

The Causal Relationship between the Consumption of Energy and Trade in Developing Countries

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ABSTRACT

As an important factor in production, energy plays a remarkable role in economic development and growth of countries, on the other hand, energy use in developing countries is to a great extent influenced by economic growth. Also, in recent decades, as a part of GDP, trade has had a significant role in economic growth of countries. Therefore, studying the relation between energy and trade can efficiently contribute in policymaking of energy and foreign trade sectors. In this paper, panel unit root, panel co integration and panel causality tests have been performed in order to investigate the relation between energy consumption and trade among 70 developing countries during the period of 1980- 2010. These countries have been selected based on available statistics and data. These findings have policy implications for macroeconomic planners results show that in short term there is a unilateral causal relation from export (import) to consumption of energy. Common or strong causal findings also verify bilateral causality between export (import) and consumption of energy.

Keywords: consumption of energy, trade, developing countries, panel causality

1. INTRODUCTION

Energy has been considered as a major production factor during the past few decades; as alongside with other production factors, it has played a determining role in economic existence of countries. Its importance has increasingly grown with economic development and progression. Human's increasing dependence on energy has provided the field for this sector to play a significant role in performance of different economic sectors of countries both potentially and actively. In addition, the consumption of energy in developing and new countries is influenced by economic growth to a great extent (chousa et.al, 2008).

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On the other hand, in recent decades, trade has had a prominent role in economic growth and development of developing countries. Since the 1980s, these countries have integrated in global economy more speedily. To be more precise, since this decade, these countries have actively participated in globalization. This movement can be considered to be motivated by inappropriate status of payment balance of these countries after 1970s oil shock and the decline in demand for export from these countries to developed countries which encounter recession. Consequently, many of these countries executed economic adjustment program which had been suggested by World Bank and International Monetary Fund. Simultaneously, majority of developing countries understood inefficiency of industrial strategy of that time; i.e. import substitution strategy.

By apply Outward-oriented policies, some developing countries expected to improve resource allocation through integrating with global markets, more participation in international trade and more extensive attraction of foreign investment. They also expected to form production procedures in their countries based on relative advantage. Furthermore, they tended to promote their enterprises, efficiency through increasing competition with foreign enterprises, encouraging learning and importing technology and eventually providing bed for more economic growth in their country (World Bank, 1996). Accordingly, flow of trade can influence economic activities and consequently energy use.

Studying the relation between energy and trade is important due to several reasons. If energy consumption is the reason of export or import, any decline in energy, or in other words, thrift policies in energy, would reduce export or import and benefits of trade. Thrift policies in energy, which reduce energy consumption, neutralize free trade policies designed to facilitate economic growth. Therefore, these thrift policies contradict free trade policies. Finally, if there is a unilateral causality from export or import to energy, thrift policies in energy won't influence policies designed to promote economic growth (Sadorsky, 2011). So, studying this relation can provide overseas trade and energy sector policymakers with useful information.

In this research, modern econometric methods such as panel unit root, panel cointegration and panel causality have been introduced and used. In order to calculate and estimate equations, Eviews 7 software has been used. This research includes 4 main sections. After introduction, theoretical bases and empirical studies will be reviewed in the second and third sections. In the fourth, the applied variables and data will be defined and explained. Econometric methods and empirical results from equations are in the fifth and finally in the last section, conclusion and policy suggestion will be offered based on results of calculations.

2. A REVIEW ON THEORETICAL BASES

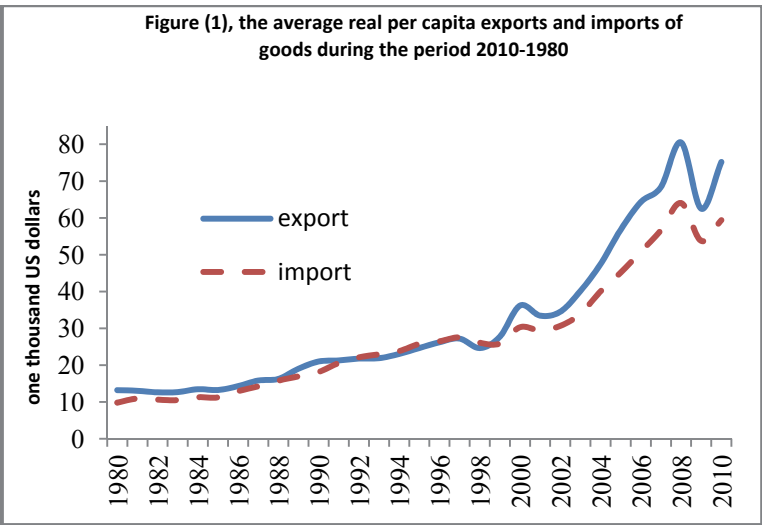
Trade liberalization includes policies which reduce or remove tariff or non-tariff obstacles of merchandise transaction. It can include policies which open economy to foreign investment. It is reasoned that liberalization promotes economic growth and improves welfare due to static and dynamic profits of trade. Static profits might have increased due to decreasing expenses originated from economies of scale and competitive advantage performance efficiency profits, a decline in incomplete competition deviation and diversity of products. Dynamic profits can be due to better transfer and adaptation of management performance and efficient energy technology (Ghani, 2012).

Alongside with developing business relationship between countries, various economic hypotheses have tried to design mechanisms to maximize welfare and benefits of nations to participate in world trade system. In the 19th century, hypotheses by Adam Smith and Ricardo were put forward based on absolute and relative advantages of countries' production recourse's. As time marched on, they were noticed regarding to defining and organizing international trade relationships (salvatore, 2004).

According to these hypotheses, if a country reduces trade obstacles, not only it, itself but also its trade counterparts will enjoy the profit; because thanks to trade liberalization, consumers in these countries will access to cheaper and better merchandise. Also, producers' efficiency will improve due to competition pressure. Since the 1980_s, developing countries have integrated into the global economy with higher speed. To be more precise, since then these countries have actively participated in globalization process.

The main motivation can be inappropriate condition of payment balances of these countries after the oil shock of the 1970_s and the reduction of demand for their export to developed countries which faced recession. In the past 30 years, many new and developing economies have experienced fast increase in trade, income and energy consumption. According to world trade organization (2009), world merchandise exportation grew with average annual rate of 12% from 2000 to 2008. During this period, exportation of merchandise from south and central American, African and middle east countries climbed with average annual rate of 15%, 18% and 18% respectively. However, these high rates of growth in merchandise export are lower than registered rate in china (24%) and higher than registered rate of export growth in most developing countries. figure 1 shows average merchandise export and import in developing countries during the surveyed period of time.

Figure 1: The average merchandise export and import in selected developing countries during the period of 1980-2010.



Source: World Bank data (2012)

It is evident that energy is a fundamental institution in industrial and production activities (Chaitanya, 2007). Also, developing countries, industrialization with increment in industrial products, establishing miscellaneous factories as well as creating economic substructures (Chaitanya, 2007). As producing industrial merchandise results in more consumption of energy, exporting this merchandise (whose prerequisite is production) leads to an increase in consumption of energy (Chousa et al 2008). Some believe that exportation of industrial merchandise is growing in all developing economies of the world. A more interesting aspect of their idea is that demand for these countries' products is increasing and their major customers are developed economies (Suri and Chapman, 1998)

Theoretically, there are several reasons how trade influences energy use. Expansion of export increases demand for production factors (capital, labor force and energy) which create export (Sadorsky, 2011). On the other hand, transportation is considered an important factor in the level of energy consumption (Chousa et al, 2008). Energy use is higher in areas where the number of trips is higher, they are longer and finally there are more vehicles. Moreover, international trade requires an efficient transportation system (air, rail, road, water and pipeline) for transporting merchandise. Approximately 30% of total global demand for energy is dedicated to transportation sector (US Energy Information Administration, 2010). Therefore, a rise in export induces an increment in economic activities which increases demand for energy (Sadorsky, 2011).

On the other hand, changes in energy use can influence merchandise export because energy is an important institution for producing merchandise for export. So, a significant decline in energy consumption or being thrifty in using energy can influence ability to produce merchandise. Also, there may be feedback relation energy and export. Because of it, consumption of energy may be important for explaining movements in export as export may be important for explaining movements in demand for energy. In this case, consumption of energy and export share interdependence and complementary effects. The relation between energy and export may be neutral, too. In this case, there is low correlation between energy use and export. It does not show meaningful statistical relation in the level of conventional test.

Importing industrially manufactured goods has bilateral effects on energy use (Chousa et. Al, 2008). If mentioned goods are imported in order to replace local, similar goods (which are produced using large amount of energy), an increment in industrial merchandise import would decrease energy consumption. However, if industrial imports are machinery and intermediate and capital goods, energy consumption would rise in country because this issue would ameliorate production in the country. Therefore, pure effect of increasing industrial merchandise import on consumption of energy can be positive or negative (Sadorsky, 2011)

In their study, Suri and Chapman (1998) showed that importation of industrial merchandise in majority of developing countries has undergone a downward trend; even if this trend is positive in some economies, it is insignificant.

Theoretically, changes in import can influence consumption of energy in two ways. Firstly, distribution of imported merchandise in a country requires a transportation network for distributing imports. This transportation network is fueled by energy. Secondly, combination of import can influence energy use especially if imported goods are durable, energy- consuming products like Automobile, dishwasher, refrigerator and etc. that are great energy consumers. The products are the main imported merchandise increases demand for energy. Also, energy consumption may influence the flow of imported goods especially if the imported merchandise is machinery and equipment which needs application of energy. Thrift policies in energy or lack of available energy can reduce usefulness and efficiency of energy consuming imported merchandise. Thus, such goods would be imported less. Also, there may be a feedback relation between import and energy consumption or there may not be any meaningful statistical relation between these variables (Sadorsky, 2011).

2.1 Empirical Studies

There has been numerous overseas and only one local study about the relation between trade and energy consumption; some of which are reviewed here.

Narayan and Smyth (2009), surveyed the causal relation between electricity consumption, export and Gross Domestic production in a group of six middle east countries (Iran, Israel, Kuwait, Oman, Saudi Arabia and Syria). They found out that there are meaningful feedback effects between these variables. That is to say, a one percent rise in electricity consumption would raise GDP by 0.04%. likewise, 1% rise in export would increase GDP by 0.17%. in the other hand, 1% of increment in GDP would raise consumption of electricity by 0.95%. They found a short-term Granger Causality from consumption of electricity to real GDP and from income to export as well. They also found evidence of long-term Granger causality from export and consumption of electricity to real income and from export and real income to consumption of electricity.

Lean and Smyth (2010) investigated causal relation between economic growth, production of electricity, export and prices for the period of 1970-2008 in a multi-variate model using Malaysia annual data and Auto Regressive Distributed lag³ and applying Toda and Yamamoto Causality. Results showed that at the 5% level, there is Granger Causality from economic growth and prices to production of electricity and from production of electricity to export and they found no causal relation between prices and economic growth. Furthermore, policy consequences of these results are thrift policies in electricity consumption, like productivity amelioration approaches and demand management policies which can be executed to reduce waste of electricity and limit its production without any negative effect on Malaysia economic growth.

Using annual data of 1971-2006 and Toda and Yamamoto method, Lean and Smyth surveyed the relation between total production, consumption of electricity, export, labor force and capital in a multi-variate model for Malaysia. They found a bilateral causality between total production and consumption of electricity. However, they did not find any evidence of Granger causality between export and consumption of electricity. Policy consequence of this result is that Malaysia should adopt a dual strategy of increasing investment in electricity substructures. This country should also consider thrift policies in consumption of electricity in order to reduce on necessary waste of electricity for avoiding negative effects of reducing electricity consumption on total production. They found a support for the hypothesis “export-led growth”, too which elucidates Granger Causality from export toward total production.

Sami (2011) studied the relation between export, consumption of electricity and real income per capita in Japan using time-series data of 1960-2007. Using

Bounds testing procedure, he found a cointegration relation between electricity consumption, export and economic growth.

Also, the causal relations between mentioned variables were studied in a Vector Error Correction Model (VECM). Results show that in long term, there is a causal relation from export and real GDP per capita to electricity use. In short term there is causality from export and electricity use to real GDP per capita at 5% and 1% significance level respectively. In addition, in short term, there is causality from real GDP per capita and electricity consumption per capita to export at the 1%. These outcomes reveal the fact that any interruption in power service can have a causal effect on export in short term. Halicioglu (2011), in a dynamic economic study of income, energy and export of Turkey, investigated dynamic causal relations between total production (as the dependent variable), energy consumption, export, capital and labor force in Turkey using time series data of 1968-2008. He Surveyed cointegration between variables by using Bounds test cointegration. He showed a long-term relation between variables. In this study, three sets of rival hypotheses were tested regarding the relation between total production, export and energy consumption and a complete form of analysis of Granger causality was fulfilled between variables. In long term, there is causality from labor force, export and energy consumption to total production through error correction statement. In this study, there is also feedback relation between export and economic growth in short term.

Therefore, economic policies should encourage expanding the scale of economy and increasing productivity with prospect of increasing export. Profits from export should be invest in research and developmental activities targeted at decreasing production expenses in industries. Sadorsky (2011) used panel co integration data estimation to investigate the effect of trade on energy consumption in a sample of 8 countries between 1980 and 2007. Dynamics showed a Granger Causality from export to energy consumption and a bilateral feedback relation between import and energy consumption. Estimated long term Elasticities from fully Modified ordinary least Square (FMOLS) show that 1% of rise in export percapita increases energy use percapita by 11% while 1% of growth in import percapita increases energy use up to 0.04%. these results reveal that amelioration of trade would influence energy demand in the middle east both in long and short term. This issue has consequences for energy policies as well as environmental ones.

Sadorsky (2011) studied the relation between consumption of energy' production and trade in a sample of 7 South American Countries during 1980-2007 using Auto regressive panel cointegration. Cointegration panel tests reveal a long-term relation between 1) production, capital, labor force energy and export and 2) production, capital, labor force, energy and import. Short-term dynamics illustrated a bilateral feedback relation between consumption of energy and

export, production and export as well as production and import. Also, there is evidence of a short-term relation from energy consumption to import. In long term, there is evidence of causal relation between trade (export and import) and energy use. These results have consequences for energy and environmental policies. An important consequence is that environmental policies designed to reduce energy consumption would decrease trade. This issue, creates a controversy between environmental policies targeted at declining energy consumption and trade policies.

Arman and Barzegar (2012) investigated the effect of trade liberalization on energy consumption in a sample of 62 developing countries during 1990-2010 by using dynamic panel and Generalized method of moments. Outcomes elucidated a meaningful and positive effect of trade liberalization on energy use in these countries. It means with 1% of increment in trade liberalization, energy use would climb by 0.02%.

2. 2 Estimation Method

In this section, the three stages of estimation have been mentioned to start with, panel unit root test is used and then through using panel integration test, data integration is tested. In case there is integration relation between the two variables, there will be Granger causality at least in one direction – between them. However, although integration test can determine presence or absence of Granger causality between variables, it cannot determine the direction of causal relation. Therefore, Engle and Granger (1987) state that if the two variables are cointegrated, there will always be a regressive error correction model between them. As a result, to investigate Granger causality between variables, this model can be used.

Model introduction and used variables:

Inspired by the offered model of Sadorsky (2010), total energy demand in i^{th} country in time t can be expressed as below:

$$E_{it} = f(Y_{it}, P_{it}, O_{it}, \eta_{it}) \quad (1)$$

Variables used in the model are:

E, Energy use in kg of oil equivalent per capita² which is the dependent variable

Y, Real GDP percapita³ in dollar (in stable price of 2005)

P, Real price of energy

O, Merchandise trade

4-1- Ex, Merchandise Exports percapita⁴

4-2- IM, Merchandise Imports percapita⁵

Country special variable η_{it} which include invisible and unmeasurable variables influencing energy use, like culture, institution, climate and technology.

As energy price data cannot be easily achieved for all countries, the real price of energy for every country is obtained by deflating Dubai crude oil price to consumer price index of every country.

Dubai crude oil price data has been obtained from British Petroleum's 2011 statistical review of world energy.

Based on theoretical bases, the main framework of the used model in this study can be written as below:

$$IE_{it} = \alpha_1 IY_{it} + \alpha_2 IP_{it} + \alpha_3 IEX_{it} + \eta_i + \varepsilon_{it} (2)$$

$$IE_{it} = \alpha_1 IY_{it} + \alpha_2 IP_{it} + \alpha_3 IIM_{it} + \eta_i + \varepsilon_{it} (3)$$

η_i is country specific effects and ε_{it} is the estimated residuals of long-term relations. The statistical society of this research during 1980-2010 is 70 developing countries. Also, variables are logarithm.

5-1 Stationary tests of variables:

In the first stage and prior to estimation of model, unit root test was fulfilled on introduced variables of model. If variables are static, the outcome estimation won't have Spurious regressive but if not, cointegration relation between dependent and independent variables should be surveyed. For this purpose, lin, Levin & chu, Im, pesaran & shin tests were used to investigate stationary of model variables. The outcomes of panel unit root test on the level of variables have been shown in table 1. As can be seen, due to significance of all test's statistics in the null hypothesis is based on a unit root cannot be rejected. In other words, all variables have unit root.

Table 1: The results of unit roots test on variables at 5% significance level

Im, pesaran & shin	lin, Levin & chu	variables method
4.064 (1.000)	2.413 (0.9921)	IE
0.285 (0.6124)	1.639- (0.1505)	IEX
3.332 (0.9996)	0.590- (0.2775)	IY
4.404 (1.000)	1.763- (0.2389)	IP
0.903 (0.8168)	0.791- (0.2143)	IIM

Values in (), report the probability (P-Value) at 5% significant.

In the next stage, stationary test has been performed for first order differencing of variables. Due to significance of all statistics, it can be concluded that variables used in this study become static with differencing once. And the null hypothesis based on having unit root first-order difference variables be rejected so they are static, and Opposite hypothesis that the first difference of variables are static, is accepted 95% confidence level.

So, all variables are integrated of order one, I (1). The results of test have been illustrated in table 2.

Table 2: Test of Unit Roots for variables with differencing once.

Im, Pesaran & Shin	Breitung& Meyer	variables method
20.170- (0.000)	5.868- (0.000)	D(IE)
25.387- (0.000)	15.466- (0.000)	D(LEX)
19.334- (0.000)	12.291- (0.000)	D(IY)
36.333- (0.000)	23.735- (0.000)	D(IP)
22.477- (0.000)	15.076- (0.000)	D(IIM)

Value) at 5% significant.

As variables, used in introduced model are I (1), to analysis Causality between variables, panel cointegration test would be applied on model variables.

5-2- Results of cointegration tests:

To determine variables of cointegration model, pedroni method has been used in this study. Table 3 gives information about outcomes of Pedroni cointegration test in two states of with time trend and without time trend. As can be seen in table 3, in both states, four statistics out of seven statistics of Pedroni fit in reject the null hypothesis area. Therefore, it can be concluded that the null hypothesis based on no cointegration among the variables is rejected and therefore, variables are cointegrated.

Table 3: Results of Panel Cointegration test

Statistics	
Panel v-stat	0.470 (0.319)
panel rho-stat	0.78 (0.997)
panel pp-stat	7.004- (0.000)
Pane ADF -stat	8.20- (0.000)
Group rho-stat	6.49 (1.000)
Group pp-stat	6.98 (0.000)
Group ADF-stat	7.65- (0.000)

Values in (),report the probability (P-Value) at 5% significant.

Based on pedroni test, it can be concluded that there is a long- term cointegration between Energy use in kg of oil equivalent per capita (E), Real GDP per capita (Y), Real price of energy (P). merchandise exports per capita (EX).

Through Pedronicointegration test, it is similarly reasoned that in long term, there is cointegration between Energy use in kg of oil equivalent per capita (E), Real GDP percapita (Y), Real price of energy (P) and Merchandise imports per capita (IM). Table 4 reveals outcomes of cointegration test for these variables.

Table 4: The results of panel integration tests.

Statistics	
Panel v-stat	-0.23 (0.319)
panel rho-stat	3.72 (0.999)
panel pp-stat	5. 42- (0.000)
Pane ADF -stat	7.02- (0.000)

Group rho-stat	7.02 (1.000)
Group pp-stat	-5.51 (0.000)
Group ADF-stat	6.86- (0.000)

Values in (), report the probability (P-Value) at 5% significant.

5-3- Panel Granger Causality test

Since surveyed variables of model are cointegrated, to identify causality between variables, like Granger, a vector error correction model (VECM) in the framework of panel data is estimated as equations 5 and 6. Error correction model states that changes in dependent variables is a function of deviation from long term relation (which is expressed by error term) and changes in other explanatory variables. However, error correction term in regressive error correction creates an extra trend for surveying Granger Causality which is often neglected in Granger causality tests. If the investigated variables are for instance order one static and cointegrated, like the present study, using an autoregressive model on first order differencing instead of using a regressive error correction model for investigating Granger causality between variables increases regressive equation variance due to elimination of error correction term. Thus, the Wald test statistics will be biased. This issue causes incorrect justification about the direction of causality. Also, in addition to determining the direction of Granger causality between variables, VECM enables us to differentiate between long and short-term Granger causality.

$$\begin{aligned} \Delta LE_{it} &= \alpha_{1j} + \sum_{k=1}^q \theta_{11ik} \Delta LE_{it-k} + \sum_{k=1}^q \theta_{12ik} \Delta LEX_{2it-k} + \sum_{k=1}^q \theta_{13ik} \Delta LY_{it-k} \\ &+ \sum_{k=1}^q \theta_{14ik} \Delta LP_{it-k} + \sigma_{1i} ECT_{it-1} + u_{1it} \quad (4) \\ \Delta LEX_{it} &= \alpha_{2j} + \sum_{k=1}^q \theta_{21ik} \Delta LE_{it-k} + \sum_{k=1}^q \theta_{22ik} \Delta LEX_{2it-k} + \sum_{k=1}^q \theta_{23ik} \Delta LY_{it-k} \\ &+ \sum_{k=1}^q \theta_{24ik} \Delta LP_{it-k} + \sigma_{2i} ECT_{it-1} + u_{2it} \quad (5) \\ \Delta LE_{it} &= \alpha_{1j} + \sum_{k=1}^q \theta_{11ik} \Delta LE_{it-k} + \sum_{k=1}^q \theta_{12ik} \Delta LEX_{2it-k} + \sum_{k=1}^q \theta_{13ik} \Delta LY_{it-k} \\ &+ \sum_{k=1}^q \theta_{14ik} \Delta LP_{it-k} + \sigma_{1i} ECT_{it-1} + u_{1it} \end{aligned}$$

$$\Delta LIM_{it} = \alpha_{3j} + \sum_{k=1}^q \theta_{31ik} \Delta LE_{it-k} + \sum_{k=1}^q \theta_{32ik} \Delta LIM_{2it-k} + \sum_{k=1}^q \theta_{33ik} \Delta LY_{it-k} + \sum_{k=1}^q \theta_{34ik} \Delta LP_{it-k} + \sigma_{3i} ECT_{it-1} + u_{1it} \quad (6)$$

In which, Δ is variables' first order differencing, q is the number of optimal lags and u_{1it} is residual term. ECTs are error correction terms derived from cointegration vector. Based on Schwartz criterion, the length of optimal lag was chosen 1. The statistical importance of independent variables in ECM shows evidence of short-term causal origin. In an equation that energy is the dependent variable, in order to investigate short-term causality from export to energy, null hypothesis is $\theta_{12ik}=0$. As according to Wald test, null hypothesis has been rejected, in short term, there is a Granger Causality from export to energy. However, in an equation that export is the dependent variable, null hypothesis ($\theta_{12ik}=0$), which is based on lack of Granger causality from energy consumption is not rejected. Long- term causality is studied through investigation of statistical importance of ECT coefficients. Also, error correction coefficient should be in $(-1, 0)$. That is to say, in short term disequilibrium. In each period, the amount of error correction coefficient is adjusted to long run equilibrium.

Null hypothesis based on presence of Granger causality, in long term according to wald test on error correction coefficients is rejected in two equations of ($\sigma_{2i}=0$ and $\sigma_{1i}=0$). Therefore, in long term, there is a bilateral causality between energy consumption and export. Finally, strong causality test is applied through examining the statistical significance of the combined and simultaneously short and long-term coefficients ($\theta_{22ik}=\sigma_{2i}=0$ and $\theta_{12ik}=\sigma_{1i}=0$ in equations 5). The outcomes of Wald tests for Granger causality between variables of export and energy consumption have been offered in table 5.

Table 5: The results of Granger Causality test between variables of export and energy consumption.

Source of causation(independent variable)					
Depen dent	Short-run Joint	Long-run (short-run/long- run)	Short-run Long-run Joint (short- run/long- run)	Short-run (short-run/long-run)	Long-run Joint
	ΔIE	ΔIEX	ECT(-1)	ΔIE , ECT(-1)	ΔIEX , ECT(-1)

variabl					
e		F=5.023	F=8.864		F=7.742
ΔIE	--	(0.02)	(0.00)	--	(0.00)
ΔIEX	F=0.018		F=136.932	F=68.626	
	(0.089)	--	(0.00)	(0.00)	--

Values in (), report the probability (P-Value) at 5% significant.

Table 5 data shows that in short term, there is a causal unilateral relation from export to energy consumption. Increasing export in these countries would lead to a rise in energy consumption that can influence future energy demand predictions. This is what should be considered by energy demand predictors. On the other hand, thrift policies in energy won't influence export growth or export promotion policies.

In long term, there is a bilateral causality between energy consumption and Merchandise export. Common or strong causality also verify Granger bilateral Causality between these two variables. It means in long term, export promotion policies will influence energy demand and thrift policies in energy will influence export growth. Policies for reducing consumption of energy or energy thrift policies will decrease export in long term. This can have unpleasant implications on economic growth in long term.

Like above-mentioned reasoning for export, the results of wald test for Granger Causality between import and energy consumption have been shown in table 6.

Table 6: The results of Granger Causality test between variables of import and energy consumption.

Source of causation(independent variable)					
	Short-run Joint (short-run/long-run)	Long-run (short-run/long-run)	Short-run Long-run Joint (short-run/long-run)	Short-run (short-run/long-run)	Long-run (short-run/long-run)
Dependent	ΔIE	ΔIIM	ECT(-1)	ΔIE , ECT(-1)	ΔIIM , ECT(-1)

variabl					
e		F=15.50	F=11.014		F=15.142
ΔIE	--	8)0.02(	)0.00(	--	)0.00(
ΔIM	F=0.033)0.085(	--	F=126.979)0.00(	F=63.725)0.00(	--

Values in (),report the probability (P-Value) at 5% significant.

According to results, the Causal relation between energy use and import is unilateral in short term and it is from import toward energy consumption. It means changes in import influences energy consumption. In other words, limitations in import would decrease consumption of energy. In contrast, import promotion strategies would increase energy consumption.

In long term, there is bilateral causality between energy consumption per capita and real merchandise import percapita common or strong causality also verifies the bilateral Granger causality between these two variables. That is to say, changes in import would influence consumption of energy and changes in consumption of energy would influence import. For this very reason, a reduction in consumption of energy or energy thrift policies would reduce import. Therefore, in case majority of imported merchandise is new machinery, equipment, technology or raw material, this policy will have negative effect on economic growth.

The outcomes of Sami (2011) research showed that in long term, there is a causality from export to electricity consumption while in short term, it is from electricity consumption to export at the 1%.

The results of Sodersky (2011) study on 8 middle east countries elucidated a unilateral relation from export to energy consumption in short term. Also, he found a bilateral causality between import and energy consumption.

In long term, Causality is from trade (export and import) to consumption of energy.

It was witnessed that causal relations between variables differ from country (group of countries) to country (group of countries) both in long and short terms. So, policies differ, too.

3. SUMMARY AND CONCLUSION

In this research, the relation between consumption of energy and trade in developing countries was studied. For this purpose, firstly stationary of research variables and then cointegration were surveyed.

Causality outcomes in the framework of panel error correction showed that in short term, there is Granger Causality between merchandise export (import) and energy consumption; this relation is unilateral and from export to consumption of energy. The results of long term and common causality verify a bilateral causality between merchandise export (import) and energy use. This means in long term, trade promotion policies influence demand for energy and energy thrift policies influence export. In long terms energy consumption reduction policies would reduce trade. This can have undesirable implications on long-term economic growth; unless there will be more investment on clean energy and these kinds of energy would be used more.

Furthermore, one of these implications of fossil fuel abuse is environmental pollutions. As developing countries to a great extent contribute to emission of green house gases due to their increasing consumption of energy, a way to prevent emission of these gases is to reduce energy consumption per capita in these countries. However, findings of this research showed that decreasing energy consumption leads to reduction of trade and consequently reduction of economic growth. Therefore, to reach both aims (reducing environmental pollution and maintaining a determined level of economic growth), increasing productivity of energy and investing on clean energy (Solar, wind) seem essential.

REFERENCES

- Arman, Seyyed Aziz and Barzegar, Soheila. (2012). the effect of trade liberalization on energy consumption indeveloping countries.The first national seminar of environmental conservation and planning.
- BP Group. BP Statistical Review of World Energy, June 2011. (2011).
- Chaitanya, V. (2007). Rapid Economic Growth and Industrialization in India, China & Brazil: At What Cost?.
- Chaitanya, V. (2007). Rapid Economic Growth and Industrialization in India, China & Brazil: At What Cost?.
- Chousa, J. P., Tamazian, A., & Vadlamannati, K. C. (2008). RAPID ECONOMIC GROWTH AT THE COST OF ENVIRONMENT DEGRADATION?– PANEL DATA EVIDIENCE FROM BRIC ECONOMIES (No. wp908).William Davidson Institute at the University of Michigan.
- Engle, R. F., & Granger, C. W. (1987). Co-integration and Error Correction: Representation, Estimation and Testing Econometrica: *Journal of the Econometric Society*, 251-276.
- Ghani, G. M. (2012). Does trade liberalization effect energy consumption?.Energy Policy.
- Halicioğlu, F. (2011).A dynamic econometric study of income, energy and exports in Turkey.Energy, 36(5), 3348-3354.

- Heston, A., & Summers, R. B. Aten. (2012). Penn World Table Version 7.1, Pennsylvania. Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.
- IEA–International Energy Association. (2010). World Energy Outlook 2010.
- Lean, H. H., & Smyth, R. (2010). On the Dynamics of Aggregate Output, Electricity Consumption and Exports in Malaysia: Evidence from Multivariate Granger Causality Tests. *Applied Energy*, 87 (6), 1963-1971.
- Lean, H. H., & Smyth, R. (2010). Multivariate Granger causality between electricity generation, exports, prices and GDP in Malaysia. *Energy*, 35(9), 3640-3648.
- Narayan, P. K., & Smyth, R. (2009). Multivariate granger causality between electricity consumption, exports and GDP: Evidence from a panel of Middle Eastern Countries. *Energy Policy*, 37 (1), 229-236.
- Sadorsky, P. (2011). Energy consumption, output and trade in South America. *Energy Economics*. *Energy Economics*, 34(5), 476-488.
- Sadorsky, P. (2011). Trade and energy consumption in the Middle East. *Energy Economics*, 33(5), 739-749.
- Salvatore, D. (2004). International trade and economic development. ISTITUZIONI E SVILUPPO ECONOMICO.
- Sami, J. (2011). Multivariate cointegration and causality between exports, electricity consumption and real income per capita: Recent evidence from Japan. *International Journal of Energy Economics and Policy*, 1(3), 59-68.
- Suri, V., & Chapman, D. (1998). Economic growth, trade and energy: implications for the environmental Kuznets curve. *Ecological economics*, 25(2), 195-208.
- World, B. (2012). World development indicators. World development indicators.

Countries that studied in this research:

Algeria- Angola- Argentina- Bahrain- Benin- Bolivia- Botswana- Brazil- Brunei Darussalam- Bulgaria- Cameron- China- Colombia- Democratic- Republic of Congo- Republic of Congo- Castarica- Ivory Coast- Republic of Dominican- Equador- Arab Republic of Egypt- Elsalvador- Ethiopia- Gabon- Ghana- Gualemala- Honduras- Hong kong- Hungary- India- Indonesia- Iran- Iraq- Jamaica- Jordan- Kwait- Lebenon- Libya- Malaysia- Republic of Malta- Mexico- Morocco- Mozambique- Nepal- Nigeria- Oman- Pakistan- Panama- Paragua- Peru- Philipines- Poland- Qatar- Romania- Saudi Arabia- Senegal- Singapore- South Africa- Serilanka- Arab Republic of Syria- Tanzania- Thailand- Togo- Tunisia- Turkey- United Arab- Emerate- Uruguay- Venezuela.

