

Income Convergence among Member Countries of the Organization of Islamic Conference (OIC)

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Abstract

Poverty is still one of the most important economic problems in the world despite the fact that general welfare programs, services, and distribution have been improving since 1980 and the number of people living in poverty has declined. Although many studies have been conducted on income convergence among various countries, their results are still problematic. More specifically, studies on OIC countries are not only few in number, but their methodology has also been insufficient. This article explores whether or not there existed a convergence among the 29 member countries of the OIC between 1969-2007 and whether there was a convergence between these countries and the 17 most developed countries in the world. The results, reached through the usage of Sigma convergence and absolute beta convergence methods, show that the 29 OIC member countries do not demonstrate absolute convergence. The conditional convergence method, calculated with time series and panel data, shows that the countries have conditional convergence when their differences are compared. This article analyzes OIC countries for possible convergence, focusing on convergence between these countries and the 17 most developed countries using the panel data method, a successful method when taking into consideration the heterogeneity among the countries.

Key Words

Convergence, Economic Growth, Organization of Islamic Conference, Panel Data, Time Series Data.

JEL Classification: O40, O47

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Poverty is still one of the most important economic problems facing humanity, despite the fact that general welfare has been improving since 1980 and the number of people living in poverty is declining. In a World Bank Report (2003) it is stated that 80 percent of the world population earns less than \$10 a day, thus living below the poverty line. The ratio between the average income of the richest 20 countries and that of the poorest 20 countries is 37%. The report continued to state that twenty percent of the world population received 58% of the world's income and that the injustice in the distribution of income increases progressively (Weil, 2009, pp. 12-19). Although there are many studies focusig on income convergence among countries, the results are still problematic. Studies among the OIC countries and between the OIC countries and the 17 most developed countries are both few in number and insufficient in the methods employed.

Convergence among OIC member countries was first introduced and studied by Afshari, Pour, and Sheibani (2005). Afshari and his colleagues applied the tests of convergence, absolute convergence, and relative convergence among 56 OIC member countries between the years of 1950 and 1998.

Duasa (2008) analyzed data of 10 OIC member countries chronologically between 1970-2004 and found there to be no convergence except for among 3 countries in the group.

This article examines whether or not there exists a convergence among OIC member countries as well as whether there is a convergence between these countries and the 17 most developed countries, using data from the OIC countries that were independent during the time of the study. Along with other methods, the panel data method was used, which successfully takes into consideration the heterogeneity existing among countries.

Theoretical Literature

The first significant contribution to Modern Growth Theory was made by Ramsey (1928) and was continued by Harrod (1939) and Domar (1946). The most important subsequent contributions to Modern Growth Theory (or neoclassical

growth theory) were made by Solow (1956), Swan (1956), Koopmans (1965), and Cass (1965). Both in Ramsey's research (1928), whose work presented the first such model and in Modern Growth Theory, it is projected that over the long term, the real income per capita in different countries that have similar structural choices and technologies will reach the same level.

As in the New Growth Theories (or Internal Growth Theories), which started with Romer (1986) and Lucas (1988) and which were continued by Jones and Manuelli (1990) and Kelly (1992), in the last twenty years, technological developments have not been entered into the model from outside the model as data, unlike as in the Modern Growth Theory. On the contrary, they are identified within the model itself. In these above mentioned models, innovation, human capital, and physical capital are variables that determine the growth which are not subject to the decreasing performance rule due to the structure of the production function. The most significant result of these specifications is the hypothesis that not all countries will reach a common, stable, balanced state per capita.

The most basic model used to explain the concept of convergence among countries is the Solow-Swan model. In this model, long-term economical growth is determined by capital accumulation, population growth and technological developments.

The general production function, which has fixed returns to scale, is $Y = F(K, L)$. It can be shown as: $Y(t) = K(t)^\alpha [A(t)L(t)]^{1-\alpha}$

In this formula Y stands for the total domestic production, K stands for capital reserve (which can include physical or human capital), L stands for the amount of labor, and A stands for the technology that increases labor productivity. In t time, the amount of labor increases in proportion to $(L)n$, along with the technology that increases labor productivity $(A)g$. The AL in the formula refers to the efficient labor used in production.¹

The Solow model enables a relative comparison of the steady-state income balance levels (relative income differences) of countries. Production per labor is specified for countries i and j ;

¹ For more details see Jones (1998), Barro and Sala-i Martin (2004).

$$\frac{\tilde{y}_i(t)^*}{\tilde{y}_j(t)^*} = \frac{A_i(t)}{A_j(t)} \left(\frac{S_i/S_j}{(n_i + g_i + \delta_i)/(n_j + g_j + \delta_j)} \right)^{1/\alpha}$$

As seen in this formula, the difference in terminology that affects the production per labor causes differences in the income levels of countries. If countries have the same technology, power of disposition, depreciation and technological growth, these countries will share the same steady-state income levels.

An important inference of this model is as follows: In order for a country that is poorer in the beginning to reach the steady state income levels of a richer country which is very similar to it, the poorer country must grow faster than the richer country. The hypothesis which states that among countries having the same steady situation, the poorer country will grow faster than the richer country is called the *convergence hypothesis*.

The Solow-Swan model also concludes that countries will have conditional convergence when they are allowed different steady-state national income per capita and investment levels. In conditional convergence, if the steady state of the rich country is higher than that of the poor country, the poor country will never catch up with the income levels of the rich country.

Empirical Literature

The convergence hypothesis aims to answer two important questions. First, is a per capita income difference seen among various countries permanent or temporary? The second question begging an answer is dependent on the qualities of the answer given to the first question: if the difference of income between countries is permanent, is its persistence due to structural heterogeneity (referring to the conditions that they possessed in the beginning)? Meanwhile, if the per capita income differences are temporary, how long will this temporary situation continue? (Durlauf, Johnson, & Temple, 2005, p. 38).

Empirical studies on convergence started with Abramovitz (1986) and Baumol (1986). Baumol studied the data of 16 OECD countries between the years 1870

and 1974 in order to test the convergence hypothesis and, as a result, came to the conclusion that a convergence did, in fact, exist. Barro and Sala-i Martin reported their findings in 1991 on the USA and the EU region, while in 1992 they reported results on the individual American states, 98 countries, and the OECD countries. Mankiw, Romer, and Veil (1992) used three data sets. The first one included all countries except the oil rich countries, the second one included those countries with a population of more than a million people in 1960, and the third one included 22 OECD countries with populations of over one million people. Convergence results were revealed by Sala-i Martin (1996a; 1996b) for the American states, the Japanese territories, the Canadian provinces, and the EU region; by Cashin (1995) on the Australian states and New Zealand; by Canova and Marcet (1995) on the EU region, Cashin and Sahay (1996) on the Indian region; Persson (1997) for the Swedish territories; and by Shioji (2001) on the Japanese territories.

When we look at recent studies, we see that data set choices continue to differ. Hakura (2004) studied Middle Eastern and North African countries (MENA), whereas Wane (2004) studied the member countries of the West African Economic and Monetary Union, and both researchers found conditional convergence among these countries. Ashfari et al. (2005) studied 56 Muslim Countries, Guetat and Serrantino (2005) studied North African and Middle Eastern countries, Sala-i Martin (2006) studied 138 countries, Serra, Pazmino, Lindow, Sutton, and Ramirez (2006) studied six large Latin American countries, Galvao and Reis Gomes (2007) studied Latin American countries, Pastor and Serrano (2008) looked at 89 countries, Duassa (2008) studied 10 member countries of the Organization of the Islamic Conference, Masron and Yusop (2008) studied the Asian-5 (Indonesia, Malaysia, Philippines, Singapur and Tailand), Lei and Yao (2008) studied the Chinese territory with the inclusion of Hong Kong and Macau, O'Neil, and Van Kerm (2008) studied 25 OECD countries and 98 countries with two different data sets, Rapacki and Prochniak (2009) studied 27 former Russian transitional economies, Desli (2009) studied 15 EU countries, and Apergis, Panopoulou, and Tsoumas (2010) studied 14 EU countries in order to ascertain whether there was a case of convergence.

Among the studies mentioned above, those that used global scale data sets show that under the assumption that the science of economics is universal,

absolute convergence will take place in all countries. Therefore, although different data sets are preferred in different studies, all countries and regions have been brought together here.

The results of these studies reveal conclusions that are ambivalent with respect to the validity of the convergence hypothesis. The absolute convergence hypothesis is verified in countries that have similar characteristics and which are more homogenous (e.g. the developed OECD countries), whereas this hypothesis cannot be verified in studies on all countries that exhibit different characteristics and different steady states.

Convergence Tests

There are two types of convergence terms in the literature to test the convergence hypothesis: beta (β) convergence and sigma (σ) convergence. Beta convergence takes into account the starting conditions and the convergence rates of the countries or the regions and then separates findings into the two categories of beta convergence and conditional beta convergence. In the literature, when beta convergence is studied, the cross-section approach, the panel approach, and the time-series approach are used.

Sigma convergence, rather than focusing on the starting conditions of countries or regions, focuses on whether or not there is a decrease over time in per capita income differences. Convergence among countries takes place when a decrease in per capita income distribution occurs. Because this convergence is based on income distribution, the income distribution of countries should be measured correctly for this test. The most basic distribution measure in statistics is standard deviation.

Convergence Tests on OIC Member Countries

In this section the existence of absolute and conditional convergence through the estimation of statistical and econometric models are investigated among OIC member countries for which sufficient data exist.

Convergences were found in the studies of Afshari et al. (2005) and Duasa (2008), which were mentioned in the introduction, and in more regional studies focusing on Middle Eastern and North African (MENA) countries. Among those countries, Hakura (2004) found conditional convergence between 1998-2000 in his regression analysis, Guetat and Serrantino (2005) found absolute and conditional convergence between the years 1960 and 2000, and Sameti, Farahmand, and Koleyni (2010) found absolute and conditional convergence between the years 1970 and 2003.

Figure 1 shows the average growth rates of 29 OIC countries between 1969-2007 and their related per capita income in 1969, which is the start date.

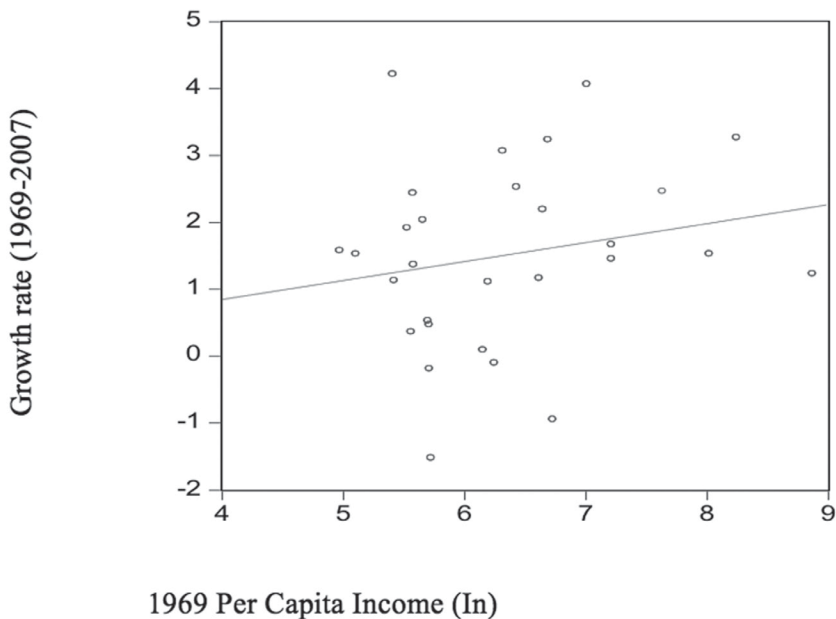


Figure 1.
Growth Rate of Countries and its Relation to Per Capita Income

When the four members of the OIC countries with the highest income are removed, the average per capita income of the countries between 1969-2007 reaches 720 US dollars. The OIC countries whose income levels are close to each other are Turkey, Gabon, Malaysia, Oman, and Saudi Arabia. In *Figure 2*

the average growth rate of these five countries between 1969-2007 and their per capita income in 1969 are shown. The country with the lowest income among these countries with similar income levels shows the fastest rate of growth.

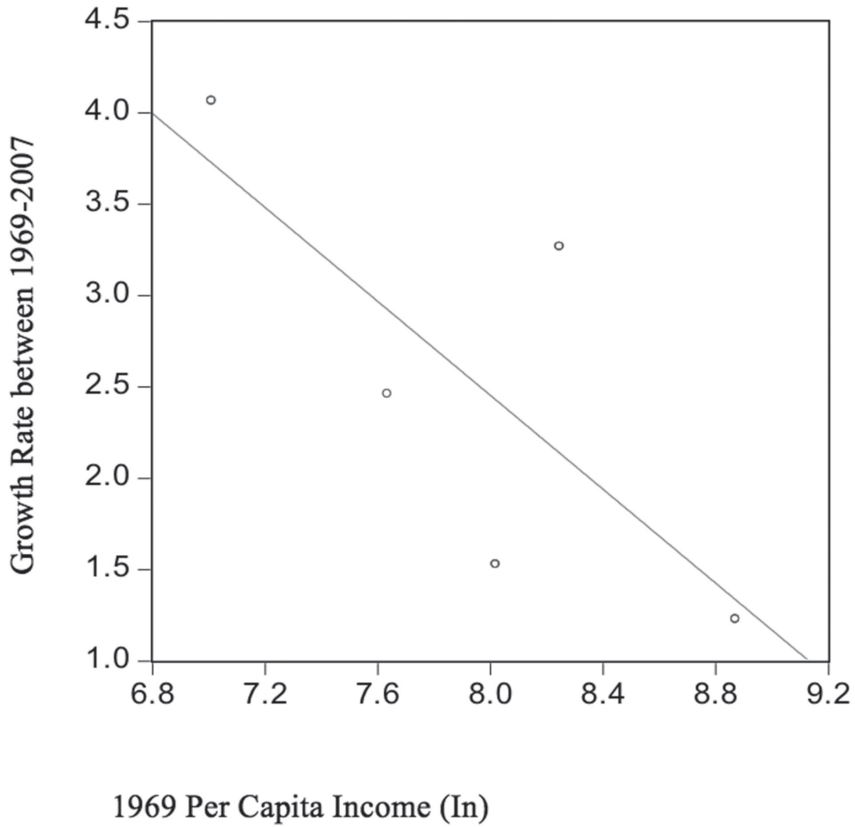
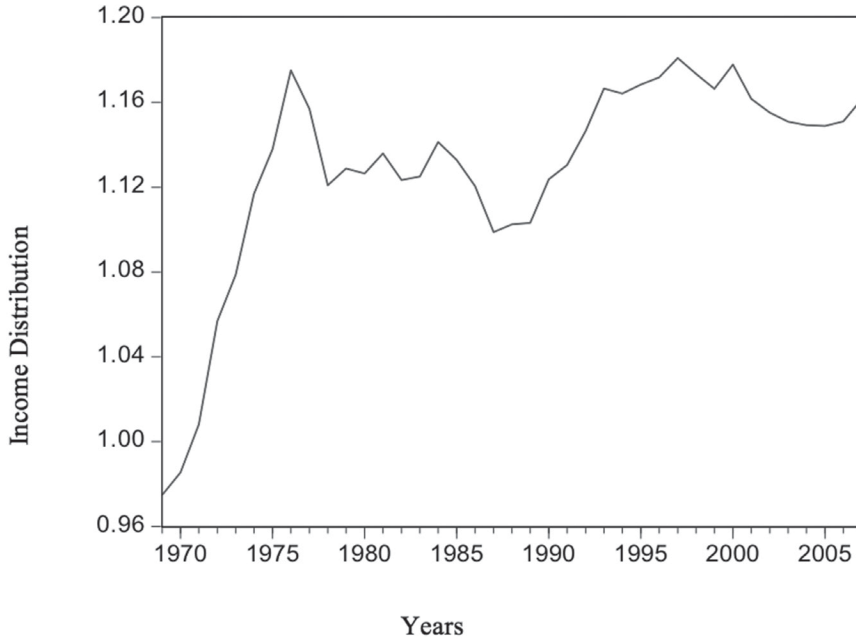


Figure 2.

The Growth Rate of Four Countries That Have Similar Growth Rates and Per Capita Income

Sigma (σ) Convergence Test: The sigma convergence test, which is based on the variations of per capita income over time, has also been applied to these 29 countries. In *Figure 3*, the variations of per capita income distribution of 29 OIC countries between 1969-2007 can be seen.



Note: The series that has been calculated is the per capita gross national income series of the natural logarithm of the i country in t time.

Figure 3.
Per Capita Income Distribution of the OIC Member Countries

The sigma convergence method used in the graph in *Figure 3* shows whether the countries display absolute convergence or not.

Sigma Convergence Test between Turkey and the OIC Countries: Knowing if there is convergence between Turkey and the OIC member countries that were chosen in the period between 1969-2007 provides information about the economic performance of these countries and of Turkey at that time. In *Table 1*, the per capita income in different time periods for 29 OIC member countries can be seen. Among these countries, all of them except Gabon, Malaysia, Oman and Saudi Arabia have lower per capita income when compared to Turkey, and this situation has continued until the present day.

Table 1.
Average Gross Domestic Product Per Capita Values of OIC Member Countries in Different Periods of Time

Countries	1969-1978	1979-1988	1989-1998	1999-2007	1969-2007
Algeria	1564.3	1929.2	1734.4	1965.6	1794.1
Bangladesh	230.7	235.2	276.6	374.7	276.8
Benin	294.8	313.9	304.3	345.3	313.8
Burkina Faso	148.3	171.9	190.5	242.6	186.9
Cameron	549.2	848.7	633.1	663.1	673.8
Chad	209.0	166.0	179.6	227.8	194.8
Ivory Coast	954.4	821.5	626.3	566.6	746.7
Egypt	624.8	971.5	1192.5	1501.9	1061.7
Gabon	5121.4	4996.1	4632.9	4078.0	4723.2
Gambia	317.6	342.0	324.4	332.0	328.9
Guyana	805.6	698.4	757.8	980.9	806.3
Indonesia	285.9	456.0	746.8	889.9	587.1
Iran	1833.8	1421.6	1410.8	1798.1	1611.4
Malaysia	1386.7	2099.1	3249.1	4333.7	2727.0
Mali	185.1	193.7	197.5	261.9	208.2
Mauritania	476.1	433.0	412.0	434.1	438.9
Morocco	866.0	1039.5	1191.5	1445.5	1127.7
Niger	265.3	223.9	176.9	168.2	209.6
Nigeria	395.0	342.2	361.0	406.2	375.3
Oman	4292.7	5884.4	7526.1	8876.7	6587.7
Pakistan	283.5	378.3	498.0	571.7	429.3
Saudi Arabia	12492.0	11915.3	9189.7	9369.6	10776.9
Senegal	520.1	482.5	450.1	497.5	487.3
Sierra Leone	276.5	276.3	209.9	207.5	243.4
Sudan	271.3	267.4	293.0	404.8	306.7
Syria	779.4	1016.7	1091.2	1220.8	1022.1
Togo	306.5	294.3	255.0	250.6	277.3
Tunisia	1043.3	1388.7	1641.0	2262.7	1566.5
Turkey	2341.3	2730.4	3550.9	4299.5	3203.1

Note: Calculations have been made with the data that were provided from the World Bank WDI Database (2012) for the year 2000 in fixed US dollars.

Table 2 uses the sigma convergence method to illustrate whether there is a convergence between some of the OIC member countries and Turkey during the period between 1969-2007. This period has been divided into 10-year segments with both the natural logarithms of the average gross domestic product per capita and their distribution being calculated. The table shows that there was divergence between Turkey and 11 countries, convergence between Turkey and 3 countries, and no conclusion with regard to the remaining 15 countries.

The per capita income level distribution of countries having a higher or relatively similar income levels compared with Turkey balance out with time, which is consistent

with the absolute convergence hypothesis. However, there is a wider spread of income distribution per capita in countries which have lower income levels compared to Turkey. For this reason, the absolute convergence hypothesis was not validated for this period.

Table 2.
Sigma Convergence between Turkey and 28 OIC Member Countries in Various Periods

Countries	1969-1978	1979-1988	1989-1998	1999-2007	Result
Algeria	0.287	0.243	0.505	0.551	Divergence
Bangladesh	1.639	1.731	1.804	1.725	?
Benin	1.463	1.527	1.735	1.779	Divergence
Burkina Faso	1.949	1.953	2.068	2.030	?
Cameron	1.027	0.827	1.221	1.318	?
Chad	1.706	1.981	2.109	2.093	?
Ivory Coast	0.634	0.853	1.226	1.430	Divergence
Egypt	0.937	0.731	0.771	0.741	?
Gabon	0.514	0.427	0.190	0.033	Convergence
Gambia	1.412	1.466	1.690	1.807	Divergence
Guyana	0.753	0.965	1.100	1.041	Divergence
Indonesia	1.492	1.267	1.108	1.112	?
Iran	0.179	0.464	0.653	0.616	?
Malaysia	0.375	0.185	0.070	0.007	Convergence
Mali	1.794	1.870	2.041	1.977	?
Mauritania	1.124	1.300	1.521	1.618	Divergence
Morocco	0.703	0.681	0.770	0.769	?
Niger	1.543	1.772	2.120	2.288	Divergence
Nigeria	1.260	1.471	1.614	1.668	Divergence
Oman	0.427	0.536	0.532	0.516	?
Pakistan	1.490	1.399	1.387	1.424	?
Saudi Arabia	1.155	1.024	0.674	0.554	Convergence
Senegal	1.061	1.223	1.458	1.521	Divergence
Sierra Leone	1.508	1.618	2.005	2.152	Divergence
Sudan	1.526	1.641	1.764	1.672	?
Syria	0.788	0.697	0.836	0.886	?
Togo	1.435	1.575	1.863	2.006	Divergence
Tunisia	0.576	0.476	0.546	0.453	?

Note: Calculations have been made with the data that were provided from the World Bank WDI Database for the year 2000 in fixed US dollars.

Sigma Convergence between the OIC Countries and the 17 Most Developed Countries: The following question is of importance here: “During these years, were the OIC member countries selected, including Turkey, catching up with developed countries?” In order to properly respond to this question, a separate study was carried out to determine whether there was convergence between these countries and the 17 industrialized countries, as selected by Maddison.

As seen in *Table 3*, although no conclusion could be reached for 13 of the OIC member countries, there was divergence between the 17 developed countries and 13 of the OIC countries as well as convergence between 3 member countries. It can therefore be concluded, at least for most OIC member countries, that the income gap between themselves and the 17 most developed countries has, in fact, grown greatly during the forty years studied.

Table 3.
Sigma Convergence between 17 Developed Countries and 29 OIC Member Countries

Countries	1970-1979	1980-1989	1990-1999	2000-2007	Result
Algeria	1.587	1.604	1.805	1.831	Divergence
Bangladesh	2.973	3.085	3.083	3.000	?
Benin	2.789	2.885	3.025	3.064	Divergence
Burkina Faso	3.265	3.304	3.350	3.312	?
Cameron	2.323	2.181	2.535	2.601	?
Chad	3.057	3.325	3.415	3.359	?
Ivory Coast	1.940	2.243	2.528	2.730	Divergence
Egypt	2.234	2.068	2.052	2.022	Divergence
Gabon	0.771	0.942	1.111	1.326	Divergence
Gambia	2.727	2.824	2.993	3.092	Divergence
Guyana	2.073	2.343	2.365	2.328	?
Indonesia	2.779	2.596	2.383	2.389	?
Iran	1.485	1.851	1.930	1.891	?
Malaysia	1.664	1.523	1.336	1.270	Convergence
Mali	3.096	3.240	3.328	3.253	?
Mauritania	2.451	2.662	2.820	2.904	Divergence
Morocco	2.009	2.030	2.061	2.047	?
Niger	2.876	3.152	3.428	3.578	Divergence
Nigeria	2.558	2.844	2.908	2.946	Divergence
Oman	0.886	0.790	0.757	0.764	?
Pakistan	2.804	2.730	2.675	2.706	?
Saudi Arabia	0.112	0.379	0.620	0.730	Divergence
Senegal	2.387	2.586	2.756	2.805	Divergence
Sierra Leone	2.828	2.986	3.337	3.413	Divergence
Sudan	2.844	2.998	3.049	2.944	?
Syria	2.081	2.063	2.114	2.171	Divergence
Togo	2.758	2.941	3.165	3.299	Divergence
Tunisia	1.867	1.827	1.820	1.729	Convergence
Turkey	1.310	1.345	1.283	1.279	?

Note: Calculations have been made with data from the World Bank WDI Database for the year 2000 in fixed US Dollars.

Absolute Beta Convergence: The second method used to test whether the convergence hypothesis among countries is valid was beta convergence².

² See more details Valdes (1999, pp. 44-50).

Using Equation 9, the existence of absolute convergence among 29 OIC member countries was estimated. *Table 4* shows the findings of the data for these countries between 1969-2007.

Table 4.
Beta Convergence Estimations between 1969-2007

Coefficient	Estimation	t statistic
α	-0.28	-0.16
β	0.28	1.06
R^2	0.04	

According to the estimation results, the beta coefficient in the model came out positive and statistically meaningless. According to this result, absolute convergence did not take place among the countries studied in that period. This result is consistent with the previous findings.

Conditional Beta Convergence: In conditional beta convergence, it is assumed that the steady state of countries can vary. Using the section data regression model and the panel data steady effects model, research was conducted to measure the possibility of such convergence.

The disadvantage of this method is the fact that it disregards the specifications unique to a particular country. The unique specifications of a country are strong indicators of where its steady state might occur. In cases where a country's steady state cannot be precisely pinpointed, it will be difficult to calculate the negative relationship between that country's starting income and the growth rate.

As in the absolute convergence estimation, the existence of conditional beta convergence among 25 OIC member countries between 1969-2005 was done by using both section data and panel data methods.

Table 5 shows the results obtained by using the section data method for all 25 OIC countries between 1969-2005 to determine whether there was conditional convergence among them. The coefficient of variation of the gross domestic income per capita in 1969, the beginning of the period, is both negative and statistically meaningful, which means that there is a conditional convergence among the countries in the sample.

Table 5.
Section Data Regression Model and Conditional Convergence Estimation

Dependent Variable: Average Growth Rate (1969-2005)		
Variable	Estimated Coefficient	t Statistics
Gross Domestic Income Per Capita (ln)	-1.22	-2.60
Life Expectation	0.14	3.70
Government Spending	0.02	0.45
Domestic Savings	0.07	2.31
Trade Gap	-0.01	-0.98
Rate of Inflation	0.02	1.05
R ² = 0.61	Total Number of Observations= 25	

Note: Data are taken from the World Bank World Development Indicators database (2012).

Table 6 illustrates whether or not there is conditional convergence among the 25 OIC member countries using the panel data steady effects method. The model is estimated by calculating the average of each variable in these sub-periods using the steady effects method. According to the results of the estimation, the variable of the coefficient of the gross domestic product per capita is negative and statistically meaningful; therefore as in the section data model, there is conditional convergence among the countries.

Table 6.
Panel Data Steady Effects Method and Conditional Convergence Estimation

Dependent Variable: Average Growth Rate		
Variable	Estimated Coefficient	t Statistics
Gross Domestic Income Per Capita (ln)	-2.81	-1.98
Life Expectancy	-0.06	-1.17
Government Spending	-0.07	-1.41
Domestic Savings	0.12	3.19
Trade Gap	0.04	2.65
Rate of Inflation	-0.02	-1.17
R ² =0.37	Total Number of Observations =175	

Note: Data are taken from the World Bank World Development Indicators database (2012). The coefficients of the steady effects in the model are not shown.

Results

Theoretical models show that a selection of countries, each with unique qualities, will not reach absolute convergence, and that each country will rather reach its own steady-state, balanced income level. On the other hand, the empirical studies on income convergence have produced inconclusive results. The convergence studies among the OIC member countries themselves, along

with studies between these countries and the 17 most developed countries, are very few and insufficient with regards to methodology. In this study, absolute and conditional beta convergence was estimated by calculating the sigma convergence for 29 OIC member countries, using the section and panel data methods. The results that we found are similar to those of Afshari et al. (2005), and Duasa (2008). According to the graphic demonstration of sigma convergence analysis and the estimated econometric model, absolute convergence does not exist among the OIC members during the period of time under study here. Nevertheless, the graphic analysis of four countries which share more similarities, including Turkey, suggest that absolute convergence is verified. In estimations made with both the section data regression model and the panel data steady effects model, it can be seen that countries progress toward their own steady, balanced income levels, a finding congruent with the absolute convergence hypothesis.

Among the OIC member countries, Turkey, Gabon, Malaysia and Saudi Arabia show features of convergence, while only Malaysia, Tunisia, and Egypt show convergence with the 17 most developed countries. The varying growth performances among countries sharing the same cultural climate can be a result of differences in savings percentages, technological levels, investment levels, and population levels. The reason for the difference of these variables across different countries needs to be explained. Different growth rates of OIC members can be explained through the luck hypothesis, the geography hypothesis, or the institutions hypothesis. Accordingly, future studies may look into these explanations.

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