Panel Cointegration Analysis of Government Spending, Exports, Imports and Economic Growth

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Abstract

This study explores association among government spending, exports of country, imports of country and its economic growth. Eight countries have been included in the panel for this purpose. Panel data over the time period from 1995 to 2011 has been used for the analysis. Stationarity of variables has been tested by using IPS test for unit root whereas cointegration has been tested by applying Pedroni panel cointegration test. Hausman test has been used to choose the appropriate estimation technique. Fixed effects model has been used for estimation of model as suggested by results of Hausman test. Results of Pedroni cointegration test imply the presence of cointegration between variables. Results of fixed effects model show that government spending, exports and domestic private investment affect economic growth positively and significantly. However, imports affect economic growth negatively and significantly. Study recommends to increase government spendings for development purposes, exports and domestic investment and reduction in imports to boost up economic growth of selected countries.

Keywords: Economic Growth, Export, Import, Government Spending, Panel Cointegration
JEL Codes: F00, F43, F63, F62
1. Introduction

The importance of government in the growth of an economy cannot be neglected. There are many important economic decisions which have to be taken by the government. A large number of developmental projects are initiated by the government and they lead to more economic growth because different sectors of economy cannot be separated from each other. The government may also play the role of leader in an economy because it initially invests in certain sectors and then private investors may also invest in those sectors. Government also invests in those sectors which are neglected by private investors due to less margin of profit. Apart from this, there are different sectors which are source of welfare of people and need long-term investment such as education, health etc. Government also invests in such sectors. Therefore, it is mostly believed that more government spending leads to more economic growth of a country. Contrary to this, the argument presented against the negative role of government spending in economic growth is that more government spending may hamper economic growth of country due to involvement of corruption, bad governance and huge size of public sector etc. Some researchers argue that government spending may lead to economic growth if more expenditures of government are directed towards developmental projects.

From the very basic economics, we know that no country of world can become self-dependent in everything and therefore needs international trade which consists of exports and imports. The importance of international trade for growth of economy has been extensively discussed by researchers and economists. Exports are advocated because they lead to better allocation of resources, exploitation of comparative advantage, economies of scale, earning of foreign exchange and so on. Therefore, it is argued that more exports lead to more growth of an economy. The arguments related to effects of imports on economic growth are mixed. Some researchers say that imports hamper economic growth as they make the country dependent on other countries and also become source of expenditure of foreign exchange. The argument against this is that imports are favorable for economic growth if more imports consist of capital goods because it leads to more capital formation and ultimately higher economic growth.

Therefore, there is controversy about the impact of government spending, exports of country and imports of country on its economic growth and hence it needs empirical investigation. This study empirically analyzes the association of government spending, exports, imports and economic growth of eight selected countries i.e. China, Indonesia, Japan, Malaysia, Pakistan, Philippines, Sri Lanka and Thailand and tests cointegration between them. Empirical findings show that government spending, exports and domestic private investment affect economic growth positively and significantly. However, imports affect economic growth negatively and significantly. Results of Pedroni cointegration test imply the presence of
cointegration between variables. The rest of study has been organized in such a way that literature review and derivation of research hypothesis have been presented in section two. Data description and model specification have been presented in section three. Description of variables and their expected impacts have been explained in section four. Estimation of empirical results and their interpretation has been shown in section five. Conclusion and policy recommendations have been presented in section six.

2. Literature Review

The views of different researchers about the relationship between government spending, exports, imports and economic growth are different. A review of some of existing studies is as follows:

Ramos (2001) examined the association among economic growth, imports and exports of Portugal over time period of 1865 to 1998. The question addressed in the study is that whether there is unidirectional or bidirectional relationship between these selected variables. Cointegration of variables has been analyzed by employing Johansen cointegration test which implies existence of cointegration among variables. The direction of causality among economic growth, exports and imports has been checked using Granger’s causality test. The study finds that causality between exports and economic growth is bi-directional. The causality between economic growth and imports is bidirectional. However, no causality exists among exports and imports.

Alexiou (2009) found the impact of government spending on economic growth for seven transitional economies of South Eastern Europe over the time period from 1995 to 2005. Dependent variable of model is real GDP. Independent variables are government expenditure for capital formation, trade openness, net official development assistance, private investment and labor force. Random coefficient model and fixed effects model have been employed for estimation of model. The results imply that government spending affects economic growth positively and significantly.

Rizvi and Shamim (2010) explored the association between development spending and economic growth for Sindh province of Pakistan. Data has been used from 1979 to 2008. The variables used are government development expenditures and gross provincial product. Long-run relationship was checked by using Johansen’s cointegration test which shows that there is cointegration between economic growth and development expenditure. Short-run relationship has been verified by using ECM approach. The direction of causality between variables has been checked by Granger’s causality test which implies there is uni-directional causality running from economic growth to development expenditures.
Amiri and Gerdtham (2011) studied the relationship among imports, exports and economic growth of France from 1961 to 2006. The variables used are real GDP, imports and exports. The existence of cointegration between variables has been tested by using autoregressive distributed lag (ARDL) technique. Empirical results imply that cointegration exists between variables. Linear Granger’s causality test and causality test with geostatistical methods have been employed to find the causality direction between variables. Both tests show uni-directional causality from imports to economic growth and from exports to economic growth.

Kogid et al. (2011) investigated the association between economic growth and imports for Malaysia. Annual data from 1970-2007 has been used. Cointegration of variables has been checked by using Engle-Granger test and Johansen’s cointegration test which suggest no long-run relationship. Granger’s causality test and Toda-Yamamoto test for causality have been employed to check the causality direction between variables. The results of both tests suggested bidirectional causality between economic growth and imports. The study concludes that imports of Malaysia contribute towards its economic growth.

Abbas (2012) used data for Pakistan from 1975 to 2010 to test the causality direction between economic growth and exports. An econometric model has been specified in which dependent variable is GDP whereas independent variable is exports. Cointegration between economic growth and exports was checked using Johansen’s test of cointegration. The results show that long-run relationship exists between exports and economic growth. The direction of causality between economic growth and exports was checked by using Granger’s causality test. The results show presence of uni-directional causality from economic growth to exports for short-run as well as long-run in case of Pakistan.

Chamorro-Narvaez (2012) analyzed the effect of two components of government spending on economic growth for twelve Latin American countries. Panel data has been used spanning over the time period from 1975 to 2000. Explained variable of the model is per capita GDP growth rate whereas explanatory variables are government current spending, government capital spending, terms of trade, inflation rate, M2 to GDP ratio, black market premium and trade openness etc. GMM estimator has been employed for estimation of model. The results imply that impact of government current spending and government capital spending on economic growth is statistically insignificant.

Sultan (2012) attempted to explore the association among economic growth, exports and energy in Mauritius from 1970 to 2009. Explained variable of model is real GDP whereas explanatory variables are real exports, capital stock, aggregate electricity and level of employment. Variables have been taken in the form of growth rate. Autoregressive distributed lag (ARDL) approach and Johansen’s test for cointegration have been used to test the cointegration which suggest that there is cointegration between variables. Empirical analysis
for short-run relationship has been done using VECM approach. This implies uni-directional causality running from economic growth to exports in short run and bi-directional causality between exports and economic growth in long run. Usman et al. (2012) analyzed the nexus between exports and economic growth for Pakistan. Data from 1980 to 2009 has been used for the analysis. Regressand of econometric model is economic growth proxied by GDP growth. Regressors are exports, inflation measured by consumer price index (CPI) and real exchange rate. Ordinary least squares (OLS) technique has been employed for the estimation of model. The empirical results imply that exports enhance economic growth significantly. Inflation and real exchange rate also affect economic growth positively and significantly.

**Research Hypothesis:** On the basis of existing literature, the hypothesis of present study is that government spending, exports and imports have statistically significant impact on economic growth of selected countries and existence of cointegration among variables.

### 3. Data Description and Model Specification

Panel data for eight countries over the time period from 1995 to 2011 has been used. Data on GDP, general expenditure by government, goods and services’ exports, goods and services’ imports and capital formation has been collected from the website of World Bank. Following model has been used for empirical analysis:

\[
EG = f (GS, X, M, PI)
\]

In econometric form:

\[
EG_{it} = \beta_0 + \beta_1 GS_{it} + \beta_2 X_{it} + \beta_3 M_{it} + \beta_4 PI_{it} + \varepsilon_{it}
\]

Where:

- \(EG_{it}\) = Economic growth proxied by GDP of country in current U.S. $
- \(GS_{it}\) = General expenditure by government in current U.S. $
- \(X_{it}\) = Value of exports in current U.S. $
- \(M_{it}\) = Value of imports in current US $
- \(PI_{it}\) = Domestic private investment proxied by gross capital formation in current U.S. $
- \(\varepsilon_{it}\) = Error term
- \(i\) = Countries
- \(t\) = Years

### 4. Description of variables and their expected impacts

Regressand of econometric model is economic growth proxied by GDP of country in current U.S. $. Regressors are spending by government, goods and services’ exports, goods and services’ imports and domestic private investment. All of regressors have been taken in current U.S. $. The expected effect of spending by government on growth of economy may be mixed
i.e. either positive or negative because government spending is a source of boosting economic growth if it is directed towards developmental projects. Contrary to this, government spending may hamper economic growth if it is directed towards non-developmental projects. The expected impact of exports on economic growth is positive as exports are source of increased competition, economies of scale, better use of resources, production specialization and competitive production. Expected impact of imports on economic growth may be either positive or negative. Imports are favorable for economic growth if they consist of capital goods and machinery which help in production process. On the other hand, if more imports consist of consumption goods and luxury items, then they may lead to decrease in economic growth. The expected impact of domestic private investment which has been proxied by gross capital formation is positive because more private investment leads to more use of resources, increased level of employment creation and ultimately more economic growth.

5. Estimation and Interpretation of Results

First of all, stationarity of variables has been checked by using Im, Pesaran and Shin (2003) panel unit root test, i.e. IPS-test.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Deterministic Terms</th>
<th>IPS-Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>EG_{it}</td>
<td>Constant &amp; Trend</td>
<td>5.06921</td>
</tr>
<tr>
<td>GS_{it}</td>
<td>Constant &amp; Trend</td>
<td>4.35212</td>
</tr>
<tr>
<td>X_{it}</td>
<td>Constant &amp; Trend</td>
<td>2.70895</td>
</tr>
<tr>
<td>M_{it}</td>
<td>Constant &amp; Trend</td>
<td>2.39460</td>
</tr>
<tr>
<td>PI_{it}</td>
<td>Constant &amp; Trend</td>
<td>3.86324</td>
</tr>
<tr>
<td></td>
<td></td>
<td>** and *** show level of significance at 1%, 5% and 10%, respectively.</td>
</tr>
</tbody>
</table>

Source: Own calculations by authors

Unit root of variables has been tested at their levels and first differences. Null hypothesis of test is that there is unit root which means non-stationarity of variables. It is clear from the results that null hypothesis was not rejected at variables’ levels. Therefore, test has been used at first differences. The results imply that order of integration of all variables is one. As they have same order of integration, therefore panel cointegration test can be employed for testing cointegration.
### Table 2: Pedroni (1999) Cointegration Test Results

**Null Hypothesis: No cointegration**

<table>
<thead>
<tr>
<th>Pedroni Test Statistics</th>
<th>Intercept</th>
<th>Intercept &amp; Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
<td>Probability</td>
</tr>
<tr>
<td><strong>Within Dimension</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel rho-Stat</td>
<td>1.734990</td>
<td>0.0886</td>
</tr>
<tr>
<td>Panel v-Stat</td>
<td>-1.670720</td>
<td>0.0988</td>
</tr>
<tr>
<td>Panel PP-Stat</td>
<td>-2.010024</td>
<td>0.0529**</td>
</tr>
<tr>
<td>Panel ADF-Stat</td>
<td>-3.473828</td>
<td>0.0010**</td>
</tr>
<tr>
<td><strong>Between Dimension</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group rho-Stat</td>
<td>2.493739</td>
<td>0.0178**</td>
</tr>
<tr>
<td>Group PP-Stat</td>
<td>-5.157040</td>
<td>0.0000**</td>
</tr>
<tr>
<td>Group ADF-Stat</td>
<td>-2.234739</td>
<td>0.0328**</td>
</tr>
</tbody>
</table>

*, ** and *** show level of significance at 1%, 5% and 10%, respectively.

*Source: Own calculations by authors*

Table 2 shows Pedroni cointegration test results. It has been employed to check whether there is co-integration. The null hypothesis is “no cointegration” among variables. If null hypothesis is rejected, this implies presence of cointegration, otherwise not. This test uses seven test statistics; four for “within dimension” and three for “between dimension”. The test has been applied for intercept and intercept and trend. With intercept, five out of seven test statistics whereas with intercept and trend, six out of seven test statistics have rejected the “no cointegration” null hypothesis. As majority of test statistics suggest the presence of cointegration, therefore this shows that cointegration exists among variables.

### Table 3: Hausman Test (Fixed Effects Model v/s Random Effects Model)

**Null Hypothesis: Random Effects Model is appropriate**

<table>
<thead>
<tr>
<th>Chi-square statistic</th>
<th>D.F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>60.668556</td>
<td>4</td>
<td>0.0000*</td>
</tr>
</tbody>
</table>

*, ** and *** show level of significance at 1%, 5% and 10%, respectively.

*Source: Own calculations by authors*

Table 3 shows the results of Hausman test which has been used to choose between fixed effects model and random effects model. It is clear from test statistic and p-value that fixed
effects model should be used. Therefore, fixed effects model has been employed for the estimation of model.

### Table 4: Fixed Effects Model Estimation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>T-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS\textsubscript{it}</td>
<td>3.171550</td>
<td>0.114854</td>
<td>27.61368</td>
<td>0.0000*</td>
</tr>
<tr>
<td>X\textsubscript{it}</td>
<td>0.683296</td>
<td>0.153936</td>
<td>4.438834</td>
<td>0.0000*</td>
</tr>
<tr>
<td>M\textsubscript{it}</td>
<td>-0.790363</td>
<td>0.194214</td>
<td>-4.069545</td>
<td>0.0001*</td>
</tr>
<tr>
<td>PI\textsubscript{it}</td>
<td>1.196066</td>
<td>0.029248</td>
<td>40.89348</td>
<td>0.0000*</td>
</tr>
<tr>
<td>C</td>
<td>1.47E+11</td>
<td>8.97E+09</td>
<td>16.38622</td>
<td>0.0000*</td>
</tr>
</tbody>
</table>

*, ** and *** show level of significance at 1%, 5% and 10%, respectively.

Source: Own calculations by authors

The above table presents the fixed effects model results showing the estimation of model to find the impact of government spending, exports and imports on economic growth. Explained variable of model is economic growth proxied by GDP of country in current US $. Explanatory variables are general government expenditure, exports, imports and domestic private investment proxied by gross capital formation. The results imply that exports, government spending and domestic private investment affect economic growth positively and significantly. However, imports affect economic growth negatively and significantly. The empirical results of present study support the studies by Ramos (2001), Alexiou (2009), Amiri and Gerdtham (2011), Abbas (2012), Sultan (2012) and Usman et al. (2012).

### 6. Conclusion & Policy Recommendations

This study explores the association among government spending, exports, imports and economic growth. For this, eight countries have been included in the panel. Panel data over the time period from 1995 to 2011 has been used for the analysis. Explained variable of model is GDP in current U.S. $ used as a proxy for economic growth, whereas explanatory variables are general expenditure by government, goods and services’ exports, goods and services’ imports and domestic private investment. Pedroni (1999) cointegration technique was employed to find panel cointegration among variables which shows the presence of cointegration. Hausman test has been used to choose between fixed effects model and random effects model. Fixed effects model has been used for estimation of model as suggested by results of Hausman test. Empirical findings show that government spending, exports and domestic private investment affect economic growth positively and significantly. However, imports affect economic growth negatively and significantly. The empirical results of present study support the results found by Ramos (2001), Alexiou (2009), Amiri and Gerdtham (2011), Abbas (2012), Sultan (2012) and Usman et al. (2012). Recommending, these countries should increase their government
spending for development purposes, exports and domestic private investment and should decrease their imports for achieving higher economic growth.

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www.globalbizresearch.org