Investigating the Macroeconomic and Qualitative Dynamics of Urban Economic Growth: Evidence From the Most Productive Turkish Cities[12]

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Abstract

Jane Jacobs (1969) defined cities as the engines of economic growth. Therefore, it is important to examine the growth dynamics of cities. However, most of the studies dealt with country level economic growth and ignored the examination of city level growth dynamics. This study investigated the macroeconomic and qualitative growth dynamics of the most productive Turkish cities by employing linear panel data methodology. Findings indicated that gross fixed capital formation, population, last growth performance, call deposits, bank loans, exports, the sum distance to Ankara and Istanbul, crime rates, having a shore and harbour, the spirit of entrepreneurship and schooling in secondary education have significant influences on urban economic growth in Turkish economy.

Keywords: Economic growth, Cities, Turkish economy.

1. Introduction

Ceteris paribus, only way for increasing income is to set a sustainable economic growth performance. Since achieving this objective depends on determining basic dynamics which cause economic growth and economic policies which are based on these dynamics, theories of economic growth (e.g. Domar 1946, Harrod 1948, Solow 1956, Romer 1986, Lucas 1988, Romer 1990, Barro 1990) had always investigated the factors which basically conduct macroeconomic growth. However, it is clear that sustainable growth cannot be accomplished by only using macro level growth dynamics. Hence, researchers started to take these dynamics into account in a micro perspective. Cities and city level growth dynamics are one of the most important strands of this perspective. The Jacobs's (1969) idea that, while a dynamic which cause economic growth at the national level does not always hold the same importance for a city, but a dynamic which is important for the growth performance of a city is always as important as for the country which hosts that city, attracted the economists to deal with the studies which investigate the role and the growth dynamics of cities in the economic growth process of the nations.

The aim of this study is to find out the macroeconomic and qualitative growth dynamics of the most productive Turkish cities. These cities were selected due to their GDP rankings and data avaliability. Selected cities are the first two of which produce the highest GDP in their geographical region. The main motivation behind this study is that, there is no other paper which investigates the growth dynamics of cities in Turkish economy. Hence, this paper aims to fulfill this gap and contribute to the empirical literature. In addition, this study also differs from the previous studies, which investigated the dynamics of urban economic growth. Previous studies employed population growth as the proxy of urban economic growth. In this study, following Barro (2002) who stated that GDP growth is the best proxy for economic growth, city level GDP growth were utilized for proxying economic growth performance of cities. The rest of the paper is organized as follows: Next section reviews the related literature. Section 3 gives brief information about the macroeconomic and qualitative structure of selected cities. Section 4 explains the model and data. Section 5 outlines the methodology. Section 6 presents the results. Finally, Section 7 concludes.

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2. Literature Review

The literature about the dynamics of urban economic growth can be divided into two groups.

The first one consists of studies which conceptually analyze the role and the growth dynamics of cities in the economic growth process. Hoselitz (1953, 1955) is the first who explained the role of cities in the economic growth process of developing and developed countries. He stated that since cities are the places where industrialization begins, the core education takes place, new knowledge is produced and used, and which give a rise for economic diversity and entrepreneurship, host governments and administrative organizations and provide continuity for socio-economic activities; they have a very important positive role in the economic growth process of the nations. However, because there are more employment oppurtunities in cities in developed countries, this positive role is relatively larger than developing ones. Although it is not the first one, the major attempt for investigating the role of cities in economic growth process was made by Jacobs (1969) who defined the cities as the engines of economic growth. According to her study, the fact that cities are the places where new knowledge and technology occur and all other factors of production come together, create the linkage between cities and economic growth. In addition, Jacobs suggested that it is not possible for a nation to catch the balanced growth path without ensuring its cities' economic development. She showed that, in the most of the developed countries, approximately 85% of GDP is produced in cities.

A similar framework was generated by Friedman (1969), Ragan and Trehan (1998), Quigley (1998) and Duranton (2000, 2007). The common idea in these studies is that since cities are important centers for knowledge production, productivity level is always higher. This is the linkage which keeps the cities as the engines of economic growth. However, Polèse (2005) proposed a review of the arguments for and against the Jacobs' idea and concluded that the presence *per se* of cities is not a sufficient condition to generate long-term economic growth. He argued that cities (urban areas) are important not because they are unique engines of economic growth, but because it is increasingly in urban areas that people live and that economic activity takes place. With his pioneering study, Lucas (1988) is one of the most important researchers who dealt with the role of cities in the economic growth process. He stated that cities are like the nucleus of an atom. The role which is undertaken by cities for economic growth is similar to the role which is commited by exogenous human capital for macroeconomic growth. Using this feature, cities provide the accumulated factors to operate efficiently. Following Lucas (1988), Rauch (1991) agreed that human capital is one of the most important growth dynamics and since the relative wages are higher than other places, cities have important advantages for accumulating human capital. Thus, level of productivity and production is always higher in cities.

Using a Romer (1990) type endogenous growth model, Duranton (2004) theoretically analyzed the growth dynamics of cities and suggested that the basic growth dynamic of a city is R&D investments. According to his model, population is the determining factor for R&D and cities are the places where population is relatively high. That is why urban areas have improved growth experiences. The second group of the studies empirically analyzed the role and the growth dynamics of cities in the economic growth process. Sveikauskas (1975) proved that larger cities are important for national economic growth in US. Because, the productivity level is higher in these cities and production operates more efficiently. Similarly, Clark and Stabler (1991) showed that there is a positive relation between the size of the city and real income in Canada. Their findings support the fact that as the city size measured by the population increases, raises the level of productivity and production. Glaeser *et al*. (1992, 1995) tried to find the growth dynamics of cities in US. Findings revealed that while labor, geography, average schooling rate above five years, urban diversity and health infrastructure is associated with higher economic growth rates; there is negative relationships between local specialization, unemployment rate, crime level, traffic congestion, average schooling rate below five years and cities' economic growth rates.

De Long and Schleifer (1993) analyzed the growth performance of cities in Europe and argued that considering the last 800 years to industrial revolution, growth performance of cities which were governed by monarchy is worse than cities which were governed by feudalism. The higher taxation charges in the monarchic system prevented the cities to experience higher growth rates. Cheshire and Carbonaro (1996) investigated the growth dynamics of 118 urban areas in Europe and found that while there are positive relations between city based economic growth and European Union integration process, employment share of agriculture, population growth, R&D activities and last growth performance; employment share of manufacturing, the historic effects of coal industry, the historic effects of harbours and population density negatively affect urban economic growth. Eaton and Eckstein (1997) analyzed the growth dynamics of urban areas in France and Japan. Findings revealed that the basic dynamic behind the economic growth performance of urban areas in these countries is human capital.

Bradley and Gans (1998) tried to find the basic growth dynamics of Australian cities and concluded that although last growth performance, education infrastructure, human capital and health infrastructure positively affect economic growth; there is a negative link between economic growth and population density, employment share of public staff in manufacturing industry, crime rate and environmental pollution in Australian cities. Viladecans Marsal (2002) investigated the growth dynamics of cities in Spain. Results showed that city based economic growth in Spain is highly structural and the basic growth dynamics of Spanish cities are initial conditions such as higher population, density of economic activities, density of manufacturing industry, higher unemployment rate and zoning status of the urban areas. Finally, Da Mata *et al.* (2005) examined the growth patterns of Brazilian cities and found that sectoral production share of manufacturing industry, rise in the average schooling rate, population growth and initial conditions such as having a shore, historic background and natural resources have positive growth effects in Brazilian cities.

3. An overview about selected cities

One of the biggest problem faced in this study is that there is no avaliable data for all cities in Turkey. In addition, the fact that the data for city level GDP are avaliable only in the period of 1987-2001 and the data for other independent variables are balanced only in the period of 1990-2001, prevented us to use more recent data. Thus, these forced us to restrict the coverage and time span of this study and investigate the growth dynamics of the most productive Turkish cities by emplyoing the panel data for the period of 1990-2001. Although there are 81 cities in Turkey since 1999, this study covers 14 of them. As mentioned, these cities were selected due to their GDP rankings and data avaliability. Selected cities are the first two of which produce the highest GDP in their geographical region. However, if one takes a look at the macroconomic and qualitative structure of these 14 cities, he or she can realize that restrictions about coverage and time span do not matter for the investigation of the dynamics of urban economic growth for Turkish economy. In this regard, Table 1 comparatively shows some macroeconomic indicators of seleceted cities by referencing the observation of the year 2001 and the recent avaliable one[14]. In 1990 and 2001, total GDP produced in Turkish economy was 393 millions and 178 billions Turkish Liras, respectively. Table 1 indicated that these 14 cities produced 57.27% and 57.76% of the total Turkish GDP in 1990 and 2001, respectively. This situtation supports that selected 14 cities are very important for Turkish economy and they have a representative power for the investigation of the dynamics of urban economic growth. Table 1 also illustrates that, as well as city level GDP, for the case of the share of city level private investments, taxes, government investments, population, call deposits, bank loans, imports and exports, these cities are carrying the same importance for Turkish economy in the considered time intervals.

Insert table 1 about here

The situation which is avaliable for macroeconomic structure of considered cities holds for the qualitative one. Table 2 supports that health and education infrastructure of considered cities nearly cover the half of the total infrastructure of considered indicators of the whole country. In addition, these 14 cities are approximately representing 65% of the spirit of entrepreneurship in Turkish economy.

Insert table 2 about here

Finally, when considered indicators in Table 1 and Table 2 are analyzed, it is seen that these 14 cities are very important centers for urban economic life in Turkey both in 2000's and later. Thus, it can be concluded that restrictions about coverage and time span do not matter for the reliability of this study.

4. The Model and Data

The macroeconomic and qualitative growth dynamics of the most productive Turkish cities were investigated by using 2 sets of standard sources-of-growth equations based on a dynamic Cobb–Douglas aggregate production function which can easily be extended to include various growth dynamics.

$$\ln Y_{i,t} = \ln A_{i,t} + \beta \ln I_{i,t} + \delta \ln L_{i,t} + \phi \ln \mathrm{Yd}_{i,t} + \varepsilon_{i,t} \quad \mathbf{(1)}$$

$$\ln Y_{i,t} = \ln A_{i,t} + \beta \ln I_{i,t} + \delta \ln L_{i,t} + \phi \ln \mathrm{Yd}_{i,t} + \gamma \ln \mathrm{S}_{i,t} + \varepsilon_{i,t} \quad \mathbf{(2)}$$

$$\ln Y_{i,t} = \ln A_{i,t} + \beta \ln I_{i,t} + \delta \ln L_{i,t} + \phi \ln \mathrm{Yd}_{i,t} + \gamma \ln \mathrm{C}_{i,t} + \varepsilon_{i,t} \quad \mathbf{(3)}$$

$$\ln Y_{i,t} = \ln A_{i,t} + \beta \ln I_{i,t} + \delta \ln L_{i,t} + \phi \ln \mathrm{Yd}_{i,t} + \gamma \ln \mathrm{X}_{i,t} + \varepsilon_{i,t} \quad \mathbf{(4)}$$

$$\ln Y_{i,t} = \ln A_{i,t} + \beta \ln I_{i,t} + \delta \ln L_{i,t} + \phi \ln \mathrm{Yd}_{i,t} + \gamma \ln \mathrm{M}_{i,t} + \varepsilon_{i,t} \quad \mathbf{(5)}$$

The second set consists of the models which were utilized for determining the qualitative growth dynamics of considered cities. These models can be expressed as follows:

$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln \mathrm{Z}_{i,t} + \alpha \ln \mathrm{H1}_{i,t} + \varepsilon_{i,t} \quad \mathbf{(6)}$$

[14] Excep for city level GDP. For the lack of data, city level GDP is compared by using the observations of the years 1990 and 2001.

$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln Z_{i,t} + \alpha \ln H2_{i,t} + \varepsilon_{i,t} \quad \textbf{(7)}$$
$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln Z_{i,t} + \alpha \ln D_{i,t} + \varepsilon_{i,t} \quad \textbf{(8)}$$
$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln Z_{i,t} + \alpha G_{i,t} + \varepsilon_{i,t} \quad \textbf{(9)}$$
$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln Z_{i,t} + \alpha \ln CR_{i,t} + \varepsilon_{i,t} \quad \textbf{(10)}$$
$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln Z_{i,t} + \alpha \ln E_{i,t} + \varepsilon_{i,t} \quad \textbf{(11)}$$
$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln Z_{i,t} + \alpha \ln O_{i,t} + \varepsilon_{i,t} \quad \textbf{(12)}$$
$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln Z_{i,t} + \alpha P_{i,t} + \varepsilon_{i,t} \quad \textbf{(13)}$$
$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln Z_{i,t} + \alpha \ln SC1_{i,t} + \varepsilon_{i,t} \quad \textbf{(14)}$$
$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln Z_{i,t} + \alpha \ln SC2_{i,t} + \varepsilon_{i,t} \quad \textbf{(15)}$$
$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln Z_{i,t} + \alpha \ln SP_{i,t} + \varepsilon_{i,t} \quad \textbf{(16)}$$
$$\ln Y_{i,t} = \ln A_{i,t} + \gamma \ln Z_{i,t} + \alpha U_{i,t} + \varepsilon_{i,t} \quad \textbf{(17)}$$

Variables in all models, except the variables G, P and U are in logarithmic form. Since G in model 9, P in model 13 and U in model 17 are dummy variables, they are not in logarithmic form. The detailed explanation of the variables used in the growth equations are as follows:

- $Y_{i,t}$ is growth rate of GDP at the city level measured in 2001 prices in domestic currency.
- $I_{i,t}$ is gross fixed capital formation at the city level measured in 2001 prices in domestic currency (capital).
- $L_{i,t}$ is total population (labor).
- $Yd_{i,t}$ is the last growth rate of GDP of considered city measured in 2001 prices in domestic currency.
- $S_{i,t}$ is the sum of call deposits at the city level measured in 2001 prices in domestic currency (savings).
- $C_{i,t}$ is the sum of bank loans at the city level measured in 2001 prices in domestic currency (credits).
- $X_{i,t}$ is the sum of exports at the city level measured in 2001 prices in US Dollars.
- $M_{i,t}$ is the sum of imports at the city level measured in 2001 prices in US Dollars.
- $H1_{i,t}$ is the number of hospital beds per 10000 persons.
- $H2_{i,t}$ is the number of hospitals per 10000 persons.
- $D_{i,t}$ is the geographical distance in kilometers from considered city to Ankara the host of government and Istanbul the financial center of Turkish economy (distance).
- $G_{i,t}$ is a geographical dummy variable which is equal to 1 if considered city has a shore, otherwise 0 (geography).
- $CR_{i,t}$ is the city level crime rate which is formulated as follows:

$$CR = \frac{the \quad number \quad of \quad crimes \quad occured \quad in \quad considered \quad city}{the \quad total \quad number \quad of \quad crimes \quad occured \quad in \quad Turkey}$$

- $E_{i,t}$ is the number of new enterprises established in considered city.
- $O_{i,t}$ is the level of openness which is formulated as follows:

$$O = \frac{city \quad level \quad \exp orts + city \quad level \quad imports}{GDP \quad at \quad the \quad city \quad level}$$

- $P_{i,t}$ is a political dummy variable which is equal to 1 if considered city has been governed by the same party or person for more than ten years (i.e. 2 election periods), otherwise 0.
- $SC1_{i,t}$ is schooling rate of primary education in considered city.
- $SC2_{i,t}$ is schooling rate of secondary education in considered city.
- $SP_{i,t}$ is the level of specialization in manufacturing industry at the city level which is estimated by a slightly modified Herfindahl index that is formulated as follows:

$$SP = \sum_{j=1}^{j} (L_{j,t} / L_{i,t})^2$$

where $L_{j,t}$ is the number of employees in the manufacturing industry and $L_{i,t}$ is the number of all employees.

- $U_{i,t}$ is a urban dummy variable which is equal to 1 if the average urbanization rate of considered city in 1990-2001 period is higher than the average urbanization rate of Turkey in 1990-2001 period, otherwise 0.

5. The Methodology

In this study, in order to estimate the developed models (i.e. Model 1 to Model 17), linear panel data estimation techniques were utilized. If one takes a look at the literature, it is seen that the ordinary least squares (OLS), the fixed-effects model (FEM), or the random-effects model (REM) are employed for the estimation of linear panel equations.

However, since the OLS ignores the unobservable effects which are one of the most important properties of panel data analysis, FEM or REM is used for the estimation. But before starting the estimation, the existence of unit root in the data set should be checked. For this purpose, Levin, Lin Chu (LLC) (2002) and Im, Peseran and Shin (IPS) (2003) unit root tests were executed to the data. If the purpose of the panel analysis is to obtain a general result by using the data of randomly selected units from the whole sample, the REM is an appropriate choice. However, if the aim is to reach a general result by employing the data of a fixed group, the suitable model is FEM (Baltagi, 2005: 12-15). In this study, since the considered sample is randomly selected, the REM theoretically seems to be the proper choice.

The usage of REM requires no correlation between unobservable effects and explanatory variables. Hausman (1978) and Hausman-Taylor (1981) developed a test statistic (i.e. Hausman test) which shows the estimator of REM (FGLS- Feasible Generalised Least Squares) is unbiased and consistent under the null of no correlation between unobservable effects and explanatory variables. If the null hypothesis is rejected, then the estimator of FEM (WE-within estimator) should be used. In this study, Hausman test statistic was used for the determination of the correlation between unobservable effects and explanatory variables. Panel data analysis accommodates two unobservable effects which should be investigated before the estimation. These effects are group and time effects. Breusch and Pagan (1980) developed LM statistics in order to test the existence of group and time effects in REM (Green, 2003: 298-299). LM_1 statistic tests the significance of group effects under the null of no group effects and LM_2 statistic tests the significance of time effects under the null of no time effects. If one of the null of LM_1 or LM_2 is rejected, the model is one-way REM; on the other hand, if both the nulls of LM_1 and LM_2 are rejected then the model takes the from of two-way REM. Considered test statistics are formulated as follows (Baltagi, 2005: 60):

$$LM_1 = \frac{NT}{2(T-1)}\left[1-\frac{u^{'}(I_N \otimes J_T)u}{u^{'}u}\right]^2 \sim \chi^2$$

$$LM_2 = \frac{NT}{2(N-1)}\left[1-\frac{u^{'}(J_N \otimes I_T)u}{u^{'}u}\right]^2 \sim \chi^2$$

The existence of group and time effects in FEM is evaluated by an ANOVA-F statistic which was developed by Moulton and Randolph (1989). This F-statistic tests the significance of group and time effects under the nulls of no group and no time effects. The formulation of considered F-statistic is as follows (Baltagi, 2005: 63):

$$F = \frac{\gamma^{'}MD(D^{'}MD) - D^{'}M\gamma/(p-r)}{\gamma^{'}Gy/\left[NT-(\tilde{k}+p-r)\right]}$$

One of the most important diagnostics in econometric studies is to determine whether there exists serial correlation in the data. Wooldridge (2002: 283) proposed an AR(1) serial correlation test under the null hypothesis of no serial correlation. The test is applied by regressing the residuals from the OLS estimation of first-differenced variables on the lagged residuals. If the residuals from this estimation have an autocorrelation coefficient of -0.5, then the null hypothesis can not be rejected. Drukker (2003) developed a Wald test ($F_{AR(1)}$) for testing this approach that is used in this study. Another important diagnostic which should be taken into account in panel data studies is to check the existence of multicollinearity. For this purpose, VIF (Variance Inflation Factor) was utilized in this study. If the estimated VIF is smaller than 10, multicollinearity is not an important problem; if it exceeds 10, then it could be serious problem. In case the value which is over 10, probability of VIF that is measured as (1/VIF) should be evaluated. If the probability is smaller than 0.01, there is no multicollinearity among explanatory variables, otherwise there exists (Gujarati, 2004: 362-363).

The last diagnostic which was considered in this study is investigating the existence of heteroscedasticity. The standard error component model of developed models assume that the regression disturbances are homoscedastic with the same variance across time and groups. When heteroscedasticity is present, homoscedastic disturbances will result in consistent but inefficient coefficient of the variables and biased standard errors (Baltagi, 2005: 79). The heteroscedastic models assume that the variances of the error terms change between cross-sectional units and this difference is not accounted for by variables. Greene (2003) proposed an LM_h statistic under the null of homoscedasticity to test the existence of heteroscedasticity in error terms. This test statistic which is used in this study is formulated as follows (Erlat, 2006: 24)

$$LM_h = \frac{T}{2}\sum_{i=1}^{N}\left[\frac{\hat{\sigma}_{\varepsilon i}^2}{\hat{\sigma}_{\varepsilon}^2}-1\right]^2$$

LM_h test uses the residuals from the OLS estimation. If we expect heteroscedasticity to exist in error terms in the REM or FEM cases, then the statistic based on the OLS estimation may also be used in the both models. Once the heteroscedasticity is detected, one possible way to correct heteroscedastic bias in the variance-covariance matrix is to use the White's estimator (Erdem and Nazlioglu, 2008: 4).

6. Findings

The existence of unit root in panel data was investigated by employing LLC (2002) and IPS (2003) tests. Findings shown in Table 3 revealed that all of the variables are difference stationary in the case of intercept and trend specification.

Insert table 3 about here

After being proved the stationariy of the variables, developed models were estimated by using linear panel data estimation techniques. According to the Table 4 which illustrates the estimation results of the first five models (i.e. macroeconomic growth dynamics), while there exists statisticially significant relationships between city level GDP growth and population, gross fixed capital formation, last growth rate, call deposits, bank loans and exports; there is no avaliable significant relationship between city level GDP growth and imports.

This result states that the macroeconomic growth dynamics of cities are gross fixed capital formation, population, last growth performance, call deposits, bank loans and exports. In addition, findings indicated that all the significant dynamics positively affect urban economic growth in Turkish economy. Diagnostic checking in Table 4 revealed that all the models, except the Model 2, were estimated by using FEM; all the models contain both group and time effects; and there is no multicollinearity, no heteroscedasticity and no serial correlation in the estimated models.

Insert table 4 about here

Table 5 shows the estimation results of the models which were developed for finding the qualitative dynamics of urban economic growth in Turkey. Accordingly, while there are statisticially significant relationships between city level GDP growth and geography, crime rate, distance, entrepreneurship and schooling in secondary education; no avaliable significant relationship found between city level GDP growth and hospital beds, hospitals, openness to foreign trade, political stability, schooling in primary education, specialization and urbanization. This means that the qualitative dynamics which affect urban economic growth in Turkey are having a shore and harbour, crime rate, the sum distance to Ankara and Istanbul, the spirit of entrepreneurship and secondary education. However, while distance and crime negatively affect urban economic growth, others have positive growth effects on the economic performance of cities. Diagnostic checking in Table 5 indicated that while the Models 8, 10, 13 and 17 were estimated by employing REM, others were estimated by utilizing FEM; all the models contain both group and time effects; and there is no multicollinearity, no heteroscedasticity and no serial correlation in the estimated models.

Insert table 5 about here

7. Conclusion

The new trend in the empirical literature of economic growth is to deal with the micro level growth studies. In this regard, this study is aimed at investigating the macroeconomic and qualitative dynamics which are assumed to be having imporant influences on urban economic growth in Turkish economy. Findings revealed that while the macroeconomic dynamics which affect urban economic growth in Turkey are gross fixed capital formation, population, last growth performance, call deposits, bank loans and exports; the qualitative dynamics are the sum distance to Ankara and Istanbul, crime rates, having a shore and harbour, the spirit of entrepreneurship and schooling in secondary education.

The effects of all of the significant macroeconomic dynamics on city level GDP are positive. However, sum distance to Ankara and Istanbul and crime are the qualitative growth dynamics which negatively affect urban economic growth in Turkey. Compared to the previous studies, findings of the present study are boardly consistent with Sveikauskas (1975), Clark and Stabler (1991), Viladecans Marsal (2002), Duranton (2004) and Mata *el al.* (2005) who stated positive relationship between city level economic growth and population; consistent with Cheshire and Carbonaro (1996) and Bradley and Gans (1998) who found positive relationship between city level economic growth and last growth performance; consistent with Glaeser *et al.* (1992, 1995) and Mata *el al.* (2005) who stated positive relationships among city level economic growth, schooling rate and geographical structure; consistent with Hoselitz (1953, 1955) who showed positive relationship between city level economic growth and entrepreneurship; and consistent with Glaeser *et al.* (1992, 1995) and Bradley and Gans (1998) who found negative relationship between crime rate and city level economic growth.

However, there is no significant evidence about the positive relationship among city level economic growth, human capital and health infrastructure; and no significant evidence about the negative relationship between specialization and city level economic growth in Turkish cities.

Finally, in order to experience higher economic growth rates at the city level in Turkish economy, policy makers should provide the accumulation of capital and labor, should sustain the avaliable productive capacity, should strengthen economic agents to save and lend, should improve the functionality of the financial sector, should support foreign trade (i.e. export), should invest in secondary education, should keep the spirit of entrepreneurship alive, should try to decrease the crime rates, should eliminate the barriers which impede economic agents to reach goods, services and knowledge and should try to supply the same cost advantage which are only available to cities who have a shore and harbour. The requied tools (i.e. economic policies) for these purposes are avaliable in their hands. The fundemantal problem in this point is to choose the right policy and use it in the right direction. The examination of this can be a potential research area for the future studies.

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Table 1. Some macroeconomic indicators of selected cities.

Cities	Share of GDP (%)		Share of private investments (%)		Share of Taxes (%)		Share of government investments (%)	
	1990	2001	2001	2009	2001	2009	2001	2008
Adana	3,49	3,05	1,03	2,63	1,02	0,91	0,41	1,12
Ankara	7,85	8,33	3,62	6,19	16,12	13,29	4,27	5,05
Diyarbakır	1,39	1,15	0,77	0,81	0,18	0,29	1,65	0,67
Erzurum	0,66	0,69	0,41	0,63	0,16	0,18	1,09	0,70
Gaziantep	1,54	1,36	2,95	4,30	0,45	0,60	0,98	0,52
Istanbul	20,84	22,11	24,63	14,32	41,06	43,58	8,47	14,62
Izmir	7,45	7,30	4,94	2,64	5,75	9,57	5,40	2,12
Kayseri	1,18	1,22	0,72	1,49	0,51	0,66	0,59	0,70
Kocaeli	4,34	4,55	3,14	4,04	16,34	12,04	3,18	1,26
Malatya	0,82	0,80	0,83	0,41	0,16	0,19	0,98	0,48
Manisa	2,38	2,09	0,99	4,66	0,52	0,56	0,39	0,49
Mersin	2,82	2,75	0,94	2,24	1,20	1,86	1,29	1,35
Samsun	1,54	1,41	0,22	3,52	0,52	0,53	1,54	1,36
Trabzon	0,98	0,95	0,30	0,70	0,28	0,35	1,04	0,79
Sub-total	**57,27**	**57,76**	**45,55**	**48,58**	**84,27**	**84,61**	**31,28**	**31,21**
Turkey	100	100	100	100	100	100	100	100

Source: TurkStat, Turkish Statistical Institute.

Table 1. Some macroeconomic indicators of selected cities (continued)

Cities	Share of population (%)		Share of call deposits (%)		Share of bank loans (%)		Share of imports (%)		Share of exports (%)	
	2001	2009	2001	2009	2001	2009	2001	2008	2001	2008
Adana	2,73	2,84	2,96	2,68	2,14	1,84	1,29	1,06	1,36	0,98
Ankara	5,92	6,40	10,56	10,66	18,83	10,10	13,23	11,53	5,20	4,06
Diyarbakır	2,02	2,08	0,37	0,37	0,13	0,43	0,03	0,01	0,03	0,06
Erzurum	1,38	1,06	0,20	0,21	0,16	0,29	0,01	0,01	0,02	0,02
Gaziantep	1,91	2,27	0,72	0,69	0,72	1,16	1,06	1,38	1,91	2,45
Istanbul	14,93	17,79	38,38	38,93	39,75	35,39	53,91	55,11	56,96	55,67
Izmir	5,01	5,33	9,29	8,96	4,93	5,00	4,14	4,11	8,75	5,92
Kayseri	1,56	1,66	0,68	0,90	0,72	0,87	0,62	0,68	1,02	0,84
Kocaeli	1,79	2,09	1,37	1,48	1,74	1,58	13,58	12,76	2,84	6,41
Malatya	1,26	1,01	0,42	0,40	0,17	0,31	0,03	0,02	0,18	0,19
Manisa	1,84	1,83	1,22	1,10	0,37	0,92	0,35	0,41	0,79	0,77
Mersin	2,47	2,26	1,84	1,94	0,89	1,22	0,38	0,47	1,18	0,81
Samsun	1,75	1,72	0,98	0,99	0,45	0,78	0,15	0,38	0,12	0,34
Trabzon	1,45	1,05	0,59	0,74	0,24	0,56	0,06	0,05	0,66	0,69
Sub-total	**44,57**	**49,39**	**69,58**	**70,04**	**71,25**	**60,46**	**88,84**	**87,98**	**81,01**	**79,21**
Turkey	100	100	100	100	100	100	100	100	100	100

Source: TurkStat, Turkish Statistical Institute.

Table 2. Some qualitative indicators of selected cities.

Cities	Share of hospitals (%)		Share of beds (%)		Share of schools (%)		Share of students (%)		Share of universities (%)		Share of university graduates (%)		Share of new enterprises (%)	
	2001	2007	2001	2007	2001	2009	2001	2009	2001	2008	2001	2008	2001	2009
Adana	1,67	1,56	2,76	2,80	1,97	2,19	3,27	3,00	1,30	0,76	1,41	1,52	2,18	2,35
Ankara	4,76	5,40	9,43	8,66	3,74	3,88	6,13	5,81	11,69	7,63	9,60	6,88	11,34	11,01
Diyarbakır	1,42	1,41	1,68	1,76	2,00	2,84	2,39	2,83	1,30	0,76	0,97	0,79	0,76	1,32
Erzurum	1,75	1,25	1,86	1,75	2,50	2,35	1,41	1,20	1,30	0,76	2,18	1,61	0,68	0,43
Gaziantep	1,00	1,41	1,46	1,67	1,46	1,65	2,38	2,74	1,30	1,52	0,57	0,55	1,51	1,77
Istanbul	16,03	15,75	21,78	17,52	6,46	7,23	15,72	16,94	28,57	22,90	11,03	9,78	33,72	35,62
Izmir	4,09	3,68	6,15	6,11	3,60	3,60	4,88	4,45	6,49	5,34	3,84	3,75	6,83	6,28
Kayseri	1,59	2,03	1,55	1,77	1,60	1,64	1,76	1,69	1,30	1,52	1,21	1,04	1,15	1,28
Kocaeli	1,34	1,72	1,33	1,82	1,13	1,42	1,96	2,10	2,60	1,52	2,02	2,55	1,44	2,17
Malatya	1,00	1,25	0,90	1,18	1,57	1,46	1,18	1,11	1,30	0,76	1,07	0,93	0,50	0,65
Manisa	2,17	1,88	1,77	1,85	2,19	1,94	1,71	1,57	1,30	0,76	1,40	1,35	1,09	0,87
Mersin	1,34	1,41	1,80	1,87	1,89	1,92	2,50	2,31	2,60	1,52	0,99	1,18	1,84	1,80
Samsun	1,59	1,56	2,41	2,26	2,88	2,62	1,94	1,72	1,30	0,76	1,69	1,16	0,95	0,81
Trabzon	1,17	1,48	1,59	1,59	1,40	1,25	1,15	1,02	1,30	0,76	1,45	1,32	0,72	0,71
Sub-total	**40,90**	**41,79**	**56,47**	**52,61**	**34,41**	**35,99**	**48,37**	**48,49**	**63,63**	**47,27**	**39,42**	**34,41**	**64,71**	**67,06**
Turkey	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: TurkStat, Turkish Statistical Institute.

Table 3. Unit root test results

	Macroeconomic Dynamics	LLC	prob	IPS	prob	Qualitative Dynamics	LLC	prob	IPS	prob
Level										
Intercept	lnY	-9.038	(0.00)	-1.649	(0.04)	lnH1	0.358	(0.64)	2.729	(0.99)
	lnL	-2.050	(0.02)	1.592	(0.94)	lnH2	-1.365	(0.08)	0.251	(0.59)
	lnI	-2.889	(0.00)	2.461	(0.99)	lnCR	-3.030	(0.00)	-2.099	(0.01)
	lnY_d	-6.004	(0.00)	2.637	(0.99)	lnE	-1.513	(0.06)	-0.611	(0.27)
	lnS	-1.086	(0.13)	3.969	(0.99)	lnO	-1.287	(0.09)	0.408	(0.65)
	lnC	-2.190	(0.01)	0.689	(0.75)	lnSC1	-1.513	(0.06)	0.250	(0.59)
	lnM	-3.515	(0.00)	-1.344	(0.08)	lnSC2	-3.172	(0.00)	0.314	(0.62)
	lnX	-4.090	(0.00)	-1.707	(0.04)	lnSP	-0.660	(0.25)	1.149	(0.87)
Intercept and trend	lnY	8.927	(0.99)	6.309	(0.99)	lnH1	-1.836	(0.03)	0.758	(0.77)
	lnL	-1.614	(0.05)	1.504	(0.93)	lnH2	-3.376	(0.00)	-0.059	(0.47)
	lnI	-2.680	(0.00)	0.909	(0.81)	lnCR	-4.315	(0.00)	-1.517	(0.06)
	lnY_d	6.757	(0.99)	1.749	(0.95)	lnE	-2.098	(0.01)	3.060	(0.99)
	lnS	1.577	(0.94)	1.179	(0.88)	lnO	-3.796	(0.00)	-1.417	(0.07)
	lnC	4.729	(0.99)	3.848	(0.99)	lnSC1	-4.173	(0.00)	0.789	(0.78)
	lnM	-6.295	(0.00)	-2.380	(0.00)	lnSC2	-3.509	(0.00)	-0.610	(0.27)
	lnX	-5.497	(0.00)	-2.034	(0.02)	lnSP	-2.053	(0.02)	0.220	(0.58)
Difference										
Intercept	lnY	0.642	(0.73)	0.827	(0.79)	lnH1	-7.415	(0.00)	-5.048	(0.00)
	lnL	-7.229	(0.00)	-4.671	(0.00)	lnH2	-9.115	(0.00)	-5.037	(0.00)
	lnI	-11.546	(0.00)	-7.571	(0.00)	lnCR	-11.968	(0.00)	-7.837	(0.00)
	lnY_d	-1.685	(0.04)	-1.364	(0.08)	lnE	-9.671	(0.00)	-6.289	(0.00)
	lnS	-8.474	(0.00)	-4.945	(0.00)	lnO	-10.119	(0.00)	-7.064	(0.00)
	lnC	-0.338	(0.36)	0.462	(0.67)	lnSC1	-7.476	(0.00)	-4.650	(0.00)
	lnM	-15.652	(0.00)	-10.359	(0.00)	lnSC2	-8.044	(0.00)	-6.033	(0.00)
	lnX	-11.960	(0.00)	-8.092	(0.00)	lnSP	-7.186	(0.00)	-4.559	(0.00)
Intercept and trend	lnY	-5.212	(0.00)	-2.877	(0.00)	lnH1	-5.635	(0.00)	-2.383	(0.00)
	lnL	-6.412	(0.00)	-3.027	(0.00)	lnH2	-8.654	(0.00)	-2.305	(0.01)
	lnI	-9.827	(0.00)	-4.262	(0.00)	lnCR	-10.234	(0.00)	-3.474	(0.00)
	lnY_d	-4.439	(0.00)	-3.366	(0.00)	lnE	-11.754	(0.00)	-5.238	(0.00)
	lnS	-8.217	(0.00)	-1.909	(0.02)	lnO	-9.278	(0.00)	-3.262	(0.00)
	lnC	-2.324	(0.01)	-1.794	(0.03)	lnSC1	-8.560	(0.00)	-2.959	(0.00)
	lnM	-14.835	(0.00)	-5.983	(0.00)	lnSC2	-7.833	(0.00)	-3.397	(0.00)
	lnX	-17.818	(0.00)	-5.618	(0.00)	lnSP	-7.743	(0.00)	-1.805	(0.03)

Table 4. Results for the estimations of macroeconomic growth dynamics (Dependent variable: lnY)

Independent variables	Coefficients and test statistics									
	Model 1		Model 2		Model 3		Model 4		Model 5	
lnL	0.228	(0.00)	0.245	(0.00)	0.127	(0.52)	0.134	(0.50)	0.101	(0.60)
lnI	0.008	(0.07)	0.014	(0.01)	0.022	(0.07)	0.023	(0.06)	0.027	(0.03)
lnY_d	0.414	(0.00)	0.569	(0.00)	0.877	(0.00)	0.909	(0.00)	0.904	(0.00)
lnS			0.087	(0.00)						
lnC					0.043	(0.03)				
lnM							-0.001	(0.89)		
lnX									0.031	(0.09)
Diagnostics										
Hausman	11.650	(0.00)	0.290	(0.99)	19.730	(0.00)	14.000	(0.00)	17.100	(0.00)
LM_1	60.078	(0.00)	4.440	(0.03)	59.601	(0.00)	60.795	(0.00)	59.892	(0.00)
LM_2	281.868	(0.00)	573.240	(0.00)	273.191	(0.00)	278.729	(0.00)	274.565	(0.00)
VIF	2.870	(0.73)	45.020	(0.02)	7.450	(0.13)	4.310	(0.23)	4.000	(0.24)
LM_h	5.023	(0.83)	10.184	(0.74)	12.985	(0.52)	7.517	(0.91)	10.690	(0.71)
F_{AR}	0.741	(0.40)	0.466	(0.30)	0.285	(0.23)	0.440	(0.28)	0.530	(0.37)

* Numbers in parenthesis are *p*-values.

Table 5. Results for the estimations of qualitative growth dynamics (Dependent variable: lnY)

Independent variables	Coefficients and test statistics											
	Model 6		Model 7		Model 8		Model 9		Model 10		Model 11	
lnL	0.225	(0.31)	0.172	(0.37)	0.227	(0.00)	0.272	(0.00)	0.228	(0.00)	0.019	(0.85)
lnI	0.022	(0.07)	0.022	(0.07)	0.012	(0.00)	0.012	(0.00)	0.012	(0.00)	-0.014	(0.13)
lnY_d	0.790	(0.00)	0.798	(0.00)	0.507	(0.00)	0.409	(0.00)	0.509	(0.00)	0.833	(0.00)
lnS	0.079	(0.08)	0.074	(0.10)	0.071	(0.04)	0.048	(0.04)	0.072	(0.03)	0.129	(0.00)
lnC	0.038	(0.06)	0.038	(0.06)	-0.003	(0.83)	-0.006	(0.67)	-0.003	(0.83)	-0.003	(0.81)
lnX	0.031	(0.16)	0.029	(0.19)	-0.003	(0.66)	-0.000	(0.92)	-0.003	(0.67)	0.030	(0.04)
lnH1	0.055	(0.59)										
lnH2			0.018	(0.79)								
G					0.235	(0.04)						
lnCR							-0.038	(0.06)				
lnD									-0.367	(0.00)		
lnE											0.239	(0.00)
Diagnostics												
Hausman	29.190	(0.00)	27.100	(0.00)	0.010	(0.99)	28,890	(0.00)	0,020	(0.99)	134,980	(0.00)
LM_1	64.223	(0.00)	62.198	(0.00)	3.340	(0.06)	63,606	(0.00)	3,680	(0.05)	62,473	(0.00)
LM_2	268.438	(0.00)	267.344	(0.00)	545.100	(0.00)	269,163	(0.00)	549,440	(0.00)	152,347	(0.00)
VIF	2.310	(0.43)	1.660	(0.60)	2.210	(0.45)	7,780	(0.12)	2,530	(0.39)	14,820	(0.06)
LM_h	37.027	(0.37)	28.403	(0.77)	23.972	(0.89)	29,486	(0.73)	33,068	(0.56)	40,259	(0.24)
F_{AR}	0.406	(0.26)	0.784	(0.47)	0.851	(0.52)	0,212	(0.20)	0,851	(0.51)	0,750	(0.43)

* Numbers in parenthesis are *p*-values.

Table 5. Results for the estimations of qualitative growth dynamics (Dependent variable: lnY) (continued)

Independent variables	Coefficients and test statistics											
	Model 12		Model 13		Model 14		Model 15		Model 16		Model 17	
lnL	0.182	(0.24)	0.227	(0.01)	0.175	(0.39)	0.112	(0.42)	0.198	(0.32)	0.153	(0.17)
lnI	0.021	(0.05)	0.012	(0.04)	0.023	(0.08)	0.021	(0.08)	0.021	(0.08)	0.024	(0.01)
lnY_d	0.719	(0.00)	0.507	(0.00)	0.795	(0.00)	0.732	(0.00)	0.800	(0.00)	0.813	(0.00)
lnS	0.144	(0.00)	0.071	(0.06)	0.076	(0.09)	0.136	(0.02)	0.072	(0.11)	0.038	(0.43)
lnC	0.021	(0.26)	-0.003	(0.76)	0.039	(0.05)	0.018	(0.25)	0.039	(0.05)	0.021	(0.21)
lnX	0.022	(0.42)	-0.003	(0.71)	0.030	(0.18)	0.037	(0.19)	0.029	(0.19)	0.015	(0.44)
lnO	0.019	(0.46)										
P			0.045	(0.75)								
lnSC1					-0.026	(0.88)						
lnSC2							0.152	(0.02)				
lnSP									0.017	(0.61)		
U											0.038	(0.70)
Diagnostics												
Hausman	29.550	(0.00)	0.010	(0.99)	27.750	(0.00)	29.180	(0.00)	26.990	(0.00)	0.028	(0.34)
LM_1	63.654	(0.00)	2.950	(0.08)	63.203	(0.00)	61.313	(0.00)	62.380	(0.00)	28.452	(0.00)
LM_2	268.337	(0.00)	54.720	(0.00)	268.518	(0.00)	267.517	(0.00)	267.676	(0.00)	50.885	(0.00)
VIF	13.790	(0.07)	1.570	(0.63)	42.450	(0.02)	20.030	(0.04)	5.010	(0.19)	1.640	(0.61)
LM_h	23.651	(0.88)	25.819	(0.70)	22.849	(0.94)	25.440	(0.71)	29.432	(0.74)	24.145	(0.74)
F_{AR}	0.429	(0.23)	0.851	(0.52)	0.944	(0.69)	0.177	(0.11)	0.246	(0.19)	0.851	(0.50)

* Numbers in parenthesis are *p*-values.