Convergence and Growth within GAP Region (South Eastern Anatolia Project) and Overall Turkey's Regions

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Abstract

In recent years, different perspectives of Per Capita income convergences and their impact on economic growth had been under discussion. Convergence literature starling with beta convergence in avertedly biased toward variance calculation leads to several biased implications. Successively constructed sigma and alternative convergence attempts have their own biases due to neglected explanatory variables sum being economical rest being social factors. In this research, using beta and sigma convergence for Turkey's provinces and regions show us that neoclassical economic growth model wise convergence does not exist and factor like human capital and physical capital complementarity should be further emphasized.

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I. Review of Literature

One of the most prominent discussion in the economic literature is whether relatively low level income countries (regions) economically grow faster than relatively wealthier nations (regions). In this sense we search for any automatic mechanisms that leads to convergence in per capita income among countries. Generally two reasons are cited for the vigorous discussions about convergence among countries' per capita income. (Sala-i-Martin, 1996): First, the calculation of the speed of convergence in order to collect information about the share of capital in total output. Second, increasing multi-country data availability on GNP accounts. These two major factors contributed to the revision of convergence process. In neoclassical theory, per capita income growth shows inverse correlation with the initial term per capita income level. In a case if economies (countries or regions) utility and production functions are similar, relatively poor countries will relatively have a faster economic growth rate than relatively rich countries(regions).

First section of the study covers basic definitions and concepts. Second part of the study covers the process of convergence among regions and/or countries and within this respect focuses on Neoclassical Growth Model (NGM), while the third part concentrates on reviving the major contributions to economic growth theory during the post 1980 period. Final section of the study looks at convergence among regions and provinces in Turkey with special reference to the South Eastern Anatolia Project (GAP)

In economic literature two common convergence criteria used are beta (â) and sigma (ó) convergence. In a case where poor economies correspond to high level economic growth rates, this type of convergence is known as â convergence. â convergence can be simply stated by the following regression form

$$g_{i,t} = \alpha - \beta \log y_{i,t} + \varepsilon_{i,t} \qquad (1)$$

If b>0 then the result would be interpreted as absolute b-convergence.

In a case where the relative distribution of per capita GDP levels decreases over time among countries (regions), this will show a ó_t convergence. Here $\text{ó}_{t,}$ shows the standard deviation among logarithmic per capita income levels. Thus if the value of standard deviation decreases over time, this shows a ó level convergence $\text{ó}_{J-T} < \text{ó}_t$. However, existence of â – convergence does not necessarily show the existence of ó-convergence, but the opposite case requires â–convergence (Sala-i-Martin, 1996).

In recent years discussions about convergence theory have grown in two different dimensions. Formerly existence of convergence has been employed to test exogenous and endogenous economic growth models. Former post Solow models, developed β-convergence to test similar arguments (Baumol, 1986; Barro, 1991) Solowian growth models assert that over accumulation of capital lowers the marginal productivity and leading to a decline in economic growth rates while the opposite arises in developing countries. Over time difference among countries will disappear thus Per capita income convergence between developed and developing countries become inevitable This synthesis has been put forward in equation (1). Neoclassical growth theory prognosis that Per capita incomes will level out among and within world countries. During the post 1980 period some Neoclassical pioneers have worked to improve the model and added new explanatory variables. (conditional convergence) (Barro, 1991; Barro and Sala-i-Martin, 1992; Mankiw and others, 1992). Another area of efforts, criticized the assumptions of constant returns to scale, exogenous nature of technology, and especially pointed out the endogenous nature of technology (Romer, 1986 and 1990; Lucas, 1988; Grossman and Helpman, 1991; Rebelo, 1991; Aghion and Howitt, 1992). One other dimension of efforts has been in measurement techniques related to convergence (Friedman, 1992; Quah, 1996; Boyle and McCarty, 1997; Bliss, 1999; Cannon and Duck, 2000). Discussions on the measurement of convergence led to new a convergence concept like twin-peaks (Quah, 1993 and 1996)

According to Friedman (1992), the selection of the initial periods logarithmic Per capita income data in measuring b-convergence reminds the so called Galton's Fallacy. He further asserts that instead of using initial periods data in logarithmic Per capita terms, if the final value is used then the outcome will be a positive relationship (Bliss, 1999). In this sense Friedman (1992) and Quah (1993), argue that examining the change in the distribution of real GDP values of countries will lead to a better estimate. This approach used by Sala-i-Martin and is called s-convergence (Quah, 1993; 1996a; 1996b). Empirical work on the same topic shows that Per capita income of economies could be gathered under two separate distributions. With the twin-peaks contribution, he argues that countries and regions create their own development clubs or polars.

Cho (1996) points out the possible defects that might occur due to conditional convergence. In this paper it is stated that, existence of strong correlation among Per capita income, investment ratios and population, endogenize these variables. If that is the case, conditional convergence becomes biased and the prediction of the model becomes much more controversial. Paper by Carroll and Weil (1993), also found out statistically significant correlation between investment and economic growth rates.

Evans and Karras (1996) (EK), argues that validity of traditional convergence approach exists, if and only if the countries or regions under examination are identical; showing AR(1)[1] properties, continuos inter-economy differences are well endowed in modeling. Evans and Karras (1996), further proposed an alternative approach which does not rely on over simplified assumptions. Alternative approach, showing similar findings with NGM, have vast differences in terms of model creation and assumptions. In NGM economies initial term performance variable values do not have long term level effects: $\lim_{i \to \infty}(y_{n,t+i} - a_{t+i}) = \mu_n$. Here a_{t+i}, shows the parallel development trend; y_{nt}, shows the nth economies Per capita income values in log terms for period t. On the contrary, in endogenous growth models (EGM) it is asserted that initial term variable values could have an impact on the steady state equilibrium and will move in concordance with: $\lim_{i \to \infty}(y_{n,t+i} - a_{t+i})$, $(y_{n,t} - a_t)$

For EK absolute or relative convergence to occur, for all n's μ=0 and for some n's $\mu \neq 0$. In traditional convergence approach, existence of convergence is tested by $g_n = \alpha + \beta y_{n0} + \gamma' x_n + v_n$ regression equation for OLS. Here g_n, is the average growth rate for the analyzed period and x_n is the vector reflecting structural differences among countries. Estimating $\beta<0$ from the above cited equation, we can conclude that less developed economies show faster economic growth rate. Thus,

$$\text{If } \beta<0 \quad \begin{cases} \gamma=0 \Rightarrow \text{"absolute convergence"} \\ \gamma\neq 0 \Rightarrow \text{"conditional convergence"} \end{cases}$$

Econometric attempts in testing convergence takes economic growth rate as dependent, and initial income level as the explanatory variable. Other explanatory variables are handled to test utility function and technological differences. But it is clear that international and regional utility function and technological differences are very difficult to verify. In recent years empirical findings of EGM's show that world does not witness international income convergence which contradict NGM. This outcome led to new theories focusing on conditional convergence. Dissimilarities of production functions among countries, also alters the possible explanations of the approach. Islam, via panel data analysis, tested these differences for EGM's. Panel data analysis eliminates the difficulties raised by deepening capital, technological and institutional differences in terms of economic growth theory. Overall results show that, institutional and technological differences of the countries have strong bearings in understanding international economic growth differences. If there is no such differences where countries differs only in terms of per capita income, the speed of the convergence will be faster. In a case where countries (regions) have similar production functions, to increase the steady state levels of per capita income, it would be sufficient to emphasize savings and labor supply levels. In a case where we reverse the assumption, i.e. production functions being variant among countries, physical and moral variables deserve more importance to be given for Per capita income steady state levels to be improved. For Islam, usage

[1] First order autoregressive process.

of panel data for such purposes will create a very valuable link between models of economic growth and economic development (Islam, 1995).

Islam tests the convergence process for 1960-85 by using panel data for the same country group used by MRW. In MRW; savings, labor supply growth, and technological growth (g) rates are constant because the model does not contain time component, being tested only for cross sectional data. Under the panel data analysis where both time series and cross sectional analysis have been employed in equality ($\log\left[\hat{y}(t)\right] = \log\left[\hat{y}(0)\right]e^{-\beta t} + \log(\hat{y}^*)\left(1 - e^{-\beta t}\right)$) g and t variables should be simultaneously inserted to the model. In such a case, the term A(0) reflecting technological levels should also reflect factor endowments, institutional structures and climatic conditions and can be written as A(0)=a+ε. Here a shows the constant term, and ε shows country specific regression distortion term. Or in other words ε shows the deviations from the steady state equilibrium.

Islam employs the Summers;Heston's data set that used by Barro (1991) and MRW (1992) . In order to move from cross-sectional data to panel data, the whole period had been divided into sub-periods. In such a case the length of the terms usually raises some problems. For Islam yearly data intervals are very short to test economic convergence, thus not appropriate. To avoid such a pitfall he adapted five year time segments. Such as, in a case that we are examining 1960 –85, 1965, 1970, 1975, 1980, 1985 intervals should be taken and if t = 1965, t-1 should be 1960. In such a case saving ratio and population growth rate should also correspond to previous term averages. Comparing Islam's findings with MRW, α (share of capital in total output) seems to be very close in both studies, the only difference α is that being calculated openly. Islam's 60-80percent values for α matches with MRW's broad definition of capital. Meaning that, dividing the data set into subsets and calculating the regression with panel data approach; does not significantly alter the results. Islam's convergence seems to be very small[2].

Within the scope of new economic growth theories, most of the empirical studies on convergence is taking place for similar countries. For example, W.J.Baumol (1986), examines the convergence among 16 developed nations with the data set (1870-1979) created by Madison. Baumol finds a convergence among developed nations during the post 1870 period. It can be said that his findings seems to support two basic facts (De Long, 1988):

- The former being during the post II World war period growth rate in US shows a decreasing trend.
- The later being, optimistic expectations about improving economic growth process.

Baumol tested the Madison's data for 16 developed countries (today fall into the range of developed countries). For De Long, the basic problem with the Baumols approach arises from the wrong estimation of 1870 income levels. If this bias widens, beyond a certain point, not convergence but divergence would be the case. As an example if we write down the right and the wrong regression functions and calculate the variance level of the error being done.

$$(1979\ Income) - (1870\ Income) = \varphi + \beta(1870\ Income) + \varepsilon_i$$
$$(1979\ Income) - (1870\ RealIncome) = \varphi + \beta(1870\ RealIncome) + \varepsilon_i$$
$$(1870\ IncomeEstimated) = (1870\ RealIncome) + \upsilon_i$$

[2] For non-petroleum producing underdeveloped countries 0.0059, for semi-developed countries 0.0095,for OECD countries 0.0146.

The variance of the error between the estimated value of 1870 income level and the realized value could be calculated as follows $\mu = \frac{\sigma_{\vartheta}^2}{\sigma_{\varepsilon}^2}$. This value determines the length of the convergence process.

Boyle and McCarthy (1997), contributed to the convergence analysis by proposing a new b-convergence measurement in addition to b-convergence and s-convergence measures. This study measures b-convergence, by comparing the change in ranking of the economies. Thus looking at the ranking of the distribution, b-convergence and s-convergence, are calculated in a common measurement. Another attempt towards the measurement of convergence comes from Paul Cashin and Ratna Sahay (CS) where, β and σ convergence have been tested for the period 1961 –1982 among Indian states (Cashin ve Sahay, 1996). CS have built their model with NGM features. In other words, its been assumed that interstate production, consumption and savings functions are identical. To test the validity of convergence, they have looked at the impacts of labor and capital mobility on convergence that asserted by economic growth theories. In this respect, they tried to find answers to the following questions.

- Have the government aid that flows from the central government to states created convergence in India?
- Has there been labor mobility among states and what has been the outcome in terms of convergence?

In terms of capital mobility, the issue covers central government financial transfers to states (shares from tax revenues), monetary aid from state planning organization, discretionary grants and public and private financial institutions loans to the states. In this study (Barro and Sala-i-Martin, 1992), after accounting for exogenous shocks to agricultural and industrial sectors β coefficient become 1.5. This numerical value reflects half-way lifetime to be 45 years. Barro and Sala-i-Martin's estimate of β coefficient values turned out to be 2 – 4 percent for US states. Similar to the findings stated earlier, convergence cycle among OECD countries reflect 2 percent. But strikingly, finding the value of 1.5 for India that is smaller than OECD value is also very interesting for convergence literature. Other things being constant, mobility increases movements of labor and capital among states is expected to increase economic growth rates (Barro, Mankiw and Sala-i-Martin, 1995). However, this empirical finding does not match with the conclusions reached in the theoretical literature.

According to σ convergence for the period 1961-1991, the variance of Per capita income distribution among Indian states shows an increase. For the 1961-71 sub-period distribution variance declined due to high growth rates witnessed by relatively poor states. During the post 1971 period, positive trend had been seen in spite of fluctuation in values, and created a plateau at the level of 0.30 – 0.35 . When tested for developed economies, contradictory findings have found in terms of Per capita distribution variance. CS explains this with the existence of a higher labor and capital mobility obstacles within India relative to developed countries. Immense income differences had been avoided by central government policies in 1961. Existence of large income differences increases the labor mobility among the States. 10 percent income difference among States in India, effects migration among states by 0.012 percent. This percentage is relatively lower compare to OECD countries. This is mainly due to the excess cost due to migration in India. Plus the existence of labor unions, rigid wage rates, accommodations difficulties in large cities, social and cultural differences further lower labor mobility.

We had focused on BS's research on convergence among US States. Their study examines the convergence of each state, by focusing on the specialization in terms of sectors. In a case where sectors are neglected, β predictions have been found unstable for 47 States.[3] BS interprets this result with temporary cyclical shocks. As an example for some states, sharp declines in agricultural prices could lead to lower β values. To fix these types of impacts, variable that measures the sectoral composition of income has been added to the model. Similarly, in the process of measuring convergence among OECD countries, Dowrick and Nguyen also examined systematic changes in sectoral structures of income (Dowrick and Nguyen, 1989). i th State income being generated by country wise dominant sectors, leads to a higher economic growth rate. In other words, including the sectoral composition of income to the model, stabilizes the β coefficient. At a sectoral level, convergence occurs in sectors that exclude agriculture, and is very dominant in the manufacturing sector. While values of convergence coefficient outside the manufacturing sector is approximately 2 percent, in the manufacturing sector is about 4 percent. Thus we can conclude that, relatively low-income regions not only in terms of income levels but also in terms of alternative sector labor productivity show faster economic growth rates. Thus convergence findings can not be explained by time wise changes in the composition of income structure. For BS, States not showing closed economy properties, will not have similar findings for convergence tests employed among countries. In smaller economies, even under similar technological and utility properties, convergence may rarely occurs because of capital markets facing constant returns. In a case where there are technological differences; the mobility of capital may lead to divergence not convergence in Per capita income and capital stock. Economies with high $\hat{k}$ values will also have a tendency to have high A values which reduces the impact of diminishing returns. Thus it is possible that capital may fly from relatively less developed regions to developed regions. In such an event, we can not even theoretically state that, β coefficient which shows the convergence of output will exceed β coefficient which shows the Per capita income convergence.

While testing the convergence process for NGM, Barro (1991) has added several new variables to his model. Economists like R.E.Lucas and S. Rebelo introduce the human capital component as an endogenous factor (Lucas, 1988; Rebelo, 1991). In P. Romers model, human capital is the dominant input for R&D (Romer, 1990). Barro defined human capital as years of schooling. On the other hand Quality of education has been included with student/Instructor ratios. Barro’s results indicate that, years of schooling and economic growth shows positive while quality of education and economic growth shows negative regression slopes. Barro also included, investment and fertility rates in addition to human capital to the model. Relationship between fertility rates and Per capita income seems to be negative. Apart from these additional explanatory variables Barro tested the government expenditure share in GDP and economic growth rates. Educational and national defense expenditures contributing to private sector productivity and positively effects the economic growth rate. He also included the political stability variable. Findings show that in unstable countries convergence process faces larger interruptions. Similar findings have been put forward by Barro and Lee (1994) (BL). The same study asserts that there should be more explanatory variables to show international income differences. To have more meaningful income convergence predictions, years of schooling, average life expectancy, market imperfections, government expenditure, government intervention, black market premium and political instability should be included to the overall model.

Dowrick and Nguyen (1989) (DN), looks at convergence among OECD countries in terms of total factor productivity (TFP). According to DN’ there is significant difference between Per capita income convergence and

[3] valeus between -0.0285 and 0.1130.

TFP level catch-ups. While the relatively poor countries catch-up the high TFP levels of developed countries, the per capita incomes also converging. DN test whether OECD countries faced a very strong convergence during the post 1950 period. The question is whether growth in factor endowments or increasing TFP levels leads to convergence.

To measure the contribution of the "Catch-Up" following model has been adopted.:

$$\ln Y_{it} = A_i + \alpha K_{it} + \omega \ln L_{it} + gt + \tau \ln F_{it}$$

Here F_{it}, shows TFP's catch-up variable. We can further manipulate the equation as (Dowrick, 1992):

Real Per Capita GDP relative growth	=	TFP Catch-up	+	Labor Deepening	+	Capital Deepening	+	Residual

The implications of the study show us that, convergence witnessed among OECD member countries can neither be explained by capital accumulation nor by labor supply increases. TFP originated convergence value have been calculated as (τ) 0.025. Thus convergence in income can not be accounted for input growth rates but to TFP catch-up rates. DN argued that this trend lasted till 1973.

EGM's developed during the post 1980 period, should be evaluated in terms of its contribution to preferences, technology and stability conditions. These models can be categorized under the following groups. (Romer, 1989): Arrow-Romer Model; Uzawa-Lucas Model; Krugman-Lucas Model; Marshall-Young-Romer Model; Rebelo Model; and Tamura Model. All of the models with only one exception are working under perfect competition and externalities assumptions. Marshall-Young-Romer model assumes monopolistic competition, externalities which leads to dynamic competitive market model behaviors. Production technology can be defined in terms of physical capital (*K*); human capital (*H*); unskilled labor (*L*) and technology level (*A*) under increasing or constant returns. Utility function has been adapted from Ramsey Model. In general, positive and sustainable economic growth rates stem from constant returns for accumulated inputs. In Rebelo model, all inputs can be re-created . Romer and Lucas model taking human capital as the third input and adopts a different synthesis for human capital accumulation. In both models, human capital is the source of externalities. For Romer *H* is a general measure for knowledge and is endowed with physical capital stock. Physical capital investment leads to an increase in both *K* and *H.* Lucas on the contrary uses H as a measure of labor education levels.

In EGM models, it is assumed that re-producible inputs do not show diminishing returns. The most fundamental example is the knowledge stock, it is assumed that human capital faces diminishing returns. In this sense, for EGM continuity of economic growth beyond human capital depends on the stock of knowledge. MRW's model, being an improved version of NGM differs from EGM's in the sense that human capital contribution to economic growth has the highest priority. Improved NGM's special case $\alpha+\beta=1$ can be categorized under the EGM. Supporters of EGM (Romer, 1986; Lucas, 1988; Mulligan and Sala-i-Martin, 1993), offers these models as an alternative to NGM. As an example for Barro (1991), on the contrary of NGM results Per capita income growth is independent of initial income levels. Their NGM asserts that each country has a different steady state level of income, and even if they depart from the steady state level, they will converge back to it. For MRW, NGM can not reflect the convergence process, but only attempts to explain the convergence process to the steady state. This being discussed under the heading of conditional convergence. Convergence around the steady state equilibrium is defined by the following form, $\frac{d \ln y(t)}{dt} = \lambda[\ln y^* - \ln y(t)], \beta = (n+g+\delta)(1-\alpha-\eta)$ If we assume that $\alpha=\eta=1/3$ and $n+g+\delta=0.06$ then β would be 0.02. For such a value, economy will halfway complete its own steady state within 35 years. In terms of NGM in process of verging towards convergence, $\beta=0$ and $\beta=0.04$. This time lowering the halfway time period will shorten to 17 years. In NGM models, income growth is a determinant of final steady state value and initial income levels. New EGM are trying to compare international income in the context of convergence. These models do not provide steady state values for Per capita income. Under single sector EGM's[4] where y(0) is assumed to be zero determination of convergence becomes absolute. Barro (1991), starting from the dis-equilibrium cases looks at multi sector EGM convergence. For Tamura (1991), above grouped endogenous economic growth models can not verify the convergence process. Tamura's model endowed with the basic features of EGM, proves the existence of convergence. In the process of generating new knowledge stocks, economies with higher human capital stocks face declining marginal productivities. Economies that are under the average human capital stock, benefits from diffusion of knowledge and improve their human capital stocks translated to increasing marginal productivities. Thus, economies will move towards long term lasting steady state equilibrium. In the phase of steady state equilibrium, individuals with heterogeneous human capital turn into more homogeneous individuals. For Tamura, the achieved convergence process is a local one. In global terms the World economies as a whole, there are several steady state equilibrium and convergence groups.

Romer (1986, 1994), emphasizes the assumption that equal technological opportunities exist and taking technological variable as exogenous reduces the chance of international comparisons. This view also exists in Lucas (1988). In terms of EGM economic growth can be defined as, $\hat{y} = (1-\beta)\left[sA(t)^{1/(1-\beta)} y^{(-\beta)/(1-\beta)} - n\right] + \hat{A}$. Fundamental determinants of this model is the magnitude of β and the savings ratio (s). These two variables can verify the convergence process. β value turned out to be between 0.6 and 0.7. In such a case $(-\beta/(1-\beta))$ term becomes 1.5. This value, shows that a relatively poor country that is having around 1/10 of developed countries income, will have 30 times smaller income than the country involved. This value is 30 times [5] higher of a developed country relative to a developing country where their national income is 1/10 of the developed country. Thus this value is meaninglessly great, because adopted NBM assumes similar technologies among country groups. We can interpret the result in terms of EGM as labor employed has lower productivity with respect to capital. In other words β will have a smaller value with respect to cited values. According to Romer, there is access payment to labor with respect to its marginal productivity and a lower payment to capital. Arrow, explains the divergence between social and private returns by learning by doing model. In such a case technology has been taken as endogenous $Y_j = A(K,L))K_j^{1-\alpha}L_j^{\alpha}$. Here α shows the required payment to hire one worker. This equation can be rewritten to contain technology endogenously $Y_j = K^{1-\beta}L^{\beta}$. Here β, is equal to α-γ. α shows endogenous effects of production process while γ, shows the external effects. In such a model, β could be smaller than the labor share in GDP. Romer taking this model into account argues that there is a positive relationship between investment ratios and economic growth while there is a negative relationship between

[4] These model use Y=AK type.

initial income levels and economic growth. This verifies that EGM rejects convergence process in the sense of NGM. BS (1992) also estimated that β will have small values but unlike the spillovers of capital; technological levels seems to be different among countries as in the case of EGM. In relatively poor countries, returns on physical and human capital is higher than the developed countries that's why capital (defined in broad terms) moves from developed counties to under developed countries and leading to convergence.

For Romer new economic growth theory questions the following points: Existence of numerous firms in the market, simultaneous diffusion and usage of innovation, first degree homogeneity of production process, in other words validity of Euler Theory; and the technology as an endogenous result of social efforts of the society; monopolistic organizations and monopolistic profits are the questions to be answered. In the NGM first three points already existed. But the last two pints differentiates EGM from NGM. Examining both models first contributions goes back to the study of Karl Shell (1966) during the 1960's. Technological change in the Shell's Model are partially financed by tax revenues. EGM which has been developed after 1980's relies on J.K. Arrows learning by doing model. In this approach major contribution to technology comes from the private sector more than the public sector. To give an example in Romer (1986) and Lucas (1988) technological development is the end result of private sector investment decisions which is endogenous by nature. For Romer over time R&D spills over the society and changing the knowledge stock. Here Romer has taken the technology factor as a non-rival good. Similar tones can be found in all EGMs.

II. Convergence or Divergence? The Turkish Case

In this section of the study, looking at Turkish data for 67 provinces for 1979-1997[6], we would like to test whether there is statistically significant convergence or divergence among regions and provinces for the above cited time interval. Researchers familiar with Turkish statistical data gathering know that data for such purposes do not extent to longer time intervals enabling us to contact dynamic time series analysis. To avoid statistical biases that might come from data has been avoided taking the real GDP data having the base year 1987. In this empirical part, initially we will show alternative convergence measurement techniques while discussing there economic and statistical drawbacks. Before the final section of the paper, we will focus on GAP region convergence or divergence with respect to other regions of Turkey. GAP project being the largest by its on as an integrated project disserves special importance given where the financial budget goes to 22 billion US Dollar. So far, almost adopting stop and go models spending 12 billion US Dollar within 15 years research findings might create a strong evidence for further sacrifices.

A. Methodology

Methodology section starts with the neoclassical absolute b-convergence test which has also been adopted by Barro (1991), Barro and Sala-i-Martin (1992). However, typical to absolute b-convergence, authors have adopted a linear convergence models assuming that variances stay constant through out the predicted function. Theoretical foundations show that this type of an approach endows neoclassical economic growth tones. Below

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5 $(1/10)^{(-1.5)}=31.62$

6 1979-86 data has been gathered by Özötün (1988) and 1987-97 data has been gathered from various yearly statistics of Turkish State Institute of Statistics (SIS).

given, our findings for province mixes reflecting different income and social differences. Among these estimates; overall Turkey’s provinces, East Anatolia and Marmara Region, Central Anatolia and Black Sea Region, East Anatolia, Mediterranean Regions seems to be statistically significant. Constant variance through out the predicted function reduces the significance of other estimates. Data reflecting the non-linear case. Examining the scatter diagrams, we see that among total regions per capita income distribution with respect to economic growth is a bell-shaped relationship on the overall. Thus, homogenous regions usually fall into the declining or increasing segment of the curve showing a convergence or divergence, while dissimilar income regions reduces the statistical significance of the estimate. On the contrarily, regions like East Anatolia and Mediterranean Region being on the different ends of the bell-shape, still show statistical significance because of the nature of the estimate. Almost for all estimates, determination coefficients seems to be rather low, increasing the questinability of the functions on the overall. Previous studies by Erk, Çabuk and Ateº (1998) looking at convergence among countries predict that economic growth apart from other factors convergence with per capita income determined by physical capital, human capital ratios. As an explanation why low per capita income countries economically grow faster than high per capita countries, they have statistically shown that absolute value convergence between physical and human capital increases the probability of higher economic growth rates. Thus, above cited bell-shaped relationship coincides with their methodology enabling faster growth rates when the physical capital development levels matches with the availability and accumulation of human capital. This typical relationship as an economic policy simply mandates that faster economic growth could only be achieved with higher physical capital stocks as long as physical capital accumulation matches with human capital growth levels.

In the second part of our study, we have adopted σ-convergence test for the same sub-grouping for the Turkish data. Employing this technique for overall Turkey’s Provinces comes up with the expected sign with higher statistically significant values and with a higher determination coefficient which reflects an improved explanatory power. Second estimation Aegean, Marmara, Mediterranean regions also have a statistically significant estimate, a correct sign for parameters but a lower determination coefficient. Third estimation, East Anatolia, Central Anatolia, GAP and Black Sea Regions have strong statistical significance as in the case of total regions. GAP and Marmara Regions still have the correct sign, meaningful determination coefficient but not statistically significant parameters. East Anatolia and Marmara Regions have a high determination coefficients, right signs for the parameters and the significance of the parameters hardly pass the test. Aegean and Marmara Regions estimate is statistically insignificant. Next estimation is testing convergence of per capita income with GDP growth rates within the Marmara Region. Findings show that statistically estimate is not statistically significant. Marmara, Aegean, Black Sea and GAP Regions seems to be not statistically significant. That is also true for central Anatolia and Black Sea Regions. Marmara and Aegean regions also does not pass the statistical significant test. East Anatolia Mediterranean and Central Anatolia Regions’ Estimation has statistically significance in terms of parameters, in terms of parameters’ signs and in terms of determination coefficients. Ten estimates related to per capita income of provinces and economic growth one more time validates the above cited explanation. Regions converge and grow faster as long as they are not at relatively high or low income levels (Two-tails of the bell-shape). Leaving us with the regions in relatively mid-per capita income (the top part of the bell-shape) provinces where physical capital and human capital availability and levels match.

B. Findings

Under the methodology heading, we have already discussed the overall modeling and their statistical significance. In this section, we will try to interpret the economic interpretation of our statistical findings. We will start with Figure 1 which looks at log real per capita income and average growth rates. This distribution simply shows that high average growth rates matches with mid income provinces of Turkey. The argument given in the methodology section states that high income regions rich in physical endowments can not create high average growth rates due to the fact that human capital endowment lags behind the physical capital stock accumulation. Interpretation is similar for relatively poor regions. Regions lacking physical capital accumulation further lacks human capital. These overall findings one more time raise the question whether physical capital and human capital complementarity Matsuyama (1996), Young (1993), Acemoðlu (1998) Gouldvin and Katz (1996) are the key determinants of faster growth rates. Examining Table 1 and looking at parameter sign, we see that there is an overall divergence, but the linear nature of the β-convergence model reduces the explanatory power. Reason for this could be easily seen from Figure 1.

Figure 1. Beta-Convergence in Real Per Capita GDP Among Turkey's Provinces

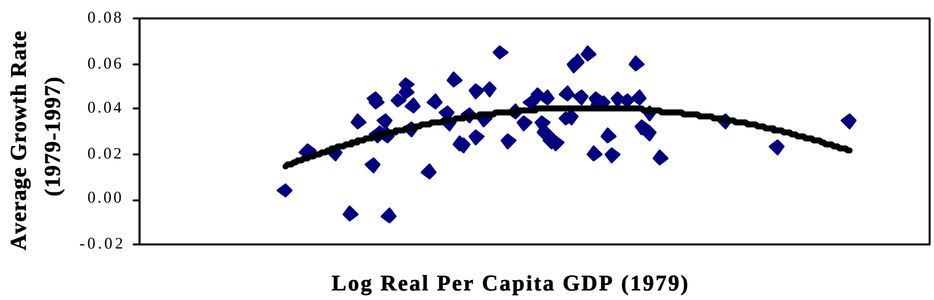


Figure 2 shows ó-convergence for Turkey's total provinces which can be interpreted as slow divergence between 1979-97 period. Strikingly, divergence between 1979-84 seems to be higher than the overall average and unlike to be expected divergence among Turkey's provinces slowdown between 1985-97. The findings at this point, does not confirm NGM for the given period. We have extended the analysis towards ó-convergence, using the logic and criticism that Friedman (1992) has used related to initial and final per capita income values in determining the process of divergence or convergence process.

Figure 2. Sigma-Convergence in Real Per Capita GDP Between Turkey's Provinces

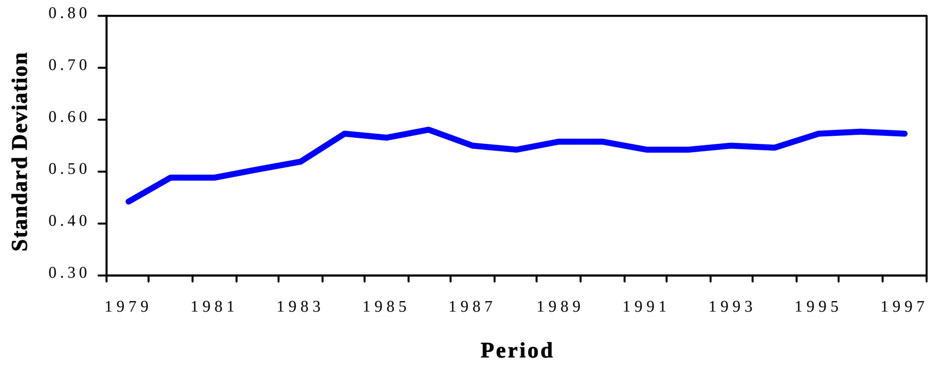


Figure 3. looking at relatively high per capita income regions of Turkey still show a bell-shaped distribution which by nature reduces the predictive power of β-convergence estimates. But as depicted, bell-shaped distribution gets flatter as the per Capita incomes get more homogeneous. This property can well be seen for all regions of Turkey. Thus, to have a well-structured bell-shaped distribution, we should have a population data that reflects all income groups.

Figure 3. Beta-Convergence in Real Per Capita GDP Among Marmara-Ege-Mediterrenean Regions

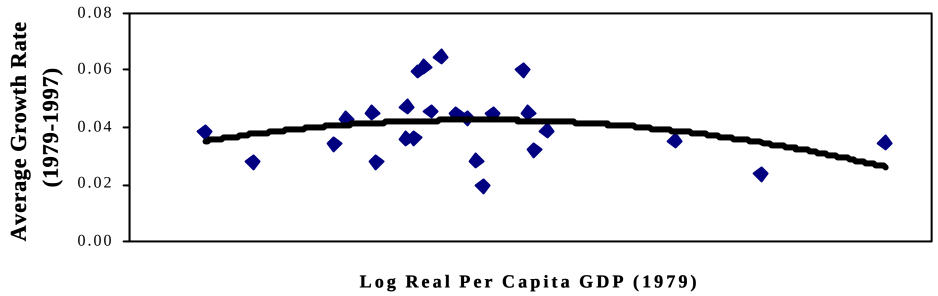


Figure 4 shows similar properties with Figure 2 with one difference that it more volatile in terms of standard deviations. But it is also a fact that Marmara-Ege-Mediterrenean regions show higher divergence during 1979-1986 period and overall evaluation with respect to initial year shows rather stable standard deviation behavior. We should keep in mind that these regions are rather more industrialized regions with respect to rest of Turkey.

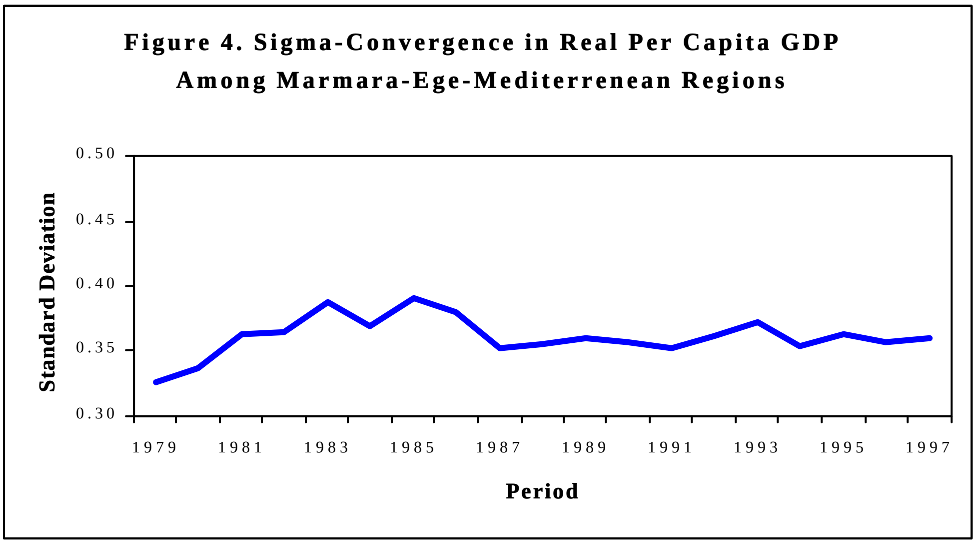


Figure 5 reflects relatively low Per Capita income regions with respect to Marmara and Aegean regions. Thus, reflecting left half of bell-shaped log real Per Capita income distribution for the total economy. In other words, these are the regions, far more showing a divergence with respect to Figure 3.

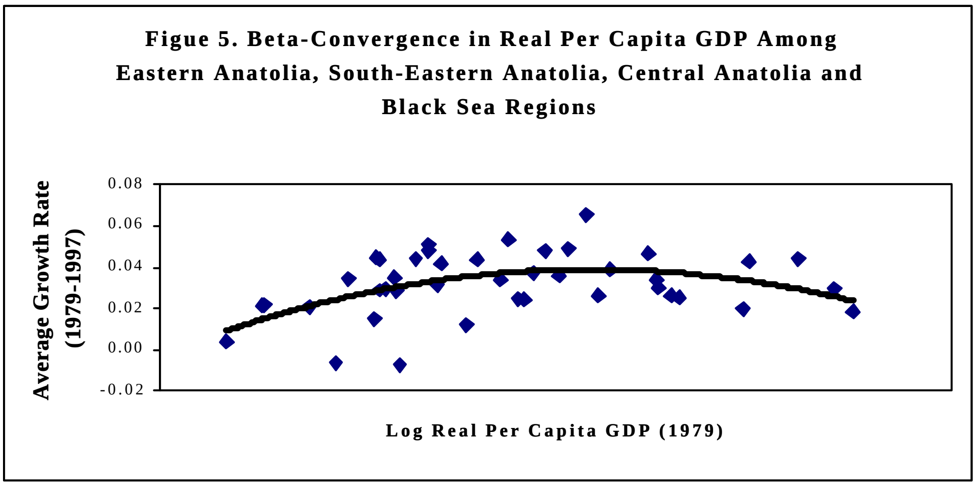
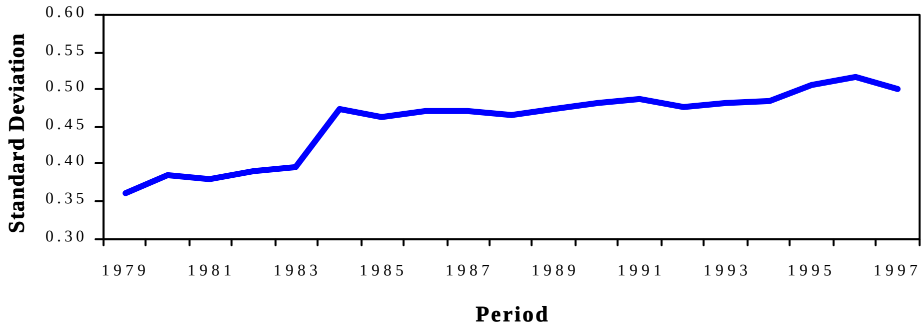


Figure 6 made out of Eastern Anatolia, South-Eastern Anatolia, Central Anatolia and Black Sea regions makes up regions outside Marmara, Aegean and Mediterranean which are well developed relatively. Our first figure (Figure 1) simply shows us that relatively low income regions are showing a divergence while relatively high Per Capita income regions showing convergence. As the countries develop (not grow), we will see that overall bell-shaped will be rather flatter with respect to less developed regions. This explanation further complements about our discussion on physical and human capital complementarity (Erk and Ateº, 1999).

Figure 6. Sigma-Convergence in Real Per Capita GDP Among Eastern Anatolia, South-Eastern Anatolia, Central Anatolia and Black Sea Regions



So far, we have looked at per Capita income levels of provinces at a regional level. This method can be preferred to the methodology that we will adopt in the coming section, because it takes into consideration factors like, population dynamics, fertility, migration components and other socioeconomic factors. Figure 7 reflects income differences of regions being independent of Per capita income, but as an income been generated by the provinces of a region. It simply reflects a more exaggerated version of our previous findings, but Marmara region being very dominant in Turkey, with the exception of 1983 and 1987 at the rest of the time span been examined shows a divergence.

Figure 7. Sigma-Convergence in Real Per Capita GDP Between Turkey's Regions

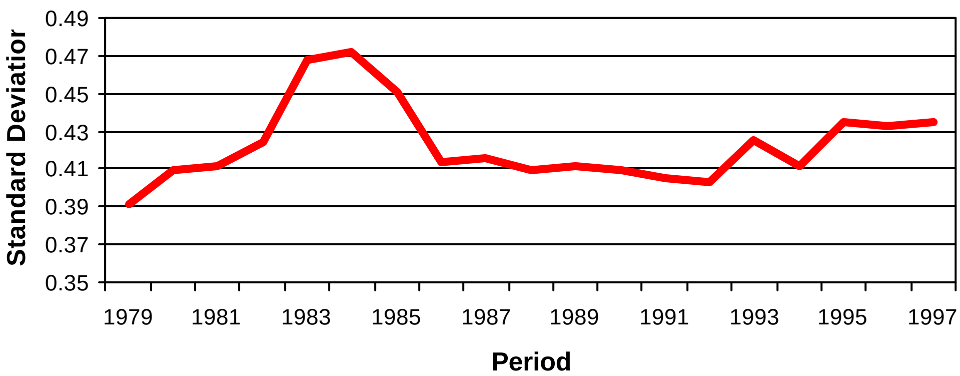
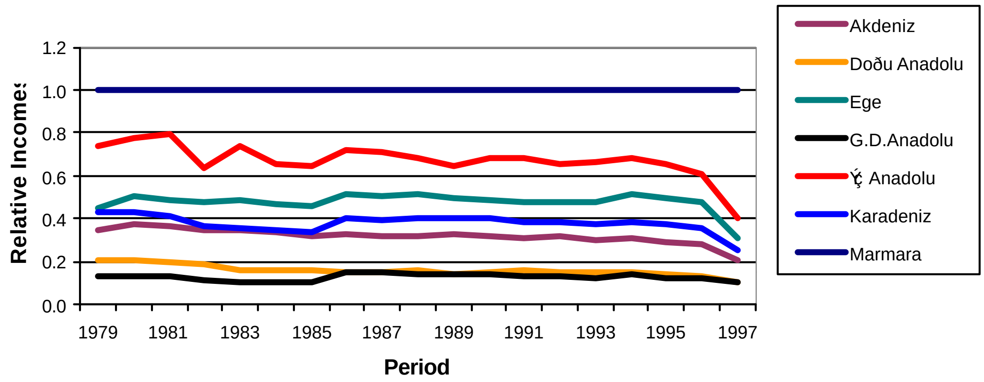


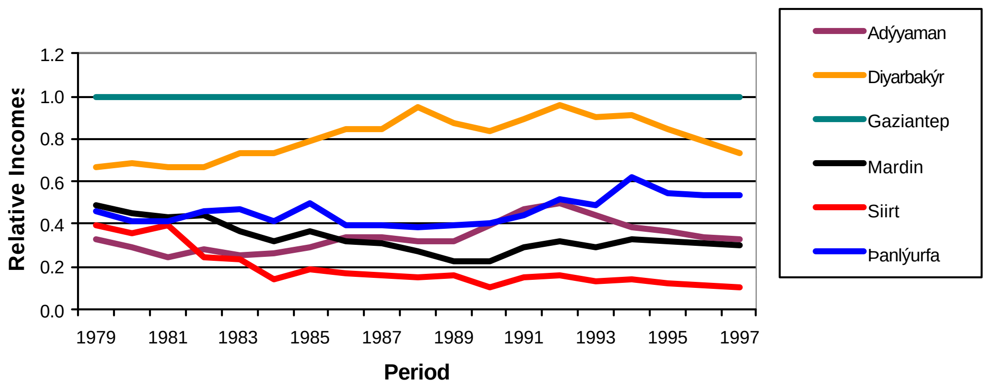
Figure 8 has been developed wit a different technique from the once that we have already presented. To generate the graph, first we ranked all regions among themselves, where the highest Per Capita Income regions got the index 1.0. As the level of income decreases, index gets closer to zero. The Marmara region having the highest income is shown by a line parallel to the horizontal axis. Thus, while there is a divergence with all regions versus Marmara, low Per Capita income regions shows a convergence. Similar findings can be found in more developed countries like USA. Taking into consideration, Silicon Valley, North Texas and Boston Region, they create 1/3 of US GDP. So, similarities of these regions with Ýstanbul should not surprise us.

Figure 8. Convergence Among Regional Relative Incomes in Turkey



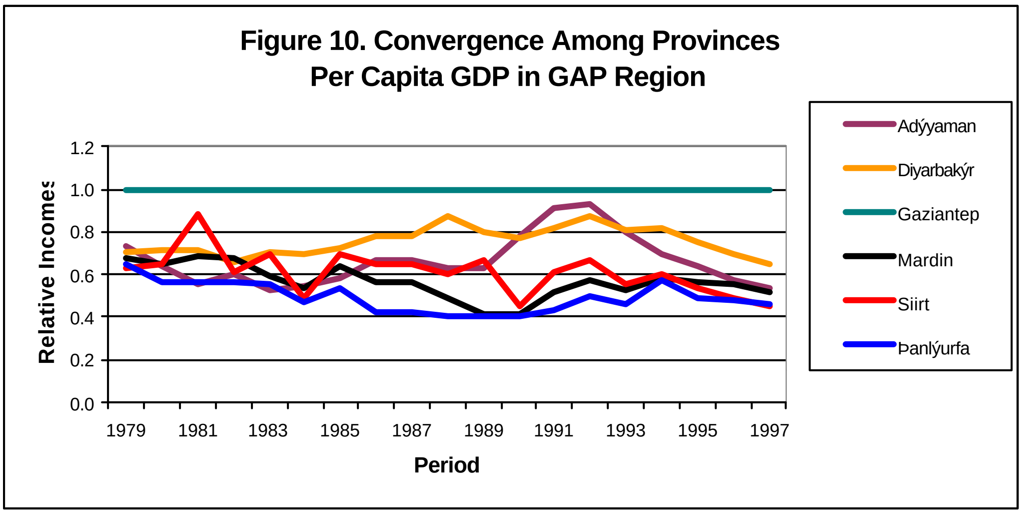
As stated earlier, GAP region is a very important starting point in Turkish economic and social structure setting due to the fact that region is witnessing drastic economic and social changes since 1980's. One last attempt of this research is to show whether two decades of economic sacrifice and political instability have positively or negatively effect that region's convergence with the rest of Turkey. Gaziantep having the highest total GDP shows a divergence with the rest of the provinces in the region. Rest of the provinces are showing converging among themselves. Intake of migration from other provinces in the region, Gaziantep even during the pre 1980 period was very dominant economically. So, findings in Figure 9 matches with international findings. This finding still verifies the bell-shaped distribution of β-convergence.

Figure 9. Convergence Among Provinces GDP in GAP Region



Comparing Figure 9 and Figure 10, we see that Per capita income levels in Figure 10 shows similarities with Figure 9. Eliminating scale differences, out migration from GAP provinces, the only province that witnesses in migration is Þanlýurfa. So, at Per Capita income levels Þanlýurfa besides it fast income growth divergence from Gaziantep on the overall. This one more time shows the importance of population dynamics in the interpretation of income convergence. Because on the one hand in-migration increases consumption levels while low income in-migration lowers the overall average Per capita income of the province.

Adýyaman –0.038 (0.036) Diyarbakýr -0.035 (0.030) Gaziantep 0 (0.019), Mardin –0.07 (0.006 Siirt -0.141, (-0.036) [a] .Urfa 0..047 (0.046) (1990)



III. Conclusion

We have started with the modest goal of testing ó-convergence and β-convergence for Per capita and total GDP levels for all provinces in Turkey. As a secondary goal, we have tested GAP regions performance within its own region and with the rest of Turkey. We see that with the exception of Marmara region rest of Turkey is converging when we adopt an index of convergence. Overall bell-shaped distribution of Per Capita GDP levels with respect to economic growth brings in an economic policy tool for a faster economic growth and convergence. To expedite the growth process, physical capital investments should be complemented with human capital upgrading (creation or in-migration). Otherwise, huge financial sacrifices will not be sufficient to generate the expected capacity. This finding further threatens the classical argument of capital-labor substitutability.

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APPENDIX A

Beta-Convergence Regressions

Model: $g = \alpha + \beta \ln y + \varepsilon$

Table 1. Oveall Turkey's Provinces

Dependent Variable: ***g***
Method: Least Squares
Sample: 1 67
Included observations: 67

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-0.088502	0.052436	-1.687829	0.0962
ln***y***	0.009231	0.003911	2.360081	0.0213

R-squared	0.078928	Mean dependent var	0.035184
Adjusted R-squared	0.064758	S.D. dependent var	0.014520
S.E. of regression	0.014042	Akaike info criterion	-5.664076
Sum squared resid	0.012817	Schwarz criterion	-5.598264
Log likelihood	191.7466	F-statistic	5.569982
Durbin-Watson stat	1.922894	Prob(F-statistic)	0.021283

Table 2. Egean-Marmara-Mediterenean Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 25
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	0.117064	0.102776	1.139017	0.2664
ln***y***	-0.005548	0.007470	-0.742767	0.4651

R-squared	0.023425	Mean dependent var	0.040746
Adjusted R-squared	-0.019035	S.D. dependent var	0.011784
S.E. of regression	0.011896	Akaike info criterion	-5.948602
Sum squared resid	0.003255	Schwarz criterion	-5.851092
Log likelihood	76.35753	F-statistic	0.551702
Durbin-Watson stat	2.162013	Prob(F-statistic)	0.465142

Table 3. East Anatolia, Central Anatolian, GAP and Black Sea Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 42
Included observations: 42 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-0.102712	0.084959	-1.208964	0.2338
ln***y***	0.010206	0.006440	1.584699	0.1209

R-squared	0.059073	Mean dependent var	0.031873
Adjusted R-squared	0.035550	S.D. dependent var	0.015100
S.E. of regression	0.014830	Akaike info criterion	-5.537936
Sum squared resid	0.008797	Schwarz criterion	-5.455190
Log likelihood	118.2966	F-statistic	2.511270
Durbin-Watson stat	1.570697	Prob(F-statistic)	0.120910

Table 4. GAP and Marmara Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 16
Included observations: 16 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	0.050122	0.074683	0.671123	0.5131
ln***y***	-0.000678	0.005493	-0.123434	0.9035

R-squared	0.001087	Mean dependent var	0.040910
Adjusted R-squared	-0.070264	S.D. dependent var	0.011208
S.E. of regression	0.011595	Akaike info criterion	-5.960058
Sum squared resid	0.001882	Schwarz criterion	-5.863485
Log likelihood	49.68047	F-statistic	0.015236
Durbin-Watson stat	2.511275	Prob(F-statistic)	0.903518

Table 5. East Anatolian and Marmara Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 22
Included observations: 22 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-0.199359	0.079253	-2.515469	0.0205
ln***y***	0.017056	0.005918	2.881868	0.0092

R-squared	0.293415	Mean dependent var	0.028817
Adjusted R-squared	0.258086	S.D. dependent var	0.019006
S.E. of regression	0.016371	Akaike info criterion	-5.300143
Sum squared resid	0.005360	Schwarz criterion	-5.200958
Log likelihood	60.30158	F-statistic	8.305166
Durbin-Watson stat	2.704640	Prob(F-statistic)	0.009219

Table 6. Eagen and Marmara Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 18
Included observations: 18 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	0.163953	0.131969	1.242364	0.2320
ln***y***	-0.008847	0.009547	-0.926696	0.3679

R-squared	0.050939	Mean dependent var	0.041693
Adjusted R-squared	-0.008378	S.D. dependent var	0.013303
S.E. of regression	0.013359	Akaike info criterion	-5.688822
Sum squared resid	0.002855	Schwarz criterion	-5.589892
Log likelihood	53.19940	F-statistic	0.858765
Durbin-Watson stat	2.217189	Prob(F-statistic)	0.367853

Table 7. Marmara

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 10
Included observations: 10 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	0.267671	0.159120	1.682194	0.1310
ln***y***	-0.016186	0.011420	-1.417405	0.1941

R-squared	0.200722	Mean dependent var	0.042200
Adjusted R-squared	0.100812	S.D. dependent var	0.012910
S.E. of regression	0.012242	Akaike info criterion	-5.791063
Sum squared resid	0.001199	Schwarz criterion	-5.730546
Log likelihood	30.95531	F-statistic	2.009036
Durbin-Watson stat	2.256218	Prob(F-statistic)	0.194113

Table 8. Marmara, Eagean, Black Sea and GAP Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 37
Included observations: 37 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	0.177439	0.101427	1.749421	0.0890
ln***y***	-0.010075	0.007387	-1.363764	0.1813

R-squared	0.050457	Mean dependent var	0.039144
Adjusted R-squared	0.023328	S.D. dependent var	0.012554
S.E. of regression	0.012407	Akaike info criterion	-5.888648
Sum squared resid	0.005387	Schwarz criterion	-5.801571
Log likelihood	110.9400	F-statistic	1.859852
Durbin-Watson stat	1.788620	Prob(F-statistic)	0.181349

Table 9. Central Anatolian and Black Sea Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 30
Included observations: 30 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-0.404926	0.167800	-2.413151	0.0226
ln***y***	0.033491	0.012911	2.594027	0.0149

R-squared	0.193757	Mean dependent var	0.030299
Adjusted R-squared	0.164962	S.D. dependent var	0.015476
S.E. of regression	0.014142	Akaike info criterion	-5.614939
Sum squared resid	0.005600	Schwarz criterion	-5.521526
Log likelihood	86.22408	F-statistic	6.728974
Durbin-Watson stat	2.223021	Prob(F-statistic)	0.014923

Table 10. Marmara and Eagean Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 24
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	0.292701	0.139738	2.094643	0.0479
ln***y***	-0.018244	0.010081	-1.809765	0.0840

R-squared	0.129583	Mean dependent var	0.039851
Adjusted R-squared	0.090019	S.D. dependent var	0.013144
S.E. of regression	0.012539	Akaike info criterion	-5.840319
Sum squared resid	0.003459	Schwarz criterion	-5.742148
Log likelihood	72.08383	F-statistic	3.275249
Durbin-Watson stat	1.970369	Prob(F-statistic)	0.084016

Table 11. East Anatolian, Mediterranean and Central Anatolian Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 43
Included observations: 43 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-0.223630	0.097977	-2.282477	0.0277
ln***y***	0.019494	0.007453	2.615598	0.0124

R-squared	0.143001	Mean dependent var	0.032579
Adjusted R-squared	0.122098	S.D. dependent var	0.014742
S.E. of regression	0.013812	Akaike info criterion	-5.681103
Sum squared resid	0.007822	Schwarz criterion	-5.599187
Log likelihood	124.1437	F-statistic	6.841353
Durbin-Watson stat	1.971745	Prob(F-statistic)	0.012410

Non-Linear Estimations

Model: $g = \alpha_0 + \alpha_1 \ln y + \alpha_2 (\ln y)^2 + \varepsilon$

Table 12. Oveall Turkey's Provinces

Dependent Variable: ***g***
Method: Least Squares
Sample: 1 67
Included observations: 67

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	-3.588099	1.124769	-3.190076	0.0022
Ln***y***	0.529576	0.167119	3.168860	0.0023
$\ln y^2$	-0.019321	0.006204	-3.114377	0.0028

R-squared	0.200148	Mean dependent var	0.035184
Adjusted R-squared	0.175153	S.D. dependent var	0.014520
S.E. of regression	0.013188	Akaike info criterion	-5.775336
Sum squared resid	0.011130	Schwarz criterion	-5.676619
Log likelihood	196.4738	F-statistic	8.007395
Durbin-Watson stat	2.009824	Prob(F-statistic)	0.000788

Table 13. Egean-Marmara-Mediterenean Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 25
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-3.703584	2.769596	-1.337229	0.1948
ln***y***	0.543657	0.397923	1.366234	0.1857
$\ln y^2$	-0.019723	0.014288	-1.380412	0.1813

R-squared	0.101269	Mean dependent var	0.040746
Adjusted R-squared	0.019566	S.D. dependent var	0.011784
S.E. of regression	0.011669	Akaike info criterion	-5.951670
Sum squared resid	0.002995	Schwarz criterion	-5.805405
Log likelihood	77.39588	F-statistic	1.239480
Durbin-Watson stat	2.102422	Prob(F-statistic)	0.308978

Table 14. East Anatolia, Central Anatolian, GAP and Black Sea Regions				
Dependent Variable: ***g***				
Method: Least Squares				
Sample(adjusted): 1 42				
Included observations: 42 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-7.683838	2.590726	-2.965902	0.0051
ln***y***	1.154307	0.390846	2.953357	0.0053
$\ln y^2$	-0.043133	0.014733	-2.927580	0.0057
R-squared	0.228598	Mean dependent var		0.031873
Adjusted R-squared	0.189039	S.D. dependent var		0.015100
S.E. of regression	0.013598	Akaike info criterion		-5.688973
Sum squared resid	0.007212	Schwarz criterion		-5.564853
Log likelihood	122.4684	F-statistic		5.778649
Durbin-Watson stat	1.970637	Prob(F-statistic)		0.006338

Table 15. GAP and Marmara Regions				
Dependent Variable: ***g***				
Method: Least Squares				
Sample(adjusted): 1 16				
Included observations: 16 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-2.978105	1.601810	-1.859213	0.0858
ln***y***	0.443191	0.234628	1.888913	0.0814
$\ln y^2$	-0.016240	0.008583	-1.892241	0.0809
R-squared	0.216802	Mean dependent var		0.040910
Adjusted R-squared	0.096310	S.D. dependent var		0.011208
S.E. of regression	0.010654	Akaike info criterion		-6.078341
Sum squared resid	0.001476	Schwarz criterion		-5.933480
Log likelihood	51.62673	F-statistic		1.799310
Durbin-Watson stat	2.312654	Prob(F-statistic)		0.204251

Table 16. East Anatolian and Marmara Regions				
Dependent Variable: ***g***				
Method: Least Squares				
Sample(adjusted): 1 22				
Included observations: 22 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-3.459244	1.630146	-2.122045	0.0472
ln***y***	0.501044	0.241838	2.071813	0.0521
$\ln y^2$	-0.017928	0.008956	-2.001808	0.0598
R-squared	0.416483	Mean dependent var		0.028817
Adjusted R-squared	0.355060	S.D. dependent var		0.019006
S.E. of regression	0.015263	Akaike info criterion		-5.400604
Sum squared resid	0.004426	Schwarz criterion		-5.251825
Log likelihood	62.40664	F-statistic		6.780589
Durbin-Watson stat	2.517479	Prob(F-statistic)		0.005991

Table 17. Eagen and Marmara Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 18
Included observations: 18 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-4.824008	4.118700	-1.171245	0.2598
ln***y***	0.704342	0.588682	1.196473	0.2501
$\ln y^2$	-0.025475	0.021025	-1.211657	0.2444

R-squared	0.135546	Mean dependent var	0.041693
Adjusted R-squared	0.020286	S.D. dependent var	0.013303
S.E. of regression	0.013168	Akaike info criterion	-5.671087
Sum squared resid	0.002601	Schwarz criterion	-5.522691
Log likelihood	54.03978	F-statistic	1.176001
Durbin-Watson stat	2.064478	Prob(F-statistic)	0.335400

Table 18. Marmara

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 10
Included observations: 10 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-0.383669	7.782515	-0.049299	0.9621
ln***y***	0.076071	1.102141	0.069021	0.9469
$\ln y^2$	-0.003264	0.038995	-0.083713	0.9356

R-squared	0.201522	Mean dependent var	0.042200
Adjusted R-squared	-0.026615	S.D. dependent var	0.012910
S.E. of regression	0.013081	Akaike info criterion	-5.592063
Sum squared resid	0.001198	Schwarz criterion	-5.501288
Log likelihood	30.96032	F-statistic	0.883337
Durbin-Watson stat	2.229614	Prob(F-statistic)	0.454905

Table 19. Marmara, Eagean, Black Sea and GAP Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 37
Included observations: 37 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	0.055953	0.018404	3.040299	0.0045
ln***y***	-2.36E-08	3.00E-08	-0.785672	0.4375
$\ln y^2$	5.61E-15	1.05E-14	0.533580	0.5971

R-squared	0.054064	Mean dependent var	0.039144
Adjusted R-squared	-0.001579	S.D. dependent var	0.012554
S.E. of regression	0.012564	Akaike info criterion	-5.838400
Sum squared resid	0.005367	Schwarz criterion	-5.707785
Log likelihood	111.0104	F-statistic	0.971627
Durbin-Watson stat	1.785009	Prob(F-statistic)	0.388728

Table 20. Central Anatolian and Black Sea Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 30
Included observations: 30 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-0.091900	0.064725	-1.419858	0.1671
Ln*y*	4.86E-07	2.94E-07	1.654143	0.1097
lny^2	-4.59E-13	3.25E-13	-1.412886	0.1691

R-squared	0.230826	Mean dependent var	0.030299
Adjusted R-squared	0.173850	S.D. dependent var	0.015476
S.E. of regression	0.014067	Akaike info criterion	-5.595340
Sum squared resid	0.005343	Schwarz criterion	-5.455220
Log likelihood	86.93010	F-statistic	4.051288
Durbin-Watson stat	2.341333	Prob(F-statistic)	0.028929

Table 21. Marmara and Eagean Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 24
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	0.097933	0.031990	3.061355	0.0059
ln***y***	-8.07E-08	4.75E-08	-1.699801	0.1039
lny^2	2.26E-14	1.53E-14	1.474243	0.1553

R-squared	0.184763	Mean dependent var	0.039851
Adjusted R-squared	0.107121	S.D. dependent var	0.013144
S.E. of regression	0.012420	Akaike info criterion	-5.822479
Sum squared resid	0.003240	Schwarz criterion	-5.675222
Log likelihood	72.86975	F-statistic	2.379688
Durbin-Watson stat	2.053212	Prob(F-statistic)	0.117080

Table 22. East Anatolian, Mediterranean and Central Anatolian Regions

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 43
Included observations: 43 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-0.064542	0.029489	-2.188701	0.0345
ln***y***	3.45E-07	1.13E-07	3.065040	0.0039
lny^2	-2.84E-13	1.02E-13	-2.794134	0.0080

R-squared	0.254739	Mean dependent var	0.032579
Adjusted R-squared	0.217476	S.D. dependent var	0.014742
S.E. of regression	0.013041	Akaike info criterion	-5.774294
Sum squared resid	0.006802	Schwarz criterion	-5.651420
Log likelihood	127.1473	F-statistic	6.836236
Durbin-Watson stat	2.271156	Prob(F-statistic)	0.002794

Beta Convergence Regressions for two different homogenous provinces group.

Model: $g = \alpha + \beta \ln y + \varepsilon$

Table 23. Beta Regression for First Homogenous Group, Initial Period: 1979

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 38
Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	0.162895	0.097514	1.670479	0.1035
ln***y***	-0.009029	0.007108	-1.270254	0.2121

R-squared	0.042898	Mean dependent var	0.039053
Adjusted R-squared	0.016312	S.D. dependent var	0.012396
S.E. of regression	0.012294	Akaike info criterion	-5.908201
Sum squared resid	0.005441	Schwarz criterion	-5.822012
Log likelihood	114.2558	F-statistic	1.613544
Durbin-Watson stat	1.802502	Prob(F-statistic)	0.212143

Table 24. Beta Regression for Second Homogenous Group, Initial Period: 1979

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 29
Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-0.424101	0.177952	-2.383229	0.0245
ln***y***	0.034981	0.013703	2.552736	0.0167

R-squared	0.194426	Mean dependent var	0.030113
Adjusted R-squared	0.164590	S.D. dependent var	0.015716
S.E. of regression	0.014365	Akaike info criterion	-5.581627
Sum squared resid	0.005571	Schwarz criterion	-5.487330
Log likelihood	82.93359	F-statistic	6.516459
Durbin-Watson stat	2.227158	Prob(F-statistic)	0.016656

Table 25. Beta Regression for First Homogenous Group, Initial Period: 1997

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 41
Included observations: 41 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-0.159578	0.080560	-1.980872	0.0547
ln***y***	0.013877	0.005595	2.480333	0.0175

R-squared	0.136252	Mean dependent var	0.040187
Adjusted R-squared	0.114104	S.D. dependent var	0.012134
S.E. of regression	0.011421	Akaike info criterion	-6.059262
Sum squared resid	0.005087	Schwarz criterion	-5.975673
Log likelihood	126.2149	F-statistic	6.152051
Durbin-Watson stat	2.087784	Prob(F-statistic)	0.017549

Table 26. Beta Regression for Second Homogenous Group, Initial Period: 1997

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 26
Included observations: 26 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Probability
c	-0.416247	0.054337	-7.660529	0.0000
ln***y***	0.032949	0.004035	8.165987	0.0000

R-squared	0.735343	Mean dependent var	0.027293
Adjusted R-squared	0.724315	S.D. dependent var	0.014671
S.E. of regression	0.007703	Akaike info criterion	-6.820519
Sum squared resid	0.001424	Schwarz criterion	-6.723743
Log likelihood	90.66675	F-statistic	66.68335
Durbin-Watson stat	1.765145	Prob(F-statistic)	0.000000

Non-Linear Estimations for Two Different Homogenous Provinces Group.

Model: $g = \alpha_0 + \alpha_1 \ln y + \alpha_2 (\ln y)^2 + \varepsilon$

Table 27. Non-linear Convergence Test for First Homogenous Group, Initial Period: 1979

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 38
Included observations: 38 after adjusting endpoints

	Coefficient	Std. Error	t-Statistic	Probability
c	-0.245745	3.029770	-0.081110	0.9358
ln***y***	0.049750	0.435633	0.114202	0.9097
lny^2	-0.002112	0.015654	-0.134947	0.8934

R-squared	0.043396	Mean dependent var	0.039053
Adjusted R-squared	-0.011267	S.D. dependent var	0.012396
S.E. of regression	0.012465	Akaike info criterion	-5.856089
Sum squared resid	0.005438	Schwarz criterion	-5.726806
Log likelihood	114.2657	F-statistic	0.793875
Durbin-Watson stat	1.807234	Prob(F-statistic)	0.460061

Table 28. Non-linear Convergence Test for Second Homogenous Group, Initial Period: 1979

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 29
Included observations: 29 after adjusting endpoints

	Coefficient	Std. Error	t-Statistic	Probability
c	-10.64666	10.29937	-1.033720	0.3108
ln***y***	1.614120	1.590826	1.014643	0.3196
lny^2	-0.060971	0.061419	-0.992691	0.3300

R-squared	0.223843	Mean dependent var	0.030113
Adjusted R-squared	0.164139	S.D. dependent var	0.015716
S.E. of regression	0.014368	Akaike info criterion	-5.549862
Sum squared resid	0.005368	Schwarz criterion	-5.408417
Log likelihood	83.47300	F-statistic	3.749189
Durbin-Watson stat	2.310803	Prob(F-statistic)	0.037097

Table 29. Non-linear Convergence Test for First Homogenous Group

Dependent Variable: *g*
Method: Least Squares
Sample(adjusted): 1 24
Included observations: 24 after adjusting endpoints

	Coefficient	Std. Error	t-Statistic	Probability
c	-1.073175	4.382850	-0.244858	0.8089
ln***y***	0.163296	0.615027	0.265510	0.7932
lny^2	-0.005986	0.021566	-0.277556	0.7841

R-squared	0.030060	Mean dependent var	0.039266
Adjusted R-squared	-0.062315	S.D. dependent var	0.012982
S.E. of regression	0.013380	Akaike info criterion	-5.673653
Sum squared resid	0.003759	Schwarz criterion	-5.526397
Log likelihood	71.08384	F-statistic	0.325414
Durbin-Watson stat	3.001601	Prob(F-statistic)	0.725805

Table 30. Non-linear Convergence Test for First Homogenous Group

Dependent Variable: *g*
Method: Least Squares
Sample(adjusted): 1 41
Included observations: 41 after adjusting endpoints

	Coefficient	Std. Error	t-Statistic	Probability
C	-3.340849	2.916541	-1.145483	0.2592
Ln***y***	0.453101	0.402559	1.125551	0.2674
lny^2	-0.015152	0.013886	-1.091183	0.2821

R-squared	0.162494	Mean dependent var	0.040187
Adjusted R-squared	0.118415	S.D. dependent var	0.012134
S.E. of regression	0.011393	Akaike info criterion	-6.041334
Sum squared resid	0.004932	Schwarz criterion	-5.915951
Log likelihood	126.8474	F-statistic	3.686405
Durbin-Watson stat	2.063190	Prob(F-statistic)	0.034417

Table 31. Non-linear Convergence Test for Second Homogenous Group

Dependent Variable: ***g***
Method: Least Squares
Sample(adjusted): 1 26
Included observations: 26 after adjusting endpoints

	Coefficient	Std. Error	t-Statistic	Probability
c	-2.403024	2.044956	-1.175098	0.2520
ln***y***	0.331762	0.307481	1.078969	0.2918
lny^2	-0.011225	0.011550	-0.971894	0.3412

R-squared	0.745783	Mean dependent var	0.027293
Adjusted R-squared	0.723677	S.D. dependent var	0.014671
S.E. of regression	0.007712	Akaike info criterion	-6.783844
Sum squared resid	0.001368	Schwarz criterion	-6.638679
Log likelihood	91.18997	F-statistic	33.73697
Durbin-Watson stat	1.807229	Prob(F-statistic)	0.000000

GAP Bölgesi’nde ve Türkiye Bölgeleri Arasýnda Yakýnsama ve Büyüme

Özet

Son yýllarda gelir yakýnsamasý ve ekonomik büyüme üzerinde yol açtýðý etkiler çok sýkça tartýþýlmaya baþlanmýþtýr. Beta yakýnsamasý analizleri ile baþlayan yakýnsama tartýþmalarý, bu tür regresyon yaklaþýmlarýnda varyansýn deðiþken olabileceði eleþtirisinden hareketle sigma yakýnsamasý kavramýný da içerecek þekilde geniþlemiþtir. Ancak sigma yakýnsama yönteminde yer almayan ekonomik ve sosyal faktörler, sigma yakýnsamasýný da yanlý kýlabilmektedir. Bu çalýþmada beta ve sigma yakýnsama yöntemlerinden hareketle GAP bölgesi ve Türkiye bölgeleri arasýnda ortaya çýkan ýraksama ve yakýnsamanýn varlýðý araþtýrýlmýþtýr. Çalýþma, illerin ve bölgelerin özellikleri dikkate alýndýðýnda, gelir düzeyi ile ekonomik büyüme oraný arasýnda alternatif bir modellemeyi önermektedir. Elde edilen bulgular neo klasik büyüme modeli özelliklerini göstermemekte, beºeri sermaye ve fiziki sermaye tamamlayýcýlýðýnýn daha farklý biçimlerde ele alýnmasýnýn zorunluluðunu ortaya koymaktadýr.