

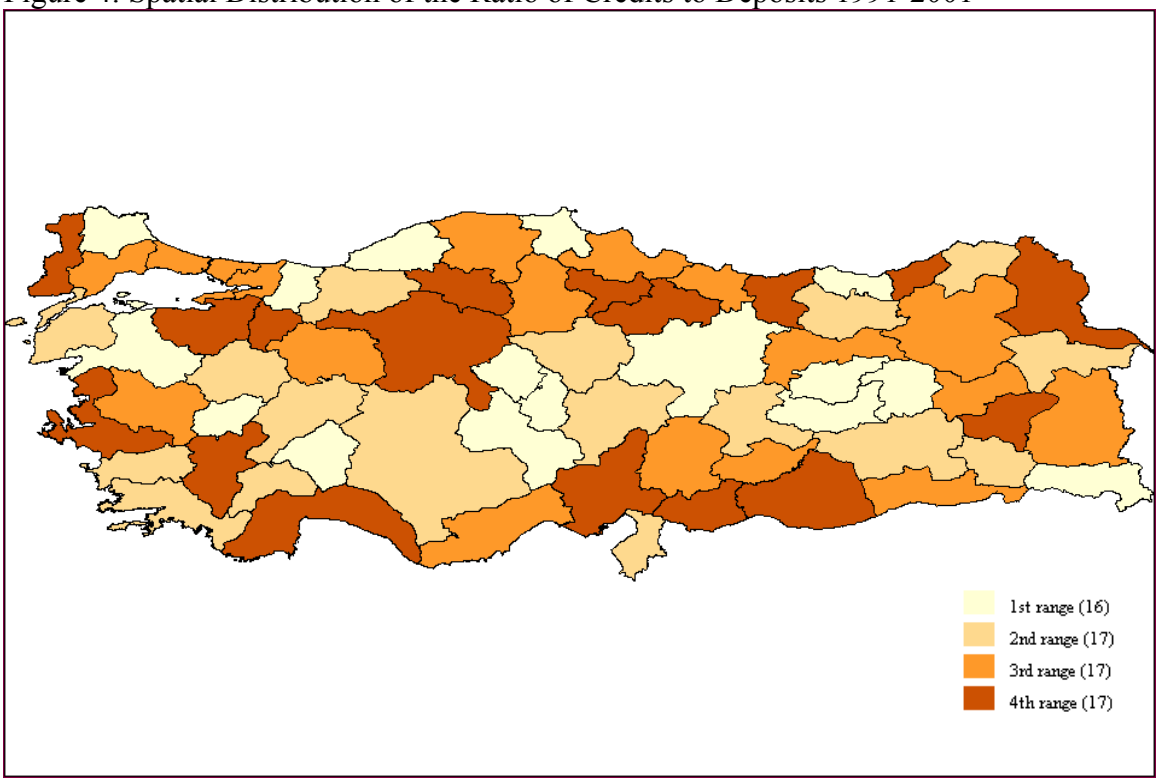

Figure 5: Spatial Distribution of Loss of Branch 1991-2001

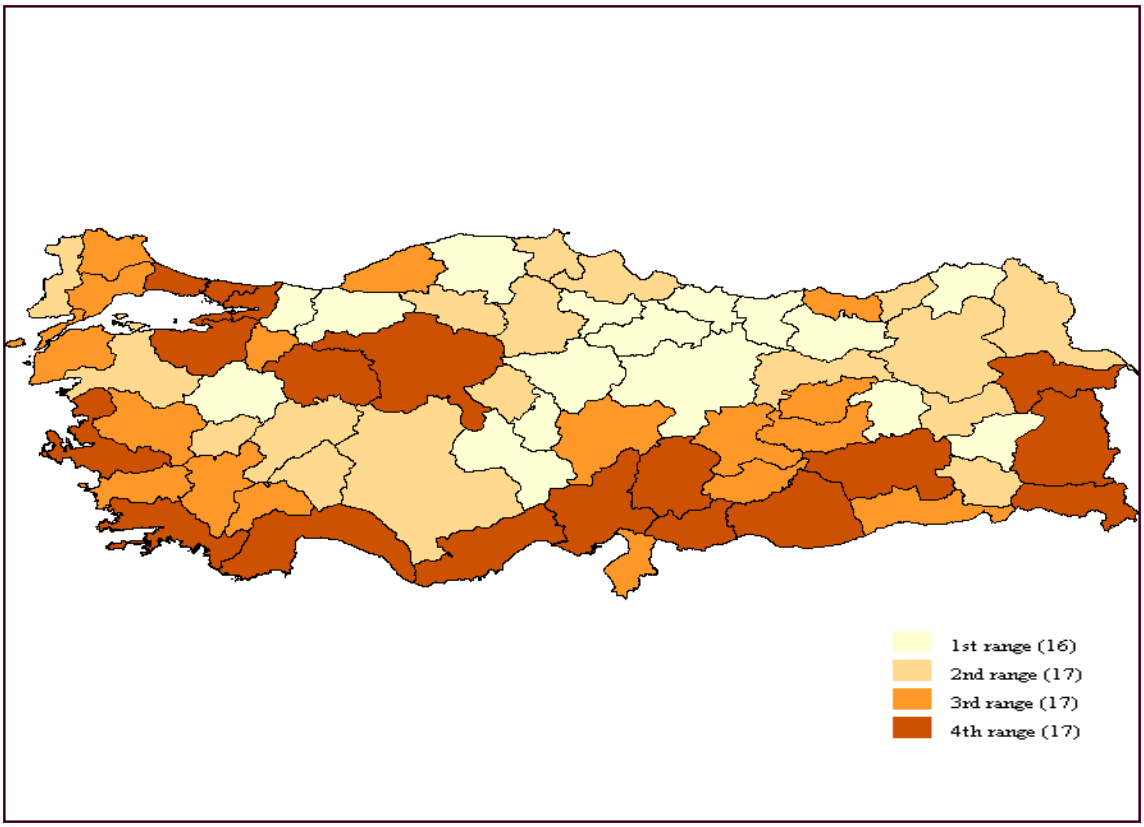

Figure 6: Spatial Distribution of Population per branch 1991-2001

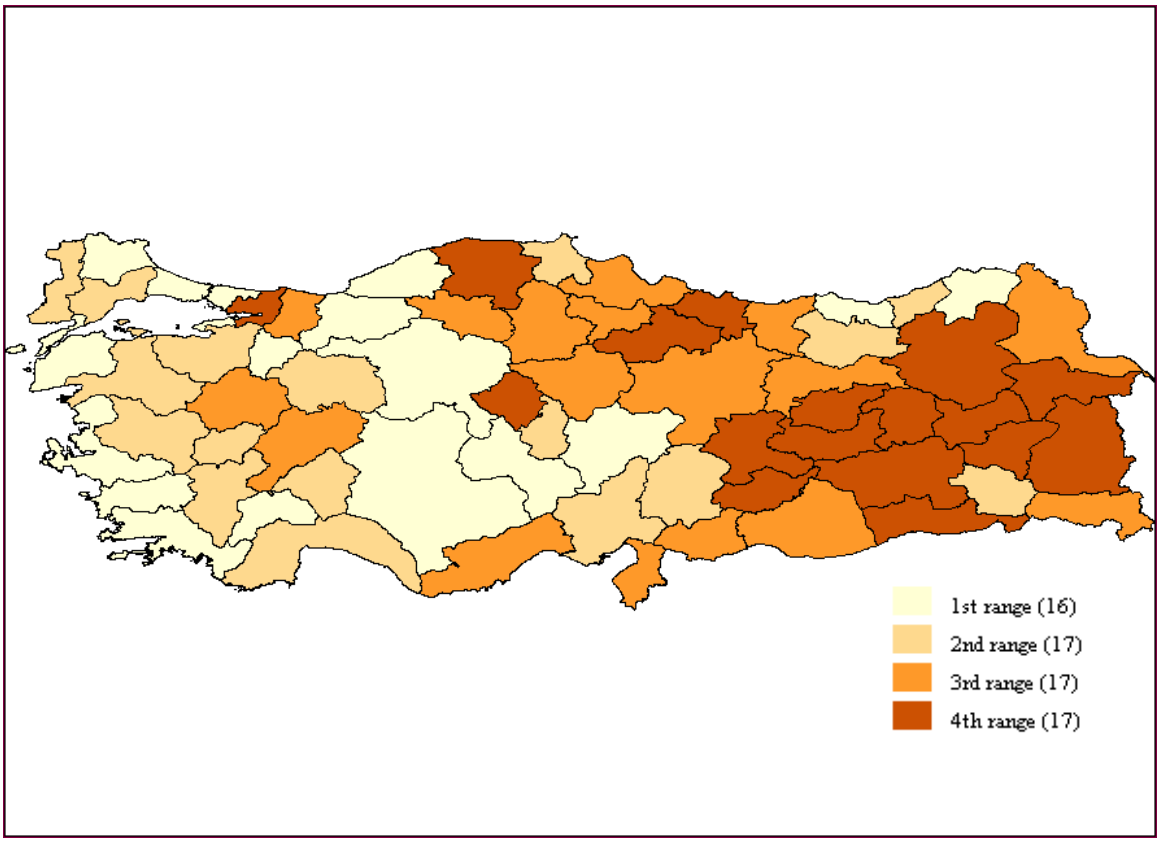

Table 1. Cross-section analysis: OLS estimation

Values in parentheses are heteroscedasticity consistent t-statistics and values in brackets are p-values.

	1991-2001	1991-1995	1996-2001
Constant	-0.193	-0.239	-0.135
	(-1.652)	(-2.368)	(-0.737)
Income	-0.006	0.014	-0.021
	(-1.000)	(2.449)	(-2.280)
Credit	-0.007	-0.003	-0.013
	(-1.178)	(-0.478)	(-1.389)
Deposit	0.013	0.002	0.024
	(2.179)	(0.382)	(2.339)
Inf	0.002	0.001	0.003
	(2.445)	(1.716)	(2.021)
Adjusted R^2	0.138	0.057	0.169
Log likelihood	161.364	158.907	131.194
Schwarz	-4.503	-4.429	-3.602
AIC	-4.668	-4.594	-3.767
# of observations	67	67	67
Jarque-Bera test	23.707	6.655	95.610
	[0.000]	[0.036]	[0.000]
Breush-Pagan	7.211	4.468	5.631
heteroscedasticity test	[0.125]	[0.346]	[0.228]
Morans' I spatial	-2.134	-1.963	-1.403
autocorrelation test	[0.033]	[0.049]	[0.161]
LM test(error)	5.529	4.749	2.794
	[0.019]	[0.029]	[0.095]
LM test(lag)	56.557	55.640	22.979
	[0.000]	[0.000]	[0.000]

Table 2. Cross-section analysis: Spatial error models

	1991-2001	1991-1995	1996-2001
Constant	-0.131	-0.215	-0.072
	(-1.574)	(-2.854)	(-0.481)
Income	-0.006	0.015	-0.021
	(-1.461)	(3.628)	(-3.133)
Credit	-0.005	0.000	-0.011
	(-1.095)	(0.009)	(-1.316)
Deposit	0.012	-0.002	0.024
	(2.423)	(-0.320)	(2.701)
Inf	0.001	0.001	0.001
	(1.538)	(1.849)	(1.169)
Lambda	-0.649	-0.505	-0.482
	(-3.837)	(-2.856)	(-2.711)
Adjusted R2	0.308	0.183	0.259
Log likelihood	189.152	185.226	156.709
Schwarz	-5.270	-5.153	-4.301
AIC	-5.467	-5.350	-4.499
# of observations	67	67	67
Wald test	29.379	13.996	10.990
	[0.000]	[0.000]	[0.001]
Breush-Pagan heteroscedasticity test	1.886	1.878	5.154
	[0.757]	[0.758]	[0.272]
Morans' I spatial autocorrelation test	-0.193	-0.179	-0.137
	[0.033]	[0.049]	[0.160]
LM test(error)	5.529	4.749	2.794
	[0.018]	[0.029]	[0.095]

Values in parentheses are heteroscedasticity consistent t-statistics and values in brackets are p-values.

Table 3. Cross-section analysis: Spatial lag models

	1991-2001	1991-1995	1996-2001
Constant	-0.151	-0.277	-0.085
	(-1.514)	(-3.017)	(-0.514)
Income	-0.008	0.018	-0.025
	(-1.534)	(3.374)	(-3.052)
Credit	-0.005	-0.001	-0.011
	(-1.031)	(-0.292)	(-1.307)
Deposit	0.013	0.001	0.024
	(2.406)	(0.104)	(2.600)
Inf	0.001	0.001	0.002
	(2.233)	(2.058)	(1.981)
Rho	-0.599	-0.453	-0.425
	(-3.514)	(-2.534)	(-2.463)
Adjusted R^2	0.185	0.062	0.199
Log Likelihood	190.253	185.229	157.523
Schwarz	-5.303	-5.153	-4.326
AIC	-5.500	-5.350	-4.523
# of observations	67	67	67
Breush-Pagan heteroscedasticity test	3.357	1.647	4.353
	[0.500]	[0.800]	[0.360]
Morans' I spatial autocorrelation test	-0.193	-0.179	-0.137
	[0.033]	[0.049]	[0.161]
LM test(error)	56.327	55.055	22.998
	[0.000]	[0.000]	[0.000]

Values in parentheses are heteroscedasticity consistent t-statistics and values in brackets are p-values.

Table 4. Panel Fixed effects model

	1991-2001		1991-1995		1996-2001	
Constant	-5.415		-5.985		-12.512	
	(-12.231)		(-5.111)		(-14.661)	
Income	0.514		0.534		0.844	
	(21.210)		(8.956)		(26.730)	
Credit	0.024		0.071		0.019	
	(2.822)		(4.060)		(1.591)	
Deposit	-0.116		-0.152		-0.003	
	(-9.806)		(-6.234)		(-0.147)	
Inf	0.001		0.001		0.001	
	(7.330)		(4.089)		(8.121)	
Sigma	0.068		0.059		0.056	
R^2	0.524		0.482		0.776	
# of observations	748		335		402	
Wald1	Chi^2(4)	652.5 [0.000]	Chi^2(4)	192.5 [0.000]	Chi^2(4)	962.2 [0.000]
Wald2	Chi^2(68)	602.1 [0.000]	Chi^2(67)	214.3 [0.000]	Chi^2(67)	944.0 [0.000]
AR(1)	N(0,1)	4.207 [0.000]	N(0,1)	-2.671 [0.008]	N(0,1)	1.868 [0.062]
AR(2)	N(0,1)	-0.3081 [0.758]	N(0,1)	-3.224 [0.001]	N(0,1)	-4.741 [0.000]

Values in parentheses are heteroscedasticity consistent t-statistics and values in brackets are p-values.

Table 5. Spatially lagged model with spatial fixed effects

	1991-2001	1991-1995	1996-2001	1991-2001		
	1	2	3	4	5	6
income	0.510	0.523	0.847	0.495	0.516	0.509
	(21.941)	(9.834)	(30.237)	(21.125)	(22.286)	(21.9219
credit	0.023	0.065	0.012	0.015	0.027	0.030
	(2.637)	(4.005)	(1.148)	(1.733)	(3.169)	(3.211)
deposit	-0.114	-0.149	0.004	-0.109	-0.104	-0.125
	(-10.025)	(-6.847)	(0.207)	(-9.576)	(-9.022)	(-9.694)
inf	0.008	0.001	0.001	0.0001	0.001	0.001
	(7.097)	(4.637)	(7.898)	(7.832)	(5.832)	(7.368)
δ	0.012	0.014	0.027	0.008	0.007	0.012
	(1.297)	(0.984)	(2.709)	(0.849)	(0.749)	(1.295)
D94				-0.033		
				(-3.459)		
D99					-0.036	
					(-3.763)	
D01						0.021
						(1.779)
Adj.R^2	0.482	0.350	0.741	0.483	0.484	0.029
log-likelihood	971.366	509.879	630.793	972.958	710.959	705.682
# of observations	737	335	402	737	737	737

Values in parentheses are heteroscedasticity consistent t-statistics.

Table 6. Spatial error model with spatial fixed effects

	1991-2001	1991-1995	1996-2001	1991-2001		
	1	2	3	4	5	6
income	0.538	0.513	0.863	0.542	0.527	0.540
	(23.109)	(9.616)	(33.708)	(23.339)	(22.530)	(23.119)
credit	0.0219	0.064	0.011	0.027	0.018	0.025
	(2.487)	(3.921)	(-0.215)	(3.221)	(2.107)	(2.675)
deposit	-0.103	-0.157	-0.004	-0.097	-0.105	-0.107
	(-7.705)	(-6.868)	(0.992)	(-6.982)	(-7.869)	(-7.067)
inf	0.001	0.001	0.001	0.001	0.001	0.001
	(7.238)	(4.875)	(7.144)	(5.789)	(7.255)	(6.371)
γ	0.065	0.030	0.096	0.057	0.058	0.057
	(6.428)	(1.852)	(8.328)	(5.470)	(5.583)	(5.464)
D94				-0.034		
				(-2.791)		
D99					-0.038	
					(-3.257)	
D01						0.003
						(0.205)
Adj.R^2	0.512	0.354	0.775	0.513	0.515	0.508
log-likelihood	985.747	509.598	480.437	989.078	990.524	985.204
# of observations	737	335	402	737	737	737

Values in parentheses are heteroscedasticity consistent t-statistics.