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# CAUSALITY RELATIONSHIP BETWEEN IMPORT, EXPORT AND GROWTH RATE IN DEVELOPING COUNTRIES

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## Abstract:

*In this paper, we tried to determine the relationship between imports, exports and growth rate in developing countries. Within this scope, 6 developing countries (Argentina, Brazil, China, Malaysia, Mexico and Turkey) were analyzed in this study. In order to achieve this purpose, annual data for the periods between 1961 and 2014 was tested by using Engle Granger co-integration analysis, Vector Error Correction Model and Toda Yamamoto causality analysis. According to the result of the analysis, it was determined that there is not any relationship among three variables in Brazil and Mexico. On the other hand, we defined that increase in export causes higher growth rate in Argentina. Moreover, it was concluded that there is a causal relationship from import to export in China and Turkey. Furthermore, it was determined that export causes higher import in Malaysia. Therefore, it can be concluded that the relationship between import, export and growth rate is not same for all developing countries..*

**Keywords:** *Economic Growth, Import, Export, Engle-Granger Causality Analysis, Vector Error Correction Model, Toda Yamamoto Causality Test*



## 1. Introduction

The relationship between export and growth rate is always discussed in the literature. Some people think that increase in export amount leads to increase in growth rate. If countries can increase export amount, this will lead to increase in GDP amount because export is one of the component of GDP (Hossain, 2014. In addition to them, there are also some studies in which a relationship was defined from GDP growth to export rate (Shihab, et. al., 2014). In other words, it is thought that increasing in growth rate provides export growth. The main reason behind this situation is that by increasing GDP growth rate, a country can increase its efficiency. Owing to this situation, it can increase its competitive advantage in international market which causes exports to go up. However, some people also argue that there is not such a relationship between export and growth rate. They assert that this relationship depends on the type of the country and period (Bahmani-Oskooee, 2009), (Jung and Marshall, 1985).

Furthermore, import plays an important role in the relationship between export and growth rate (Kim, Lim and Park, 2009). Some of the researchers have the view that import causes higher exports by providing higher quality intermediate goods (Bas, 2009). Therefore, according to this view, import can also lead to higher economic growth. Similar to export and growth rate relationship, there are also some views that come up with the idea that there is not a relationship between import and export or economic growth (Ajmi, et. al., 2015).

Moreover, economic growth is also one of the objectives of developing countries (Khan and Reinhart, 1990). They made many programs in order to achieve economic growth. Increasing export and import amount is one of these programs (Balassa, 1985). Therefore, the studies related to explain the relationship between economic growth, export and import are significant. Because of this situation, in this study, we tried to analyze the relationship between growth rate, export and import in developing countries. As a result of this analysis, it may be possible to suggest an economic policy to developing countries.

This paper is organized as follows. After the introduction part, we will give information about the similar studies in the literature and empirical results of them. The third section of this paper reviews the empirical results of our study. The final section gives information about the conclusion of the study.

## 2. Literature Review

There are many studies in which the relationship between export and growth rate is analyzed in the literature. On the other hand, only few studies look for the effect of import on growth rate and export. Some of these studies are emphasized on the table below.

Table 1: Studies Related to the Relationship between Growth Rate, Export and Import

| Authors | Method | Scope | Direction of Causality |
|---|---|---|---|
| Gibba and Molnar (2016) | VEC | Gambia | Export → Growth Rate |
| Alkhateeb et. al. (2016) | VEC | Saudi Arabia | Export → Growth Rate<br>Growth Rate → Export |
| Ajmi, et. al. (2015) | VAR | South Africa | There is no relationship. |
| Araujo, et. al. (2015) | Granger Causality | Brazil | Export → Growth Rate<br>Growth Rate → Export |
| Hossain (2014) | Granger Causality | Bangladesh, India, Pakistan and Sri-Lanka | Export → Growth Rate |
| Shihab, et. al. (2014) | Granger Causality | Jordan | Growth Rate → Export |
| Achchuthan (2013) | Regression | Sri Lanka | Export → Growth Rate<br>Import → Growth Rate |
| Fan and Nie (2013) | VAR | China | Import → Export |
| Rahman and Shahbaz (2013) | VECM | Pakistan | Import → Export |
| Pistoresi and Rinaldi (2012) | Cointegration Analysis | Italy | Import → Growth Rate |
| Shahbaz and Rahman (2012) | VECM | Pakistan | Import → Growth Rate |
| Bas (2009) | Regression | Argentina and Chile | Import → Export |
| Gerni, Emsen and Değer (2008) | Regression | Turkey | Import → Export |
| Awokuse (2005) | Granger Causality | Korea | Export → Growth Rate<br>Growth Rate → Export |
| Mah (2005) | Cointegration Analysis | China | Export → Growth Rate<br>Growth Rate → Export |

| | | | |
|---|---|---|---|
| Tuncer (2002) | Toda Yamamoto | Turkey | Import → Growth Rate<br>Growth Rate → Import |
| Mallick (2002) | Cointegration Analysis | India | Export → Growth Rate<br>Growth Rate → Export |
| Thornton (1996) | Granger Causality | Mexico | Export → Growth Rate |
| Doraisami (1996) | Cointegration Analysis | Malaysia | Export → Growth Rate<br>Growth Rate → Export |
| Oxley (1993) | Granger Causality | Portugal | Export → Growth Rate |
| Ghartey (1993) | Wald Test | Taiwan, USA and Japan | Export → Growth Rate<br>Growth Rate → Export |
| Dodaro (1993) | Regression | 87 different countries | Export → Growth Rate |
| Marin (1992) | Granger Causality | 4 OECD Countries | Export → Growth Rate |
| Segerstrom, et . al. (1990) | Dynamic General Equilibrium Model | USA | Growth Rate → Export |
| Kunst and Marin (1989) | VAR | Austria | Export → Growth Rate<br>Growth Rate → Export |
| Ram (1985) | Regression | 73 different countries | Export → Growth Rate |
| Findlay (1984) | Descriptive Statistics | USA | Growth Rate → Export |

**Sources:** Authors

Gibba and Molnar made a study so as to understand the relationship between export and growth rate in Gambia. They tested the data for the period between 1980 and 2010 by using vector error correction method. As a result of the analysis, a causality relationship was defined from export to the growth rate (Gibba and Molnar, 2016). There are also many studies that reached the similar conclusion (Hossain, 2014), (Thornton, 1996), (Oxley, 1993), (Dodaro, 1993), (Marin, 1992), (Ram, 1985). In addition to them, there are also some studies in which the causality from growth rate to the export was identified (Shihab, et. al., 2014), (Segerstrom, et . al., 1990), (Findlay, 1984).

Furthermore, Alkhateeb and others also analyzed the relationship between exports and economic growth in Saudi Arabia. Within this context, they used the data for the years between 1980 and 2013. Additionally, vector error correction model was also used in order to achieve this objective. Finally, they concluded that there is a causal relationship both from export to growth rate and from growth rate to export (Alkhateeb et. al., 2016). Araujo and others (2015), Awokuse (2005), Mah (2005), Mallick (2002), Doraisami (1996), Ghartey (1993) and Kunst and Marin (1989) reached the same conclusion by using different method.

Moreover, some studies also concluded that increase in import causes the growth rate to increase (Achchuthan, 2013) (Pistoresi and Rinaldi, 2012), (Shahbaz and Rahman, 2012), (Tuncer, 2002). Furthermore, Fan and Nie (2013), Rahman and Shahbaz (2013), Bas (2009) and Gerni, Emsen and Değer (2008) concluded that rise in import leads to increase in export by providing better quality intermediate goods. However, Ajmi and others did not find any causality relationship between export, import and growth rate for South Africa (Ajmi, et. al., 2015).

## 3. Research and Application

### 3.1. Data and Methodology

In order to analyze the relationship between export, import and growth rate in developing countries, annual data of 6 developing countries (Argentina, Brazil, China, Malaysia, Mexico and Turkey) for the periods between 1961 and 2014 was used in this study. This data was obtained from World Bank. In addition to this situation, we also used Engle Granger Co-integration Analysis, Vector Error Correction and Toda Yamamoto causality approaches so as to achieve this objective. Within this context, EViews 8.0 program was used.

### 3.2. Methods Used in This Study

#### 3.2.1. Engle-Granger Co-integration Analysis

Engle Granger co-integration analysis was used in order to see whether there is a long run relationship between the variables. The first requirement of this analysis is that both of the variables should be stationary with the same degree. After that, error term series are provided as a result of the regression analysis made between these variables. If the series are stationary, then it means that there is a long term relationship between these two variables. The result of this analysis is so important that the type of the causality test will change according to the result of co-integration analysis (Engle and Granger, 1987).

#### 3.2.2. Vector Error Correction Model

Vector Error Correction Model (VECM) is mainly used in order to determine whether there is a causal relationship between the variables. If there is a co-integration among the variables, standard Granger causality test cannot be used in this situation (Granger, 1969). VECM is very helpful for the conditions in which variables are not stationary at their level values and become stationary with their first differences (Engle and Granger, 1987). The equation of VECM is shown below.

$$\Delta X_t=a+ \sum_{i=1}^{m} B_i \Delta X_{t-i} + \sum_{i=1}^{n} C_i \Delta Y_{t-i} + \sum_{i=1}^{o} D_i \Delta Z_{t-i} + \mu EC_{t-i} + \varepsilon_i$$

In this equation, $\mu$ demonstrates the error correction parameter that helps the variables to achieve long run relationship. Because of this situation, this parameter should be statistically significant and negative in order to reach this objective.

#### 3.2.3. Toda Yamamoto Causality Test

Toda Yamamoto causality test also analyses causal relationship between the variables. However the main difference of this analysis from Granger causality test is that there is no requirement that the variables should be stationary. In addition to this situation, co-integration does not have to exist among the variables. The sum of maximum integration number and lag interval in VAR model is used as a lag interval in Toda Yamamoto analysis (Toda and Yamamoto, 1995).

### 3.3. Results of the Model

In order to define the relationship between export, import and growth rate in Argentina, Brazil, China, Malaysia, Mexico and Turkey, first of all, we made stationary analysis. After that, we made Engle-Granger co-integration analysis for these variables according to the results of the unit root tests. Just then, depending on these results, we made VECM causality tests. In addition to them, we also tested the variables by using Toda Yamamoto causality tests in order to reach better results.

#### 3.3.1. Unit Root Tests

In order to understand whether the variables are stationary or not, we made Zivot-Andrews unit root test. The details of this analysis were given on the table below.

Tablo 2: Zivot Andrews Unit Root Test

| Variable | Zivot Andrews Unit Root Test | |
|---|---|---|
| | Level p Value | First Difference p Value |
| Export Argentina | 0.0000 | - |
| Export Brazil | 0.0493 | - |
| Export China | 0.0000 | - |
| Export Mexico | 0.0222 | - |
| Export Malaysia | 0.0002 | - |
| Export Turkey | 0.0003 | - |
| Import Argentina | 0.0000 | - |
| Import Brazil | 0.0764 | 0.0009 |
| Import China | 0.0003 | - |
| Import Mexico | 0.0210 | - |
| Import Malaysia | 0.0081 | - |
| Import Turkey | 0.0551 | 0.0165 |
| Growth Rate Argentina | 0.0103 | - |
| Growth Rate Brazil | 0.0230 | - |
| Growth Rate China | 0.0479 | - |
| Growth Rate Mexico | 0.0007 | - |
| Growth Rate Malaysia | 0.0102 | - |
| Growth Rate Turkey | 0.1471 | 0.0037 |

**Sources:** Authors

Tests As a result of this analysis, it can be understood that the variables of import of Brazil, import and growth rate of Turkey are not stationary on their level values. Owing to this situation, co-integration test will be performed in order to identify the relationship between import and growth rate of Turkey.

### 3.3.2. Engle-Granger Co-integration Analysis Results

Because the variables of import and growth rate of Turkey are stationary with their first differences, co-integration between these variables will be examined. In this process, firstly, we made regression analysis between these two variables. As a result, we provided error term series of this analysis. The results of unit root test of these error term series are given below.

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Tablo 3: Unit Root Test Results of Error Terms

| Error Term Series | ADF Test | Phillps Perron Test | Zivot Andrews Test |
|---|---|---|---|
| | Level p Value | Level p Value | Level p Value |
| Import – Growth Rate (Turkey) | 0.0000 | 0.0001 | 0.0415 |

**Sources:** Authors

As it can be seen from the table above, all error term series are stationary. This situation shows us that there is a long term relationship between import and growth rate of Turkey. Therefore, VECM causality relationship should be used for these variables.

### 3.3.3. Vector Error Correction Model (VECM) Analysis Results

So as to make VECM causality analysis, first of all, lag intervals for the variables should be defined. With respect to the variables of import and growth rate of Turkey, optimal lag interval is calculated as "2". These lag intervals were calculated according to Akaike Information Criteria and Shwartz Criteria. The details of this analysis were given below.

Tablo 4: Lag Interval Analysis

| Lag | LR | FPE | AIC | HQ |
|---|---|---|---|---|
| 0 | 18.82436 | 201.0599 | 10.97935 | 11.00864 |
| 1 | 18.82465 | 157.2649 | 10.73338 | 10.82127 |
| 2 | 12.18792* | 140.5155* | 10.61965* | 10.76613* |
| 3 | 6.622071 | 141.6593 | 10.62524 | 10.83032 |
| 4 | 5.037689 | 147.7092 | 10.66257 | 10.92623 |

**Sources:** Authors

After that, VECM analysis was performed so as to define whether there is a causal relationship between these variables. The results of this analysis were emphasized below.

Tablo 5: Vector Error Correction Model between Import and Growth Rate in Turkey

| Country | Causality Direction | Lag Interval | p Value | Result |
|---|---|---|---|---|
| Turkey | Import → Growth Rate | 2 | 0.3399 | There is not causality relationship |
| | Growth Rate → Import | 2 | 0.5649 | There is not causality relationship |

**Sources:** Authors

The p values on the table above give information about causality relationship. If this value is less than 0.05, this means that a relationship is analyzed. According to the results, it was determined that there is not a causal relationship between import and growth rate in Turkey.

### 3.3.4. Toda Yamamoto Causality Analysis Results

As we emphasized before, there is need to calculate maximum integration degree and lag interval in VAR model. As a result of unit root test results, maximum integration degree was calculated as "1". Furthermore, lag interval in VAR model was calculated as "1" for Argentina, Brazil and China whereas it is "2" for Malaysia, "3" for Mexico and "4" for Turkey. Because the sum of these two numbers are used in Toda Yamamoto analysis, lag interval was accepted as "2" for Argentina, Brazil and China, "3" for Malaysia, "4" for Mexico and "5" for Turkey. The results of this analysis were emphasized below.

Tablo 6: Toda Yamamoto Results

| Country | Causality Direction | Lag Interval | p Value | Result |
|---|---|---|---|---|
| Argentina | Import → Export | 2 | 0.2040 | There is not causality relationship. |
| | Growth Rate → Export | 2 | 0.5117 | There is not causality relationship. |
| | Export → Import | 2 | 0.2611 | There is not causality relationship. |
| | Growth Rate → Import | 2 | 0.7717 | There is not causality relationship. |
| | Export → Growth Rate | 2 | 0.0218 | There is a causality relationship from export to growth rate. |
| | Import → Growth Rate | 2 | 0.0888 | There is not causality relationship. |
| Brazil | Import → Export | 2 | 0.0628 | There is not causality relationship. |
| | Growth Rate → Export | 2 | 0.0702 | There is not causality relationship. |
| | Export → Import | 2 | 0.1788 | There is not causality relationship. |
| | Growth Rate → Import | 2 | 0.5640 | There is not causality relationship. |
| | Export → Growth Rate | 2 | 0.2168 | There is not causality relationship. |
| | Import → Growth Rate | 2 | 0.2145 | There is not causality relationship. |
| China | Import → Export | 2 | 0.0020 | There is a causality relationship from import to export. |
| | Growth Rate → Export | 2 | 0.6287 | There is not causality relationship. |
| | Export → Import | 2 | 0.1950 | There is not causality relationship. |
| | Growth Rate → Import | 2 | 0.3155 | There is not causality relationship. |
| | Export → Growth Rate | 2 | 0.9426 | There is not causality relationship. |
| | Import → Growth Rate | 2 | 0.7283 | There is not causality relationship. |
| Malaysia | Import → Export | 3 | 0.1486 | There is not causality relationship. |
| | Growth Rate → Export | 3 | 0.7675 | There is not causality relationship. |
| | Export → Import | 3 | 0.0214 | There is a causality relationship from export to import. |

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|---|---|---|---|---|
| | Growth Rate → Import | 3 | 0.1934 | There is not causality relationship. |
| | Export → Growth Rate | 3 | 0.5362 | There is not causality relationship. |
| | Import → Growth Rate | 3 | 0.2451 | There is not causality relationship. |
| Mexico | Import → Export | 4 | 0.6737 | There is not causality relationship. |
| | Growth Rate → Export | 4 | 0.9526 | There is not causality relationship. |
| | Export → Import | 4 | 0.3232 | There is not causality relationship. |
| | Growth Rate → Import | 4 | 0.5000 | There is not causality relationship. |
| | Export → Growth Rate | 4 | 0.2521 | There is not causality relationship. |
| | Import → Growth Rate | 4 | 0.0639 | There is not causality relationship. |
| Turkey | Import → Export | 5 | 0.0255 | There is a causality relationship from import to export. |
| | Growth Rate → Export | 5 | 0.4673 | There is not causality relationship. |
| | Export → Import | 5 | 0.9757 | There is not causality relationship. |
| | Growth Rate → Import | 5 | 0.0571 | There is not causality relationship. |
| | Export → Growth Rate | 5 | 0.1433 | There is not causality relationship. |
| | Import → Growth Rate | 5 | 0.3056 | There is not causality relationship. |

**Sources:** Authors

According to the result of Toda Yamamoto analysis, it was determined that there is not any relationship among three variables in Brazil and Mexico. On the other hand, we defined that increase in export causes higher growth rate in Argentina. Moreover, it was concluded that there is a causal relationship from import to export in China and Turkey. Furthermore, it was determined that export causes higher import in Malaysia.

## 4. Discussion and Conclusion

In this study, we tried to define the causal relationship between growth rate, export and import in developing countries. Within this scope, annual data of Argentina, Brazil, China, Malaysia, Mexico and Turkey for the period between 1961 and 2014 was analyzed. In addition to them, Engle-Granger co-integration analysis, VECM and Toda Yamamoto analysis were used in this study so as to achieve this objective. First of all, we made unit root test to the variables of growth rate, export and import. In this process, we used Zivot Andrews unit root test. As a result of this analysis, it can be understood that the variables of import of Brazil, import and growth rate of Turkey are not stationary on their level values.

Owing to this situation, Engle-Granger co-integration test will be performed in order to identify the relationship between import and growth rate of Turkey. As a result of co-integration analysis, it was identified that there is a long term relationship between import and growth rate of Turkey. Therefore, VECM causality analysis was implemented to these variables. In addition to them, we also used Toda Yamamoto analysis so as to achieve better results.

According to the result of this analysis, it was determined that there is not any relationship among three variables in Brazil and Mexico. On the other hand, we defined that increase in export causes higher growth rate in Argentina. Moreover, it was concluded that there is a causal relationship from import to export in China and Turkey. Furthermore, it was determined that export causes higher import in Malaysia. In conclusion, it can be said that the relationship between growth rate, import and export is not similar for all developing countries. Due to this situation, it is impossible to make suggestion to developing countries with respect to the policy related to growth rate, export

and import. This situation is similar to many studies in the literature (Bahmani-Oskooee, 2009), (Jung and Marshall, 1985).

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