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THE ROLE OF INVESTMENTS IN UNIVERSITIES AND IN AIRPORTS ON THE REGIONAL CONVERGENCE

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ABSTRACT

Regional disparities are important concerns for the researchers as well as the policy makers in both developed and developing countries. The government, as a leading actor in the regional policies can create externalities through investments not only in the real sectors, but also in infrastructure and institutions. For example, investments in education (all levels of education, but especially for universities), health and transportation enhance the quality of life and business environment, and trigger the development in those regions. In the paper, we define this type of government role in a particular region as "economic environment augmenting activities of the government." We focus on two types of initiatives of the government: regional universities and the existence of an airport. The effects of universities in a region are defined in two forms: knowledge and expenditures. The paper considers the existence of manufacturing in a region in order to understand the local dynamics that can affect convergence among the regions. The paper also considers the knowledge effect of universities on manufacturing sector. The impacts of university expenditures and of the existence of an airport on the service sector are considered simultaneously. The main findings show that spending impact suppresses knowledge impact in the low income provinces. And, there is a threshold for the regional income level: The demand effect of government initiatives as state university and providing air transport has greater impact in low-income provinces.

Key Words: Regional convergence, role of government, university, panel-data modeling

JEL Codes: O18, R11, R58

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INTRODUCTION

In the late 19th century and early 20th century, Marmara (Istanbul and Bursa), Aegean (Izmir) and South Region of Turkey (Adana) were important economic centers of the Ottoman Empire. These regions are located in the West and South sides of the country. The West side of Turkey continues to be developed while the East side regions still struggle with lack of school, hospital, and poor economic activities. Hence, the basic structure of regional differences did not change structurally over the last century. After more than two decades economic reforms and opening policies were implemented; there emerged some new industrial centers in the Marmara and Aegean which are situated the West Side, and even in the Center Anatolian regions of Turkey.[1] However, the main structure of the regional development trend did not change over the two decades and the shift has happened in the West Side. The East provinces continue to battle poverty and migration to the West provinces due to poor access to education and health facilities, and low level economic activity in their regions.

The aim of the paper is to investigate the effects of government activities in the regional convergence process of Turkey. To this end, it is useful to decompose the contributions of the government towards the development of human capital through education and health, improvement of infrastructure, and investments in service sectors, particularly in the communication sector. However, the existence of manufacturing in a particular region and share of the manufacturing sector in the regional income are other vital factors for regional economies beyond the government actions. Furthermore, government initiative may affect manufacturing, and indirectly, factors affecting manufacturing could be important in regional process. We define this type of government role in a particular region as "economic environment augmenting activities of the government."

The paper first gives a particular attention to the development of the human capital through local state universities. Universities have a crucial role in the creation of regional innovation systems through their research activities and the collaboration with the local business. They have also significant contribution to the education of local employment.

[1] The regional evaluation is based on (Dogruel and Dogruel, 2006).

These are the *knowledge impacts* of regional universities. However, they have further impacts on the regional economic systems: the *spending impact* through their budget expenditures. Thus, we consider the effects of universities in a region as knowledge and expenditures. We think that, communication and transport may be other important contributions of government. Nevertheless, we exclude communication investments due to the easy access to communication tools, such as telephone. The communication investment in Turkey is almost completed before the period covered by the paper. Therefore, communication is not a distinct factor among the regions.[2] We also think that, the transport investments, especially the access to air transport (the existence of an airport), would create more distinct externality vis-à-vis communication. Then, we have decided to consider the existence of an airport in a particular region as an indicator of government investment. The last convergence issue in the analysis is the share of manufacturing sector. The paper takes the other contribution of the government investments in social and physical infrastructures other than accessing air transport, as the complementary to the investments in education. The empirical models employ panel approach and consider three level regional systems (NUT-3 level (i.e. 81 provinces)).

The findings show that university expenditure impact suppresses knowledge impact in the low income provinces. However, there is a positive and significant knowledge effect of universities on manufacturing in the high-income provinces; this effect can not be observed in the low-income provinces. University expenditures have also positive and significant effects on the service sector in all regions. Finally, the existence of an airport has an effect on both group regions; its effect is stronger in the low-income provinces.

The plan of the paper as follows: The second section outlines the "economic environment augmenting activities" of the government. The third section displays the regional disparities in Turkey employing some descriptive statistics. This section also covers several convergence studies on regional differences in Turkey. The fourth section outlines the empirical approach and exhibits the quantitative results. The last section concludes the paper.

[2] It would be interesting to consider access to the internet if there are data.

ON THE ECONOMIC ENVIRONMENT AUGMENTING ACTIVITIES OF THE GOVERNMENT

The regional differences are not common problems of only developing countries, but also of developed countries. This problem was widely discussed in development economics and economic geography offered some idea about the determinants of localization of economic activities which are important for regional growth. "*In spite of all efforts to find a universal model to explain the issue, economists are still far from a consensus. On the one hand, this is probably an outcome of the complexity of the regional differences within a country* (Dogruel and Dogruel, 2006)." On the other hand, this may be a dilemma of government policies: There is a contradiction between overall economic efficiency and preferential regional policies (Markusen, 1995). Governments are more sensitive to overall economic efficiencies and/or growth issue than regional differences. As a result, regional disparities are important concerns for researchers as well as policy makers in both developed and developing countries; and it seems that, discussion on regional differences will continue for a long time.

In general, the shares of agricultural or industrial sectors value added are used to explain the regional differences. However, the regional social and physical infrastructures such as availability of education, health, transportation and communication facilities have gained less attention. The government, as a leading actor in the regional policies can create externalities through investments not only in the real sectors, but also in infrastructure and institutions. These externalities are crucial in regional dynamics.

The regional externality concept is based on the seminal work of Marshall's (1920), *Principles of Economies*. These externalities are called as "…*the Marshallian Trinity: labor market pooling, supplier specialization, and knowledge spillovers* (Cortright, 2006:8)." The new geography has strong ties with this concept. But, we have to refer Krugman (1991b) for this field as a leading work. The regional differences and the first convergence concept

discussed in Barro and Sala-i Martin (1991b).[3] The literature has numerous empirical studies of regional convergence.

The studies on the link between public infrastructures (particularly transport infrastructure) and growth show that the outcomes of researches may differ between regions and countries. It is possible to indicate some examples. Holtz-Eakin and Schwartz (1995) could not find strong quantitative evidence on the highway-regional productivity issue in US. However, they emphasize that "spillover benefits differ significantly across industries" and they stress the need for further analysis. Boopen (2006) found that transport capital has a contribution to the development of African countries. Yamaguchi (2006) found mixed results between the infrastructure development in air transport (access to interregional air transport) and per-capita GDP growth for "core and peripheral areas in Japan."

University role in development is not restricted with the teaching and research. They can participate to the regional development process through stimulating the business environment. In the small regions, they can affect development by their budget and employment. An economic impact survey on "American state universities" provides an example for this argument:

> *"The 2000 Economic-Impact Survey (...) found that states' investment in public universities generate significant jobs, additional spending, and increased tax revenue for local and regional economies. The economic benefits take many different forms. But the data clearly demonstrate that state-supported universities remain powerful engines for economic stability and growth: The average return on every $1 of state money invested in a NASULGC [National Association of State Universities and Land-Grant Colleges] institution is $5 (Henderson, 2001: 8)."*

Newlands' paper is related to this economic impact. In addition, the knowledge impact is considered in the paper: Newlands (2003) divides economic impacts of universities in their regions into spending impacts and knowledge impacts. The effects of consumption

[3] We may also refer Barro and Sala-i Martin (1991a, 1992, 1995 and 2004). They scrutinize whether poor countries grow faster than rich ones and for this purpose, they applied the new growth theory to the convergence concept by examining the period 1840-88 for 48 US states and 1960-85 for 98 countries. They found evidence for absolute and conditional convergence respectively.

and capital spending on income and employment refer to spending impacts while production of highly educated graduates and the production and dissemination of knowledge is regarded as knowledge impacts. The paper reviews a number of studies of the roles of European and American universities in contributing to regional competitiveness in learning economy and states that the role of universities is overstated.

The different knowledge effects of universities are extensively discussed as research questions. Drucker and Goldstein (2007) found that research universities have increasing importance in economic development in US. Their results show knowledge-based activities (they indicate teaching and basic research) have significant positive effects on regional economic development. The new studies emphasize the role of universities considering the effect of globalization: As an example, Audretsch et al. (2007:11) define industry structure in the business environment of a region with the cooperation of a university.[4] D'Costa (2006) discusses a different type of business environment in the Indian software industry.

There are other examples from the literature that emphasize university role through "knowledge effect" in development. The knowledge effect appears in different forms:

Karlsson and Zhang (2001) start with the question of the relationship between knowledge generation, economic growth and development. They consider the research universities to be the main actors in knowledge generation due their role in R&D and educating skilled research personnel. Aggregation of universities is therefore considered as the knowledge sector in endogenous growth models, which produces human capital or R&D. Thus, spatial distribution of knowledge becomes important for regional economic growth.[5]

[4] "Globalization has made it possible for manufacturers to not only find, but to use, the cheapest inputs for their businesses. However, it turns out that only the production of standardized and labor-intensive inputs has been shifted to countries with competitive labor costs; capital-intensive production tends to stay close to home. In the automobile industry, for example, it is generally true that first- and second-tier suppliers are located in direct proximity to the original equipment manufacturer (OEM). The low vertical integration in this industry necessitates close coordination between OEM and important suppliers to phase production processes and assure just-in-time and justin-sequence production. Thus, R&D cooperation is particularly important for process innovations. Further, this network is often complemented by universities as well as by various types of service providers, including commercial cleaners and warehousemen, jobs likely to be filled by low-skilled workers (Audretsch et al., 2007:11)."

[5] Starting with these views in mind, they propose a dynamic two-region model with human capital accumulation. The only university in the economy is located in region 1. Dynamic interdependence between human capital accumulation, regional division of labor, spatial price structure under perfect competition and the

Chakrabarti and Lester (2002) see universities as a potential source of technology. According to the authors, a firm can both obtain knowledge and technology from a university and recruit graduates and faculty to serve as employees and consultants which makes the universities unique. Thus, the importance of university-industry alliances for advancing knowledge and new technologies is stated. For their explanatory study, they take eight universities, four from US and four from Finland. The investigation stresses the role of national policies and governmental agencies in promoting university-industry collaborations.

University-industry collaboration is also investigated using "Triple-Helix Model." The model involves government in addition to university and industry as a collaborator for regional development.[6] It is possible to refer two examples which employ this model: Arbo and Eskelinen (2003) use the triple helix framework to investigate the experience of two Nordic universities, Joensuu in Finland, and Tromsø in Norway. The conclusions focus on the realization of a university's role in local and regional development. Gunasekara (2006) investigates the role of universities in the development of regional innovation systems. The triple helix model of university, industry and government relations is used and applied to a comparative study of three non core-metropolitan universities in Australia. But, the institutional interaction between industry, university and government has other forms than the "Triple-Helix Model." The paper of D'Costa (2006), which examines the Indian software industry, has a different approach:

"...the author argues that Bangalore's (and India's) information technology (IT) industry is predicated on an Indian business model which does not encourage thick institutional linkages such as those encapsulated by the triple helix model. Under this institutional arrangement there is cross-fertilization of new ideas and new modes of institutional interaction between industry, academia, and government D'Costa (2006)."

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government intervention in R&D and higher education is explained in the model. The model examines the effects of differences in human capital improvements and environmental conditions among two regions.

[6] The related documents are Etzkowitz and Leydesdorff (1995) and Leydesdorff and Etzkowitz (1996).

Benneworth (2006) poses the question whether universities in knowledge poor regions can improve their regional innovation systems, by working in the development of territorial production complexes which stimulate innovation based competitiveness in these places. For this purpose, Newcastle in the North East of England and Twente in the Netherlands are used as two examples of less successful regions. University spin off companies is focused on to explore the extent to which recent spin off companies, and the activities which coalesce around spin offs, are 'densifying' the regional innovation system, and making a place for those regions in the 'new knowledge economy'.

REGIONAL DISPARITIES AND CONVERGENCE IN TURKEY

Turkey comprises two dissimilar regional structures considering leading economic and social regional indicators: regional GDP per head, employment level, energy consumption, and export level. They all show the dominant role of Istanbul, West Anatolia, East and West Marmara, Aegean, and partly Mediterranean region. Table 1 gives the rank of regions at the level 1 (12 regions); the regions where have the large cities in the west side are wealthy regions. Figure 1 shows the changes in per capita GDP in the 1990-2001 periods. The per capita GDP values in West regions are above the average of Turkey.[7] Furthermore, almost all the industry is located in the West side. Istanbul, the East and West Marmara, and Aegean regions account more than ¾ of the total manufacturing in the total value added and total revenue (Table 2- 2001). The share of labor force employed in non agricultural activities reaches 99 percent of total labor force in Istanbul (Table 3). Table 4 displays the distribution of household incomes by quintiles ordered by income: The wealthy regions are slightly unequal in terms of income distribution considering the Gini coefficients.

The regional disparity problem is the continuation of a long history. The governments have focused on industrialization and rapid development targets in the early republican years. This trend has continued over the three decades starting from just after the foundation of the Republic. The expansionary government policies were practiced in the 1950s: The new infrastructure investments were realized in leading cities and the government expenses increased in the rural areas of Turkey. Hence, there was no a specific regional policy, which

[7] TURKSTAT does not give the regional GDP values for the years after 2001.

intended to reduce disparities or improve welfare in unfavorable regions, from the beginning of the foundation of republic to the planning period (Dogruel, 2006). Specific regional policies have attempted to reduce regional disparities in the Five Year Plans starting from the 1960s. Although, the most of poor provinces are under preferential regional arrangements during the last half century, there is no convergence between regions. Altinbas et al. (2002) do not support the positive effect of preferential regional policies on the poor regions. The findings of Gezici and Hewings (2004) indicate a similar result.

Convergence hypothesis has been tested for the provinces and regions of Turkey in several studies. Most of the studies do not find evidence of convergence. The early studies of regional disparities in Turkey are Tokgoz (1980) and Filiztekin (1998); and also Erk et al. (2000) for GAP Region. Dogruel and Dogruel (2003) analyze the period of 1987-1999 and found β convergence for unconditional and conditional models. It is also stated that poor provinces tend to converge faster than others. Conditional models that have manufacturing sector share as a variable also signals faster convergence. According to σ convergence analysis findings, convergence occurred only in developed-rich provinces.

Following Barro and Sala-i Martin (1995), Gezici and Hewings (2004) examine regional convergence and core-periphery relations in Turkey for the period 1980-97. They applied both σ and β convergence analyses and found no evidence for convergence across both provinces and the functional regions in Turkey. East and west regions of Turkey are also compared and it is found that disparities are still obvious between the two. The authors conclude that notwithstanding the policies for "Priority Provinces in Development", they do not grow faster than core-developed provinces. Moreover, the majority of them remained as poor regions with their neighbors.

Karaca (2004) measures σ and β convergence for the period 1975-2000, using the data of 67 provinces of Turkey. The author's main question is whether policies followed after 1960 in Turkey helped convergence between provinces and also between east and west regions. To reflect the structural differences between provinces, share of agricultural sector value added in the provinces' GDP is added as an explanatory variable. The findings indicate that there is no convergence but divergence between provinces. When structural differences are controlled, divergence disappears but still there is no evidence of convergence.

A recent paper by Aldan and Gaygisiz (2006) use β convergence both based on cross-sectional regressions and Markov chain analysis to test convergence hypothesis across the provinces in Turkey for 1987-2001 period. Results from both methodologies signal non-existence of convergence. The authors also analyze the spatial spillovers in the growth process of provinces and find that such spillovers exist.

Erlat and Ozkan (2006) employ the time series approach to test for unconditional convergence of the geographical regions and provinces of Turkey. The approach involves testing if the squares of the differences of regional and provincial per capita incomes from a target income, (national and regional per capita incomes for the provinces) have significant negative average slopes when regressed on polynomials in time, and whether there are structural shifts in these slopes. The author concluded that evidence of conditional convergence may be obtained in an aggregate of national context (via panel unit root tests) but convergence results regarding individual provinces or regions may not provide support for this conclusion.

EMPIRICAL APPROACH AND RESULTS

Different methodologies used by convergence research can be classified as follows (Islam, 2003): informal cross-section approach, formal cross-section approach, panel approach, time-series approach, and the distribution approach. Magrini (2004) suggests that the first four approaches should be used with care as these are developed for convergence across nations not regions.

In this study, convergence of Turkey's provinces (NUTS 3) is analyzed with per capita GDP data from 67 provinces for the period 1990-2000.[8] We obtained per capita GDP data and manufacturing sector value added from Turkish Statistical Institute (TUKSTAT). University expenditures are taken from General Directorate of Public Accounts and airport data is obtained from General Directorate of State Airports Authority.[9] Although there are

[8] See Annex 1 for the Statistical Regional Classification.

[9] http://www.muhasebat.gov.tr/mbulten/2006genbut.php
reached at 30 July 2007.

81 provinces in this classification, only 67 are taken for the reasons stated in Dogruel and Dogruel (2003). That is, as the period includes the establishment of 14 new provinces, the values of these are added to the values of the provinces from which they were separated for simplicity and we believe that it will not cause a significant observation loss. We also divide the provinces into two groups, namely high-income provinces and low-income provinces and repeat the analysis. For this purpose we used the same table given in the Appendix of Dogruel and Dogruel (2003).[10] Before the empirical examination, we look at the picture of data in Figure 2. There seems to be no clear relation between average growth rates of provinces (vertical axis) and the log of initial GDP per capita values (1990) if we look for convergence as suggested in Barro and Sala-i Martin (1991b).

For analysis, we use the panel data approach to measure "β" convergence, represented by the following models.

[1] $$\log(y_{i,t}) = a_1 + b_1 \log(y_{i,t-1}) + c_1 U_{i,t} + d_1 M_{i,t}$$

[2] $$\log(y_{i,t}) = a_2 + b_2 \log(y_{i,t-1}) + c_2 UB_{i,t} + d_2 A_{i,t}$$

$\log y_{i,t}$= GDP per capita in province i at year t

$U_{i,t}$ = dummy variable, takes the value 1 beginning with the year of the establishment of the first university in the province.

$UB_{i,t}$ = total share of university expenditures in the related province's GDP

$A_{i,t}$ = dummy variable, takes the value 1 beginning with the year of the establishment of the first airport in the province.

$M_{i,t}$= Share of manufacturing sector value added in GDP of province i

In this approach, $\beta = -\ln(b)$ gives us the convergence coefficient. A significant positive value shows convergence, whereas the opposite shows divergence. The university

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http://www.dhmi.gov.tr/dosyalar/limanvemeydanlar/limanvemeydanlar.asp
reached at 15 August 2007

[10] See Annex 3 for the list.

existence dummy is used to capture the knowledge impacts of the local state universities. Further, we add the share of manufacturing sector value added in GDP to represent the economic environment augmenting activities of the government in Model 1 (Table 5). Model 2 in (Table 5) looks for evidence of convergence when spending impacts of the universities and the transport investments as access to air transport are considered together.

The regression results of Model 1 indicate that the coefficient of "*b*" is significant at 1% significance level in all models. Further, our variable representing the share of manufacturing sector value added in GDP ($M_{i,t}$) is found significant and positive in all fixed effects estimations supported by the Hausman Test. Also, the dummy variable for university's role in convergence is found positive and significant, indicating positive spillover effects. We have calculated "*β*" values and they showed convergence in all models. The coefficient is larger for low-income provinces, which points out that they converge more rapidly than do high-income provinces.

In Model 2, we use the shares of university expenditures in GDP to capture their spending impacts on the regional economic system. In addition, existence of an airport is used as a proxy for the transport investments of government. In terms of the industrial sector, the manufacturing component is the most important factor for growth. However, manufacturing sector shares of low-income provinces are so small that including them in the model creates bias in the coefficients of the other variables. According to the estimation results, although the coefficient of "*UB*" is positive in all regressions, university expenditures have a significant positive effect on convergence only in low-income provinces and the same conclusion is valid for airport establishments. Moreover, "*β*" coefficients reported in Table 5 show convergence in all estimations, again indicating a more rapid convergence for low-income provinces.

To investigate university-industry relations, we looked for evidence of convergence in manufacturing sector "*PCGDP*" values of provinces, explained by the existence of a university in the province in Model 3, given below. The services sector makes an important contribution to income especially in high-income provinces. Therefore, we examine the role

of university expenditures and airport availability in the convergence of this sector's "*PCGDP*" values in Model 4.

[3] $$\log(My_{i,t}) = a_3 + b_3 \log(My_{i,t-1}) + c_3 U_{i,t}$$

[4] $$\log(Sy_{i,t}) = a_4 + b_4 \log(Sy_{i,t-1}) + c_4 UB_{i,t} + d_4 A_{i,t}$$

ln $My_{i,t}$= Manufacturing sector GDP per capita in province i at year t

ln $Sy_{i,t}$= Services sector GDP per capita in province i at year t

Table 6 shows that universities create positive externalities for the business environment in the manufacturing sector. Particularly high-income provinces benefit from knowledge-based cooperation. University expenditures and access to air transport positively affects convergence in the services sector. Universities contribute to economic success of the sector especially in high-income provinces, while in contrast availability of an airport help more for low-income provinces.

CONCLUSION

The overall results show that local universities have positive spillover effects in all regions. We can observe this effect on both wealthy and poor regions. Furthermore, low income provinces converge faster than high-income provinces. However, when the model considers university expenditures, the university effect is restricted with the low-income provinces. From these outcomes, it is possible to say that the knowledge effect of universities is widespread while the effect of expenses is limited to the low-income regions. The existence of an airport has an effect on low-income provinces.

Universities create positive externalities for the manufacturing sector. Particularly high-income provinces benefit from knowledge-based cooperation. University expenditures have impacts on the service sector in all regions. Therefore, it creates an externality and this means that through service sector university expenditures stimulate demand in all provinces.

The same positive and significant effect is observed from accessing to air transport, but only for low-income regions; it positively affects convergence in the services sector.

Hence it is clear that there is a threshold for the regional income level: The demand effect resulting from university expenditures and the existence of an airport is more important in low-income provinces. The demand impact is weaker in high-income provinces; probably other factors play more significant role in those regions.

Table 1: Rank of Socio-Economic Development by Regions (Level 1) (2003)

Rank	Regions (Level 1)
1	Istanbul
2	West Anatolia
3	East Marmara
4	Aegean
5	West Marmara
6	Mediterranean
7	West Black Sea
8	Central Anatolia
9	East Black Sea
10	South East Anatolia
11	Middle East Anatolia
12	North East Anatolia

Source: The State Planning Organization

Figure 1: Per capita GDP at the regional level

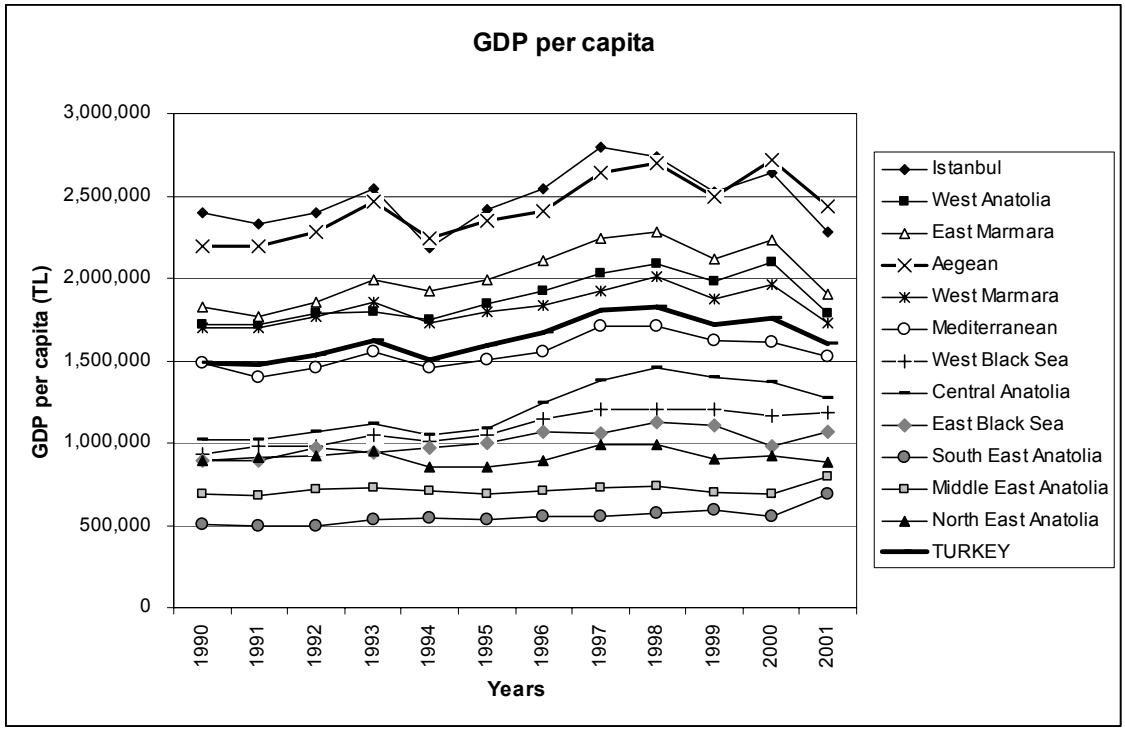

Table 2: Manufacturing industry value added and total income, 2001 (10 +) Rew 2*

		Value added Share of region	Total income Share of region
TR	Turkey	100.0	100.0
	Level 1 (Regions)		
TR1	Istanbul	23.0	22.4
TR2	West Marmara	7.0	6.6
TR3	Aegean	20.0	21.6
TR4	East Marmara	26.3	26.6
TR5	West Anatolia	5.1	4.6
TR6	Mediterranean	7.1	6.9
TR7	Central Anatolia	4.5	3.8
TR8	West Black Sea	2.7	2.6
TR9	East Black Sea	0.8	1.7
TRA	North East Anatolia	0.2	0.2
TRB	Middle East Anatolia	0.8	0.8
TRC	South East Anatolia	2.5	2.3

Source: Calculated from TURKSTAT

Table 3: Labor force status and economic activity, 2004
(15+ Age) Thousands

					Economic activities				
		Total	Agriculture, hunting, forestry and fishing	Non-agricultural activities	Total	Agriculture	Industry	Construction	Services
TR	Turkey	100	34	66	100	34	18	5	43
	Level 1 (Regions)	100							
TR1	Istanbul	100	1	99	100	1	37	5	57
TR2	West Marmara	100	42	58	100	42	17	4	37
TR3	Aegean	100	38	62	100	38	20	4	38
TR4	East Marmara	100	23	77	100	23	31	5	41
TR5	West Anatolia	100	23	77	100	23	16	6	56
TR6	Mediterranean	100	33	67	100	33	14	5	48
TR7	Central Anatolia	100	49	51	100	49	12	4	35
TR8	West Black Sea	100	53	47	100	53	11	4	33
TR9	East Black Sea	100	63	37	100	63	5	4	28
TRA	North East Anatolia	100	66	34	100	66	3	2	30
TRB	Middle East Anatolia	100	45	55	100	45	6	5	43
TRC	South East Anatolia	100	39	61	100	39	11	6	44

Source: TURKSTAT

Table 4: Distribution of household incomes by quintiles ordered by income, 2003

	(Horizontal %)		*Total* %	First 20%	Second 20%	Third 20%	Fourth 20%	Fifth 20%	Gini
	Level 1 (Regions)								
TR1	Istanbul	*Total*	100.0	6.4	10.1	13.7	19.3	50.5	0.43
		Rural	100.0	6.5	10.2	13.8	19.4	50.1	0.42
		Urban	100.0	5.4	8.1	11.4	16.9	58.2	0.50
TR2	West Marmara	*Total*	100.0	7.0	11.8	15.9	21.8	43.4	0.36
		Rural	100.0	7.8	12.0	16.2	21.7	42.3	0.34
		Urban	100.0	6.4	11.5	15.6	21.9	44.5	0.38
TR3	Aegean	*Total*	100.0	6.6	11.1	15.2	21.9	45.2	0.38
		Rural	100.0	6.6	10.8	15.1	21.7	45.9	0.39
		Urban	100.0	6.9	11.9	16.2	22.4	42.6	0.35
TR4	East Marmara	*Total*	100.0	6.8	10.9	14.9	21.1	46.4	0.39
		Rural	100.0	6.9	10.9	14.9	21.2	46.1	0.39
		Urban	100.0	6.4	10.9	14.8	21.0	46.8	0.40
TR5	West Anatolia	*Total*	100.0	5.7	10.1	14.8	22.0	47.4	0.41
		Rural	100.0	5.6	10.0	15.0	22.2	47.3	0.41
		Urban	100.0	7.0	11.7	16.1	22.5	42.7	0.35
TR6	Mediterranean	*Total*	100.0	6.0	10.3	14.7	21.1	47.9	0.41
		Rural	100.0	6.1	10.4	14.6	20.8	48.1	0.41
		Urban	100.0	5.8	10.2	14.8	21.5	47.7	0.41
TR7	Central Anatolia	*Total*	100.0	7.5	11.7	14.9	20.3	45.7	0.38
		Rural	100.0	8.4	12.5	16.4	22.3	40.3	0.32
		Urban	100.0	6.9	11.1	14.0	19.0	49.0	0.41
TR8	West Black Sea	*Total*	100.0	6.3	11.2	15.3	21.6	45.6	0.39
		Rural	100.0	6.4	11.1	15.3	21.8	45.4	0.39
		Urban	100.0	6.7	11.6	15.9	21.6	44.3	0.37
TR9	East Black Sea	*Total*	100.0	7.6	11.8	15.9	22.2	42.6	0.35
		Rural	100.0	7.3	12.4	16.6	22.3	41.4	0.34
		Urban	100.0	7.9	11.9	15.8	21.3	43.1	0.34
TRA	North East Anatolia	*Total*	100.0	6.1	11.0	15.7	22.6	44.6	0.38
		Rural	100.0	6.5	11.7	16.7	22.4	42.6	0.36
		Urban	100.0	6.1	10.7	15.4	21.8	46.0	0.39
TRB	Middle East Anatolia	*Total*	100.0	6.5	11.4	16.2	23.5	42.4	0.36
		Rural	100.0	6.3	11.3	16.3	24.2	41.9	0.36
		Urban	100.0	7.0	12.1	17.1	23.4	40.3	0.33
TRC	South East Anatolia	*Total*	100.0	7.1	11.6	15.6	21.8	43.9	0.36
		Rural	100.0	6.9	11.7	16.0	22.1	43.3	0.36
		Urban	100.0	8.3	12.7	16.2	21.2	41.6	0.33

Source: TURKSTAT

Figure 2: Growth vs. initial per capita GDP

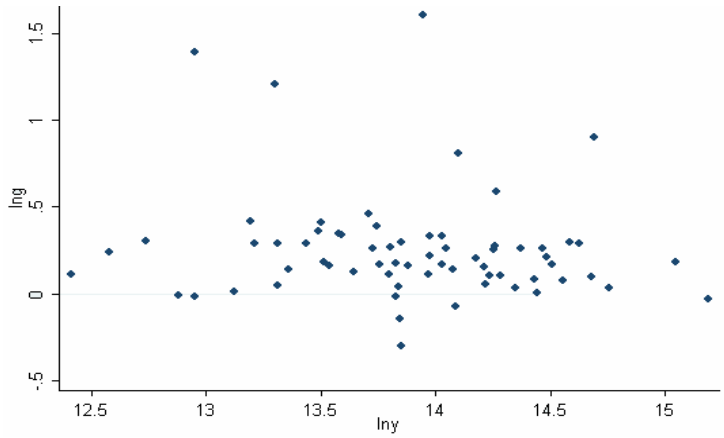

Table 5: Estimation results for Model 1 and 2.

	Model 1			Model 2		
Dependent variable: LogPCGDP	General	High Income	Low Income	General	High Income	Low Income
Constant	4.023*	2.759*	5.474*	4.296*	2.613*	8.244*
	(0.363)	(0.550)	(0.487)	(0.484)	(0.682)	(0.584)
Previous year LogPCGDP	0.700*	0.796*	0.589*	0.696*	0.820*	0.398*
	(0.026)	(0.038)	(0.035)	(0.034)	(0.047)	(0.042)
Share of manufacturing sector value added in GDP (M_{it})	0.006*	0.005**	0.007*			
	(0.001)	(0.002)	(0.002)			
University dummy (U_{it})	0.096*	0.079**	0.127*			
	(0.025)	(0.034)	(0.039)			
University budget share (UB_{it})				0.028	0.042	0.035**
				(0.021)	(0.044)	(0.018)
Airport dummy (A_{it})				0.023	-0.001	0.076*
				(0.034)	(0.076)	(0.028)
Observations				389	213	176
Number of provinces				39	22	17
R^2				0.9198	0.8549	0.7401
$\beta = -\ln(b)$	0.357	0.228	0.529	0.362	0.198	0.920

***10%, **5%, *1%, values in parentheses are standard errors.

Table 6: Estimation results for Model 3 and 4

Dependent variable:	Log Manufacturing PCGDP			Log Service PCGDP		
	Model 3			Model 4		
	General	High Income	Low Income	General	High Income	Low Income
Constant	4.548*	3.700*	5.100*	5.069*	3.714*	10.115*
	(0.322)	(0.516)	(0.404)	(0.544)	(0.731)	(0.771)
Previous year Log Manufacturing PCGDP	0.606*	0,705*	0.528*			
	(0.027)	(0.041)	(0.037)			
Previous year Log ServicePCGDP				0.622*	0.725*	0.232*
				(0.040)	(0.053)	(0.058)
Share of manufacturing sector value added in GDP (M_{it})						
University dummy (U_{it})	0.062**	0.072***	0.030			
	(0.030)	(0.037)	(0.051)			
University budget share (UB_{it})				0.069*	11470**	0.037***
				(0.026)	(0.051)	(0.022)
Airport dummy (A_{it})				0.057***	0.043	0.132*
				(0.035)	(0.075)	.0303926
Observations	737	319	418	351	193	158
Number of provinces	67	29	38	38	22	16
R^2	0.980	0.958	0.978	0.474	0.406	0.033
$\beta = -\ln(b)$	0.501	0.350	0.639	0.475	0.322	1.461

***10%, **5%, *1%, values in parentheses are standard errors.

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ANNEX 1: Statistical Regional Classification

CODE	LEVEL1	LEVEL2	LEVEL3
TR			TURKEY
TR1	İstanbul		
TR10		**İstanbul**	
TR100			İstanbul
TR2	Western Marmara		
TR21		**Tekirdağ**	
TR211			Tekirdağ
TR212			Edirne
TR213			Kırklareli
TR22		**Balıkesir**	
TR221			Balıkesir
TR222			Çanakkele
TR3	Aegean		
TR31		**İzmir**	
TR310			İzmir
TR32		**Aydın**	
TR321			Aydın
TR322			Denizli
TR323			Muğla
TR33		**Manisa**	
TR331			Manisa
TR332			Afyon
TR333			Kütahya
TR334			Uşak
TR4	Eastern Marmara		
TR41		**Bursa**	
TR411			Bursa
TR412			Eskişehir
TR413			Bilecik
TR42		**Kocaeli**	
TR421			Kocaeli
TR422			Sakarya
TR423			Düzce
TR424			Bolu
TR425			Yalova
TR5	Western Anatolia		
TR51		**Ankara**	
TR510			Ankara
TR52		**Konya**	
TR521			Konya
TR522			Karaman
TR6	Mediterranean		
TR61		**Antalya**	
TR611			Antalya
TR612			Isparta
TR613			Burdur
TR62		**Adana**	
TR621			Adana
TR622			Mersin
TR63		**Hatay**	
TR631			Hatay
TR632			Kahramanmaraş
TR633			Osmaniye
TR7	Middle Anatolia		
TR71		**Kırıkkale**	
TR711			Kırıkkale
TR712			Aksaray
TR713			Niğde
TR714			Nevşehir
TR715			Kırşehir
TR72		**Kayseri**	
TR721			Kayseri
TR722			Sivas
TR723			Yozgat

CODE	LEVEL1	LEVEL2	LEVEL3
TR8	Western Black Sea		
TR81		**Zonguldak**	
TR811			Zonguldak
TR812			Karabük
TR813			Bartın
TR82		**Kastamonu**	
TR821			Kastamonu
TR822			Çankırı
TR823			Sinop
TR83		**Samsun**	
TR831			Samsun
TR832			Tokat
TR833			Çorum
TR834			Amasya
TR9	Eastern Black Sea		
TR90		**Trabzon**	
TR901			Trabzon
TR902			Ordu
TR903			Giresun
TR904			Rize
TR905			Artvin
TR906			Gümüşhane
TRA	North Eastern Anatolia		
TRA1		**Erzurum**	
TRA11			Erzurum
TRA12			Erzincan
TRA13			Bayburt
TRA2		**Ağrı**	
TRA21			Ağrı
TRA22			Kars
TRA23			Iğdır
TRA24			Ardahan
TRB	Middleeastern Anatolia		
TRB1		**Malatya**	
TRB11			Malatya
TRB12			Elazığ
TRB13			Bingöl
TRB14			Tunceli
TRB2		**Van**	
TRB21			Van
TRB22			Muş
TRB23			Bitlis
TRB24			Hakkari
TRC	Southeastern Anatolia		
TRC1		**Gaziantep**	
TRC11			Gaziantep
TRC12			Adıyaman
TRC13			Kilis
TRC2		**Şanlıurfa**	
TRC21			Şanlıurfa
TRC22			Diyarbakır
TRC3		**Mardin**	
TRC31			Mardin
TRC32			Batman
TRC33			Şırnak
TRC34			Siirt

ANNEX 2: Statistical Regional Classification

NUTS 2, Level 2 (12 PROVINCES)

Annex 3: The List of high and low-income provinces*

High-income provinces	PCGDP**	Low-income provinces	PCGDP**
KOCAELİ	4028	SAMSUN	1242
İZMİR	2517	ELAZIĞ	1214
BİLECİK	2493	KONYA	1158
İSTANBUL	2458	ÇORUM	1155
KIRKLARELİ	2420	NİĞDE	1149
MUĞLA	2177	UŞAK	1147
BURSA	2147	KAYSERİ	1101
ANKARA	2098	KASTAMONU	1083
TEKİRDAĞ	2069	MALATYA	1081
MANİSA	2048	İSPARTA	1034
ÇANAKKALE	1980	TRABZON	1017
İÇEL	1843	DİYARBAKIR	983
ANTALYA	1770	K. MARAŞ	981
ARTVİN	1752	KIRŞEHİR	976
AYDIN	1699	AMASYA	969
DENİZLİ	1689	TOKAT	922
NEVŞEHİR	1688	SİNOP	908
ESKİŞEHİR	1687	ADIYAMAN	879
ADANA	1631	AFYON	859
BOLU	1555	GİRESUN	850
BALIKESİR	1546	SİVAS	829
SAKARYA	1394	ERZİNCAN	793
EDİRNE	1389	ÇANKIRI	773
HATAY	1357	ORDU	739
BURDUR	1337	SİİRT	715
ZONGULDAK	1326	ŞANLIURFA	698
KÜTAHYA	1321	YOZGAT	679
RİZE	1299	MARDİN	675
GAZİANTEP	1282	GÜMÜŞHANE	615
TURKEY (average)	**1270**	ERZURUM	610
		TUNCELİ	610
		VAN	495
		KARS	467
		BİTLİS	401
		BİNGÖL	374
		MUŞ	356
		AĞRI	302
		HAKKARİ	287

Source: Dogruel and Dogruel (2003).
*) The rank is made by considering the 12 years average of the PCGDP of Turkey (67 provinces)
**) PCGDP average for each province.