**Investigation the links between foreign investment, economic growth and energy usage: Organization of the Islamic Conference Countries**

Asma Gamoori

Department of Economics, Khuzestan Scince & reaserch Branch, Islamic Azad Uiversity, Ahvaz, Iran [asma.gamoori@gmail.com](mailto:asma.gamoori@gmail.com)

Alireza Jorjorzadeh[[1]](#footnote-1)

Department of Economics, Ahvaz Branch, Islamic Azad Uiversity ,Ahvaz , Iran arjorjor@iauahvaz.ac.ir

Fatemeh Mehrabani

Department of Economics, Ahvaz Branch, Islamic Azad Uiversity ,Ahvaz , Iran [Fatemeh.mehrabani@hotmail.com](mailto:Fatemeh.mehrabani@hotmail.com)

**Abstract**

The vital importance of energy on one hand and its scarcity on the other hand requires the greater attention of the economic activists to make a more efficient use of this production factor. Due to the difference between various energy resources as well as different performance of countries in using energy resources from technical and technological viewpoint, the investigation of the relationship between energy consumption and macroeconomic variables especially in Islamic countries is an outstanding issue. The purpose of the current study was to investigate the relationship between foreign investment, financial development and foreign trade with energy consumption member countries of the Organization of the Islamic Conference during the period of 2000-2014 using panel data approach. The results of the study indicated that foreign trade, investment and financial development had a positive significant effect on the energy consumption in the studied countries. Moreover, the greatest effect was attributed to the foreign trade.

**Keywords:** foreign trade, foreign investment and financial development, energy consumption, Islamic countries.

JEL Classification: F0; O5

1. **Introduction**

Energy is a prominent factor in economic, trade interaction improvements which are essential inputs to achieve sustainable development especially in developing countries. In developing countries, due to the economic growth, population growth and industrialization, energy consumption is increasing rapidly ([Omri and Kahouli](http://www.sciencedirect.com/science/article/pii/S030142151301197X?np=y), 2014, Amri 2016, Ibrahiem 2015). In order to meet to the growing needs of the people it is required to produce commodities as far as possible. Economic theories have proved that policies made with the aim of strengthening the financial sector can decrease the information and transaction costs and also it can increase the production by improving the productivity to affect the energy consumption. Investment and foreign trade are among important factors that can increase energy consumption. On the other hand, investment can affect the energy consumption directly or indirectly. Investment expand the output by increasing the number of manufacturing enterprises and increases the energy consumption. The growth of production lead to the economic growth through the inter-sectorial growth and the result of the corresponding process is the greater demand for energy. Moreover, the output growth increases demand for labor force and improves the incomes of economic agents. Finally, the income increase leads to an excess demand for consumption goods and increases the energy consumption as well (Sadrosky, 2013). Abdouli and Hammami (2016) investigated the causal links between Environmental quality, Foreign Direct Investment (FDI), and economic growth for 17 MENA countries over the period 1990–2014. Their findings showed that bidirectional causality between economic growth and CO2 emissions; as well as bidirectional causality between FDI stocks and CO2 emissions, while there is unidirectional causality from FDI inflows to economic growth. Also, Lee (2013) showed that the FDI inflows strongly leaded to economic growth and it has no relation to clean energy use in the G20. [Paramati](http://www.sciencedirect.com/science/article/pii/S0140988316300214?np=y) yet al., (2016) investigated the impact of both FDI inflows and stock market developments on clean energy use across 20 emerging market economies, spanning the period 1991–2014. Their results urged that both policy makers and governments in these emerging market economies should initiate effective public-private-partnership investments in clean energy projects by providing lucrative incentives, which, in turn, will encourage both domestic and foreign investors to invest more in clean energy projects and, eventually, moving these economies towards sustainable economic growth.

The Organization of the Islamic Countries (OIC) is the second international after the United Nations which includes 57 Islamic countries in almost four continents. Except for Albania and Turkey which are considered as European countries and Surinam which is the American member of the OIC, all other members of the organization are located in Asia and Africa. Also, the members of the OIC based on a formal classification are divided into three groups including Arab, African and Asian Countries. Arab member countries of the Persian Gulf Cooperation Council are considered as the main center of power in the OIC. OIC member countries generally include countries which have features in common and historical, geographical and cultural closeness. Their main point of aggregation is religion. OIC member countries constitute the major oil exporting countries. These countries are considered as the greatest producer and the greater consumer of the energy in the world. The total value of the foreign trade for the OIC member countries in 2014 was almost 4 billion dollars. 2 thousand billion dollars refers to the exports and the remaining is attributed to imports. The trade share of the OIC member countries in the global trade is less than 12%. OIC member countries own about 70% of the energy resources and 40 percent of the natural resources all over the world (World Bank, 2014). Most of the scholars believe that the expansion of the trade and industrial exports increase the volume of the economic activities especially polluting activities and the utilization of the energy resources. Also, the increase of the soar of the competitive pressure between the domestic firms and their rivals cause the appropriate environmental legislation to fade out in the host country and the increased environmental pollution through the indiscriminate use of energy. On the other hand, other researchers believe that due to the countries reaction to the competitive pressure of the trade expansion, the use of resources will be more efficient based on the relative advantage so that the energy waste especially energy emissions in the host country will reduce (Sadrosky, 2013). Energy consumption in addition to being influenced by developments in the domestic economy is affected by changes in foreign trade and foreign investment. The interaction of energy consumption with takes place by foreign investment and foreign trade (imports) and mainly through trade liberalization. Talking about the nature of the trade on the energy consumption, it can be stated that developing countries due to the light handed environmental regulations against polluting manufacturing industries compared to developed countries have a comparative advantage. The result is that the developed countries transfer their active polluting industries to the developing countries. Therefore, the effects of the trade volume on the energy consumption in these countries is different and multi-dimensional (Taylor, 2003). The relationship between import and energy consumption is justifiable. The distribution of the imported commodities needs an appropriate transportation network fuels by energy. Moreover, the imported goods due to the combination of the commodities can affect energy consumption. Durable imported commodities like automobiles, refrigerators etc are all energy consuming and the increase of the demand for such imported commodities increases the demand for energy (Borozan, 2013). Therefore, it can be stated that the import of the industrial commodities in order to replace them with domestic commodities which are produced with high energy consumption can decrease the energy consumption of the host country. But if the imports of were machinery and capital and intermediary goods the energy consumption increased. The effects of industrial commodities imports on the energy consumption can be positive or negative (Chapman and Suri, 1998). Taking into account the above factors, the purpose of the current study was to investigate the relationship between the direct foreign investment, financial development and foreign trade with energy consumption in OIC member countries during period from 2000 to 2014 using panel data approach.

1. **Literature Review**

Trade include the import and export of the commodities and theoretically there are various reasons for why export can affect energy consumption. In order to increase the exports, the machinery and equipment for loading and transportation of export goods should be sent to the ports, airports or unloading stations. Machinery and equipment in the manufacturing process and transportation of goods for export requires a primary energy and any increase in exports leads to the growth economic activity and the increase of the energy demand. Therefore, the export of manufactured goods requires energy for transportation meaning that without enough energy for transportation, export expansion is weakened (Abedin et al, 2015). Also, imports can affect the energy consumption. If imports include machinery, equipment and new technology, it increases the output and the energy utilization. Moreover, the imports of goods is done through the transportation system which increases the demand by the transportation system (Sadrosky, 2011). Most of the researchers consider that the relationship between energy, labor and capital in normal conditions as substitution type, however, in the short run as the production structure can't react to the increase of the prices the relationship between capital and labor will be complementary. However, investment expands production and increase the number of factories resulting in increase in the energy consumption (Gurgul and Lach, 2012). Sadrosky investigated the financial development and energy consumption in the central and Eastern Europe for 9 countries. The results of the study indicated that there was a positive significant relationship between the financial development and energy consumption. Among the analyzed variables only the volume of transactions was considered as a financial index which had a positive significant effect on the energy consumption. On the other hand, Tang and Tan (2012) studied the relationship between the energy consumption, financial development, economic growth, foreign investment and relative prices in Malaysia during the period from 1972 to 2009 using Johansen and bounding test and investigated the effects of the financial development on the energy consumption. Based on the results of the study they recommended a dual strategy to the policy makers. On one hand, increasing the investment in the energy infrastructures to provide enough energy for the financial sector and economic development and on the other hand, encouraging the research and development process in green technologies including pply appropriate soil, environmental protection techniques and sustainable farming activities in order to decrease the consumption of the fossil fuels. Gurgul and Lach (2012) obtained a direct causal relationship between financial development and energy consumption. Shahbaz and Lin (2012) investigated the relationship between the economic growth, urbanization and investment. Gurgul and Lach (2012) obtained a direct causal relationship between financial development and energy consumption. The results of the study indicated that there was a long run relationship between foreign trade and demand for energy. Islam et al (2014) indicated that the economic growth and financial development affected the energy consumption in the short run and ling run horizons, but the relationship between the population and energy is significant only in the long run.

[Khatun](http://www.sciencedirect.com/science/article/pii/S136403211500862X) [and Ahamad](http://www.sciencedirect.com/science/article/pii/S136403211500862X) (2015) examined the causal relationship between FDI in the energy and power sector, and economic growth in Bangladesh for the period 1972–2010 and it confirmed a causal relationship for the energy use equation in the long run. Nasreen and Anwar (2014), the study examined the causal relationship between trade liberalization and energy consumption. The study, in the form of Granger for 15 selected Asian countries during the period 1980 to 2011, and based on the results, bidirectional relationship between trade liberalization and energy consumption were achieved in the short and long term.

Jebli and Youssef (2015) in the article explores the relationship between foreign trade and their energy consumption. The study for 11 African countries over the period 1908 to 2008 in the form of methods and techniques Granger cointegration panel approaches ordinary least squares (OLS) and fully modified ordinary least squares (FMOLS) was performed. Based on the regression results in the short term we see a dual relation between foreign trade and energy consumption by at least square techniques, foreign trade and a significant positive impact on energy consumption.

Halicioglu (2015) the study examines the impact of exports on energy consumption. This study, using Auto Regressive Distributed Lags (ARDL) for the period 2008-1968 for Turkey was done. Results of a significant positive relationship between these variables showed energy consumption. Also in this study using a dynamic Granger causal relationship between energy consumption and exports were also examined. Ali is a one-way communication of test results showed energy exports. Kyophilavong et al. (2015) investigated the relationship between economic growth, energy consumption and trade openness in Thailand using Bayer and Hanck cointegration method and the results confirm the presence of cointegration between the variables and the existence of bidirectional causality between economic growth and energy consumption, and between energy consumption and trade openness.

Finally, Abedin et al (2015) investigated the relationship between the foreign direct investment, financial development and foreign trade with energy consumption in ASEAN countries during the period from 1998 to 2013. The results of the study indicated that there was a positive and significant relationship between foreign direct investment, foreign trade and financial development with energy consumption.

1. **Model and variables**

The model used in the current study was obtained from the study of Abedin et al (2015) as follows:

(1)



Where, L was the logarithmic transformation. The logarithmic form of the models was used in this study. The reason is that the defined model will be a constant elasticity model and the estimated coefficients could be interpreted as elasticity. On the other hand constant elasticity are more appropriate policy recommendations.

**Energy Consumption:** energy consumption in the current study was included based on the energy consumption per capita in the model. In other words, kilogram energy consumption per individual was included to the model.

Financial development index (FD): which was defined as the ratio of the total facilities granted by domestic banks to customers to the gross domestic product GDP (Litao, 2013).

Foreign Trade which was defined as the sum of imports and exports divided into the GDP to smooth survey data.

Foreign Direct Investment: (FDI): Which was defined as the investment of a corporation or an individual in another country in order to trade or produce an output. The total volume of the investment of the foreign countries in the host country was used as the criterion for the measurement of the foreign investment. The required data were obtained from the World Bank website.

1. **Estimation of the model**

Using traditional estimation methods in econometrics is based on the assumption of stationary of variables. Therefore, in order to avoid the estimation of a spurious regression it is necessary to examine and tested the stationary of variables. To investigate the stationary of variables in panel data approach particular tests can be used. The current study used the Levine and Lin (LL), Shin and Pesaran stationary tests for the investigation of stationary of variables in panel data approach. The results of the stationary test were presented in Tables (1) & (2).

**Table (1): results of the stationary test using Levine and Lin (LL) test**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Stationary or no stationary** | **Probability** | **Test statistics** | **Evaluation method** | **Variable** |
| no stationary | 0.6615 | 0.41653 | level | LEC |
| stationary | 0.0001 | -13.6840\*\*\* | 1st difference |
| no stationary | 0.8092 | 0.87505 | level | LFDI |
| stationary | 0.0001 | -8.12941\*\*\* | 1st difference |
| stationary | 0.0020 | -2.87489\*\* | level | LFD |
| stationary | 0.0175 | -2.10878\*\* | level | LTR |

\*\* indicates that the estimated parameters are significant at the 5% level.

\*\*\* indicates that the estimated parameters are significant at the 1% level.

**Table (2): results of the stationary test using Shin and Pesaran test (level)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Stationary or no stationary** | **Probability** | **Test statistics** | **Evaluation method** | **Variable** |
| no stationary | 0.9842 | 2.15056 | level | LEC |
| stationary | 0.0001 | -12.8861\*\*\* | 1st difference |
| no stationary | 2.04148 | 0.9794 | level | LFDI |
| stationary | 0.0001 | -8.67464\*\*\* | 1st difference |
| no stationary | 0.1322 | -1.11596 | level | LFD |
| stationary | 0.0001 | -12.6094\*\*\* | 1st difference |
| no stationary | 0.1050 | -1.25358 | level | LTR |
| stationary | 0.0001 | -11.3117\*\*\* | 1st difference |

\*\*\* indicates that the estimated parameters are significant at the 1% level.

According to the results of Tables (1) & (2), we confirm most variables are I(1), then we use panel cointegration tests examining the relationship among the four variables. We employ three kinds of panel cointegration tests, that is Padroni’s, Kao’s and Johansen’s Fisher panel cointegration tests. For starting to discuss the long-run relationship, we have calculated the Kao’s tests for the homogeneous panel, where the null hypothesis is the absence of cointegration.

Table (3): KAO’S RESIDUAL COINTEGRATION TEST RESULTS

|  |  |  |
| --- | --- | --- |
|  | Statistic | Prob. |
| ADF | -4.01\*\*\* | 0.0001 |

Notes: The ADF is the residual-based ADF statistic. The null hypothesis is no cointegration. \*\*\* indicate that the estimated parameters are significant at the 1% level.

Table (3) reports the results of Kao’s residual panel cointegration tests, which rejected the null hypothesis of no cointegration for the energy consumption and other variables at the 1% significance level, so that there is existence of cointegration. Table (4) shows the results of pedroni residual cointegration test. There are two parts in Table (4) the first four test statistics are computed by the “within” dimension (panel statistics). If the null is rejected, then energy consumptions are cointegrated for all variables. The last three test statistics are computed by the “between” dimension (group statistics).

Table (4): PEDORNI’S RESIDUAL COINTEGRATION TEST RESULTS

|  |  |  |
| --- | --- | --- |
| Within group |  |  |
|  | Statistic | Prob. |
| Panel v-Statistic | -24.15040 | 1.0000 |
| Panel rho-Statistic | 1.297434 | 0.9028 |
| Panel PP-Statistic | -1.875223\*\* | 0.0481 |
| Panel ADF-Statistic | -2.413421\*\*\* | 0.0079 |
| Between group |  |  |
|  | Statistic | Prob. |
| Group rho-Statistic | 2.731180\*\*\* | 0.0033 |
| Group PP-Statistic | -2.743165\*\*\* | 0.0030 |
| Group ADF-Statistic | -0.964665 | 0.1674 |

Notes: The null hypothesis is that the variable are not cointegrated. Under the null hypothesis, all the statistics are distributed as normal distributions. The variance ratio test is right-sided, while the others are left-sided. \*\* and \*\*\* indicate that the estimated parameters are rejects the null hypothesis of no cointegration at the 5% and 1% levels. Newey-West bandwidth selection using Bartlett Kemel Cross Method Statistic Prob.

In Table (4), most of the estimate results of the Padroni’s panel cointegration tests indicate that the null of no cointegration can be rejected at the 5% significant level. This displays that the changes of energy consumption in these countries are connected with other macroeconomic variables. However, the results in Table (4) are inconsistent; some statistics are significant, but there are some exceptional results. Due to the data applied in this paper are panel data, the varied results can be caused by the different relationships between energy consumption and other macroeconomic variables in these countries. The result of the Johansen’s Fisher panel cointegration test summarizes in Table (5), are fairly conclusive: Fisher’s tests, no matter with the Trace test statistics or max-eigen test statistics, support the presence of a cointegrated relation among the four variables at the 1% significant level.

Table (5): Johansen Fisher Panel Conitegration Test

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Hypothesized  No. of CE(s) | Hypothesized  No. of CE(s) | Prob. | Fisher Stat.\*  (from max-eigen test) | Prob. |
|
| None | 232.2\*\*\* | 0.0000 | 196.3 | 0.0000 |
| At most 1 | 85.24\*\*\* | 0.0000 | 69.88 | 0.0001 |
| At most 2 | 43.21 | 0.0892 | 42.23 | 0.1067 |
| At most 3 | 26.58 | 0.7375 | 26.58 | 0.7375 |

Notes: Asymptotic p-values are computed using a Chi-square distribution \*\*\*indicate that the test statistics are significant at the 1% level. Fisher’s test applies regardless of the dependent variable.

We can conclude from those results of panel cointegration tests, there is a panel

long-run equilibrium relationship among the energy consumption, financial development index, foreign direct investment and gross domestic product move together in the long run.

**4-1 Results of the diagnostic tests**

Various tests can be used for testing the strength of different models. The most common tests include Chow and Hausman tests. The Chow tests is used to select between pooled data and panel data methods of estimation. The null hypothesis refers to the pooled data and H1 refers to the panel data approach. The fixed effect can be accepted when the difference between cross sections can be explained by an intercept in the model. But the pooled data method of estimation uses similar intercepts. If the null hypothesis was rejected the Hausman test can be used for the selection of the appropriate model. The Hausman test is based on the existence or non-existence of the relationship between the error terms of the estimated regression and the explanatory variables of the model. If such a relationship exists between the error terms of the estimated regression and the explanatory variables the fixed effect model is used. The null hypothesis of the Hausman test stated that there wasn't any relationship between the explanatory variables and the error terms.

**4-2 The results of the model estimation**

In order to choose between panel data and pooled data estimation methods the Chow test was used. The null hypothesis of the Chow test can be defined as follows:

**H0 =** Pooled data

**H1 =** Panel data

The results of the Chow test indicated that the results of the F-statistic confirmed the use of panel data approach against the pooled data. The results of the test was presented briefly in Table (6).

**Table (6): results of the Chow test**

|  |  |  |  |
| --- | --- | --- | --- |
| **F Statistic** | **P-Value** | **Result** | **Chow test** |
| 259.31 | 0.0001\*\*\* | H0 |

\*\*\* indicates that the estimated parameters are significant at the 1% level.

Results of the Chow test confirmed the estimation of panel data against pooled method in both the estimated models. To conduct the Hausman test, first we estimated the model with fixed effects and then the Hausman test was conducted. Results of Hausman test were presented in Table (7) which confirmed the estimation of the fixed effect model against the random effect model.

Table (7): The results of the Hausman test

|  |  |  |  |
| --- | --- | --- | --- |
| **F Statistic** | **P-Value** | **Result** | **Hausman test** |
| 16.72 | 0.0001\*\*\* | H0 |

\*\*\* indicates that the estimated parameters are significant at the 1% level.

The results of the estimation using fixed effect approach were presented in Table (8).

**Table (8): results of the estimation of the models**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Probability** | **T-Value** | | **Coefficient** | **independent variables** |
| 0.032 | 4.85\*\* | | 0.034 | LFDI |
| 0.0001 | 2.55\*\*\* | | 0.149 | LFD |
| 0.046 | 2.00\*\* | | 0.132 | LTR |
| 0.0001 | 24.73\*\*\* | 6.08.903 | | C |
| R2 = 0.89 Prob = 0.000 (F-statistic) = (176.30)\*\*\* | | | | |

\*\* indicates that the estimated parameters are significant at the 5% level.

\*\*\* indicates that the estimated parameters are significant at the 1% level.

The results of the Table (8) indicated that the estimation of the model had good results from the view point of statistical indicators. The F- statistic confirmed the significance of the total regression. In other words, the hypothesis that the coefficients of the explanatory or independent variable of the model were simultaneously equal to zero was rejected and the whole regression was significant. The determination coefficient of the model was equal to 86 percent which indicated that 86 percent of the changes in the dependent variable could be explained by the explanatory variables of the model which showed the goodness of fit.

Based on the results of Table (8) foreign trade had a positive significant effect on the energy consumption. Various reasons could be presented about the relationship between exports imports and energy consumption. The machinery and equipment which are used in the production process of the exported goods requires a great deal of energy. The increase of the exports shows the increase of the economic activities and the demand for the energy. On the other hand, changes in the energy consumption can affect the exports because energy is considered as one of the main inputs for production and exported goods transportation. The export of the manufactured goods and inputs requires to fuel the transportation. Therefore, energy is considered as an important input in the expansion of the imports and exports.

Based on the results of the study foreign direct investment (FDI) had a positive significant effect on the energy consumption. On the other hand, foreign direct investment increased the energy consumption. Based on the harbor pollution hypothesis, developing countries had comparative advantage in the production of pollutants due to the weak environmental regulations. Therefore, the inflows of the foreign investments to developing countries is done in polluting sectors with high energy consumption and increases the energy consumption.

According to the results of the Table (8), the financial development had a positive significant effect on the energy consumption. In other words, financial development increased energy consumption in the studied countries. The increase of the financial development in an economy and the accessibility to the financial resources increase the energy consumption through the increase of the domestic demand and the production as the results. The growth of the output increases the economic growth through inter-sectorial growth which leads to the greater demand for energy. Moreover, the output growth increases demand for labor force and improves the incomes of economic agents. Finally, the income increase leads to an excess demand for consumption goods and increases the energy consumption as well.

1. **Conclusion**

The relationship between the energy consumption and economic development after the first oil crisis in 1973 had a considerable effects on the increase of the oil prices. The vital importance of energy on one hand and its scarcity on the other hand requires the greater attention of the economic activists to use make a more efficient use of this production factor. Due to the limitations and the scarcity of the resources especially energy and also the role and the importance of this factor in the supply chain has been considered both as the final commodity for the consumers and the production input in producing the commodities, the investigation of the determinant of the energy demand has received great attention during the recent decades. The purpose of the current study was to investigate the relationship between foreign investment, financial development and foreign trade with energy consumption member countries of the Organization of the Islamic Conference during the period from 2000-2014 using panel data approach. The results of the study indicated that foreign trade, investment and financial development had a positive significant effect on the energy consumption in the studied countries. During the recent years has considerably increased. Based on the obtained results of the study a great deal of attention should be paid to the energy demand and financial development and appropriate policies should be adopted in order to respond the energy demand. Also, on the close relationship between the oil and gas markets in the shadow of globalization process and scarce and non-renewable energy resources, oil sanctions against Iran, will slow down the development of energy resources in Iran. Therefore, the increase of the productivity and technological modernization of production equipment to reduce energy consumption to increase the efficiency of production is very essential. Given the positive relationship between trade and energy consumption in countries being studied, it is necessary to adopt and implement reasonable policies consistent with the role of energy trade, sustainable development and growth and economic development provide walked. Security of energy supply, considering the economy and the environment and increasing energy efficiency, use of renewable energy and incentive policies, punitive as the most important management practices can be used by policy makers. Thus, the reduced fossil fuel consumption and also provides the possibility of substitution of other energy sources as well as the commercial sector energy needs is met.

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1. Corresponding author [↑](#footnote-ref-1)