FOREIGN TRADE AND ECONOMIC GROWTH
A PANEL REGRESSION ANALYSIS

Iskra Stancheva-Gigov ✉

Institute of Economics, Unversity Ss Ciril and Methodious-Skopje, Republic of Macedonia

iskra@ek-inst.ukim.edu.mk

Klimentina Poposka

Institute of Economics, Unversity Ss Ciril and Methodious-Skopje, Republic of Macedonia

klimenti@ek-inst.ukim.edu.mk

Abstract

The ongoing debate in the research theory and practise seeks for the definite answer concerning the connection between foreign trade and economic growth. Although theoretical models and empirical analysis are employed in various countries and regions, yet there is still lack of unique answer concerning their relations. Thus, this paper is focused on examining the connection between the foreign trade and economic growth utilizing the group of 84 countries sampled by various criteria into 9 subgroups. Moreover, additionally the paper seeks to provide the answer if the trade openness of the economy influences the economic growth. Utilizing the panel regression analysis the paper demonstrates that the trade openness has moderate effect on the economic growth. Furthermore, despite economic openness other variables influencing economic growth are human capital, FDI and government consumption. The papers suggest that it is necessary to analyze the future shift in the openness of each country separately, in order to assess the sustainable future growth of these countries.

Keywords: economic growth, foreign trade, panel regression analysis, trade openness, foreign direct investment

INTRODUCTION

In the last few decades the trend of increasing international trade is followed by the tendency of increased economic growth in the world. It leads to the conclusion that economic growth and foreign trade are positively correlated (World Bank, World Bank Indicators, and International Monetary Fund, World Economic Outlook). Over the past four decades, economists have created a large amount of statistical evidence on the relationship between foreign trade and economic growth. They estimate the coefficients of correlation, coefficients of regression, cointegration test, and perform various other statistical tests to confirm the existence of the relationship between foreign trade and economic growth. But also the empirical evidence does not clearly established whether the foreign trade leads to economic growth or whether it merely follows economic growth.

There are comprehensive empirical studies about the impact of trade oneconomic growth. With the development of econometrics, however, many complicated methods based on a mathematical model were introduced to analyze the interactive impact between trade and economic growth. Early studies begin with Michaely (1977) and Balassa (1978). By simple correlation analysis Michaely found a strong positive correlation and concluded that the protectionist import substitution policies applied in many developing countries were ill advised. Balassa found that trade export volume were positively related to a country's rate of economic growth (Hendrik Van den Berg and Joshua J. Lewer, 2007). Dollar (1992) argued that outward-orienteddeveloping economies achieve indeed much more rapid growth than inward-oriented developing ones.

The seminal empirical studies of Sachs and Warner (1995) and Frankel and Romer (1999) provide support for the growth enhancing effect of international trade. Arguably the most ambitious attempt to model the channels through which international trade influences economic growth is Wacziarg (2001). According to Wacziarg's results, trade openness has a positive impact on economic growth: openness to trade encourages national governments to implement virtuous macroeconomic policies within the framework of international trade agreements. Rodriguez and Rodrik (2000) in their empirical study, they estimate the impact of institutions, geography and trade on income in a set of 140 countries, in 1995. After controlling for the quality of institutions, the results reveal no significant effect of trade on growth. However, despite the wealth of literature that supports the view that trade enhances economic growth, there are studies that argue that the increase in openness can prevent economic growth (Rodriguez and Rodrik, 2000; Clemens and Williamson, 2002, and Vamvakidis, 2002). From the above mentioned it can be concluded that the numerous consistent statistical results have not yet definitively answered the question what is the impact of foreign trade on economic growth.

The paper is organized in the following manner: Section two is focused on methods and data selection, section three identifies variable selection, section four provides the results of analysis and discussion, whereas section five indicates the main conclusions and policy recommendations.

METHODS

In order to estimate the connection between trade and economic growth the paper utilizes panel regression analysis for 84 countries dividend into the several subcategories. The data used in this analysis have been taken from the World Development Indicators, published by the World Bank and refer to 84 countries for the period between 1972 and 2011, whereas for the transitional economies the relevant period is between 1994 and 2011. The exact category is presented in the Table 1.

Table 1. Analyzed countries in several subgroups

Advanced economies (other than EU-15) (9): Australia (AUS), Canada (CAN), Israel (ISR), Japan (JPN), New Zealand (NZL), Norway (NOR), Singapore (SGP), Switzerland (CHE), United States (USA).
EU-15 (excluding Luxembourg) (14): Austria (AUT), Belgium (BEL), Denmark (DNK), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Ireland (IRL), Italy (ITA), Netherlands (NLD), Portugal (PRT), Spain (ESP), Sweden (SWE), United Kingdom (GBR).
Latin America and the Caribbean (20): Argentina (ARG), Bolivia (BOL), Brazil (BRA), Chile (CHL), Colombia (COL), Costa Rica (CRI), Dominican Republic (DOM), Ecuador (ECU), El Salvador (SLV), Guatemala (GTM), Honduras (HND), Jamaica (JAM), Mexico (MEX), Nicaragua (NIC), Panama (PAN), Paraguay (PRY), Peru (PER), Trinidad and Tobago (TTO), Uruguay (URY), Venezuela (VEN).
East Asia (with market access) (7): China, People's Republic of (CHN), India (IND), Indonesia (IDN), Korea, Republic of (KOR), Malaysia (MYS), Philippines (PHL), Thailand (THA).
Other emerging economies and middle-income countries (15): Algeria (DZA), Botswana (BWA), Egypt, Arab Republic of (EGY), Gabon (GAB), Iran, Islamic Republic of (IRN), Jordan (JOR), Kazakhstan (KAZ), Libya (LBY), Mauritius (MUS), Morocco (MAR), Pakistan (PAK), Russian Federation (RUS), South Africa (ZAF), Syria (SYR), Tunisia (TUN).
Low-income countries (6): Kyrgyz Republic (KGZ), Namibia (NAM), Sri Lanka (LKA), Swaziland (SWZ), Tajikistan (TJK), Vietnam (VNM).
Central and Eastern Europe (EU10 minus Bulgaria; this country is excluded due to lack of one of the regressors) (9): Czech Republic (CZE), Estonia (EST), Hungary (HUN), Latvia (LVA), Lithuania (LTU), Poland (POL), Romania (ROM), Slovak Republic (SVK), Slovenia (SVN).
EU candidate and potential candidate countries (6): Albania (ALB), Bosnia and Herzegovina (BIH), Croatia (HRV), Macedonia, FYR (MKD), Montenegro (MNE), Turkey (TUR).
EU neighbourhood countries (6): Armenia (ARM), Belarus (BLR), Moldova (MDA), Kazakhstan (KZH), Ukraine (UKR).

The panel regression analysis models are suitable for examination of the influence of trade openness on economic growth. In this case, the Hausman specification test has demonstrated that it is more appropriate to use the panel model with random effects.

The panel model with fixed effects is in the following form:

$$y_{i,t} = \alpha_i + x_{i,t}\beta + e_{i,t} \qquad (1)$$

While the panel model with random effects looks like this:

$$y_{i,t} = \mu + \alpha_i + x_{i,t}\beta + e_{i,t} \quad (2)$$

To empirically assess whether foreign trade contributes to the discrepancies in the economic growth worldwide, in compliance with the elaborated analytical framework, the basic equation of economic growth is formulated in the following way:

$$gr_{i,t} = \alpha_1 + \alpha_2 gr_{i,t-1} + \beta_1 ln(gdppc_{i,t}) + \beta_2 edu_{i,t} + \beta_3 popgr_{i,t} + \beta_4 to_{i,t} + \beta_5 govcons_{i,t} + \beta_6 invy_{i,t} + \beta_7 bureau_{i,t} + \beta_8 corrupt_{i,t} + \beta_9 reer_{i,t} + \beta_{10} polity2_{i,t} + \varepsilon_{i,t} \qquad (3)$$

Where i indicates the countries included in the analysis (i=1, ..., 84), whose data are available throughout the period of the analysis, t denotes the time period (1972-2011), or more specifically the years included in the analysis, $gr_{i,t}$ is the average rate of real GDP per capita, $gr_{i,t-1}$ is the growth rate of real GDP per capita from the previous year, α_1 is the common intercept, α_2 is a coefficient of the previous values of the dependent variable, β_i marks the inclination of the vector coefficients of the explanatory variables (Table 2), whereas $\varepsilon_{i,t}$ is a random error, which is individually and equally distributed over the time and the units.

Table 2. Symbols, description and expected value of the explanatory variables

Symbol	Description of the explanatory variables	Expected value*
$lngdppc_{i,t}$	Logarithm of the initial level of real GDP per capita in 1972 USA $**	–
$edu_{i,t}$	Education of the population over 25 years of age (average number of years spent in education)	+
$popgr_{i,t}$	Annual growth rate of the population in the country	+ / –
$to_{i,t}$	Trade openness (export+import as a percentage of GDP)	+ / –
$govcons_{i,t}$	Government consumption (as a percentage of GDP)	–
$invy_{i,t}$	Foreign direct investment (as a percentage of GDP)	+ / –
$bureau_{i,t}$	Bureaucracy quality	+
$corrupt_{i,t}$	Corruption	–
$reer_{i,t}$	Real effective exchange rate	–
$polity2_{i,t}$	Constitution	+

Note: * "+" denotes a positive relationship, "-" a negative one and zero indicates a theoretically ambivalent relationship with a dependent variable.

** A logarithm of the value is calculated at this point to level off the large differences of the GDP growth rates per capita among the countries analyzed.

The inclusion of the growth rate of real GDP per capita from the previous year is justified by the slow change in or rather the persistent conduct of the growth rate. Namely, it has been confirmed that as with a great deal of other phenomena, the economic growth continues to move in a state of inertia here as well in a relatively stable ambiance, i.e. in the greater part it emulates growth from previous years.

Variables Selection

Following Barro's pivotal research (1996), a significant number of variables in strong correlation with the economic growth rate have been identified in the modern empirical literature on this subject. The basic approach comprises evaluation of panel regressions in the following form (Sala-I-Martin X., Doppelhofer G., and Miller R. I., 2000):

$$\gamma_{i,t} = \alpha + \beta_1{}^*X_1 + \beta_2{}^*X_2 + ... + \beta_n{}^*X_n + \varepsilon_{i,t} \qquad (5)$$

where, γ is the vector of the real economic growth rates and $X_1, ..., X_n$ are vectors of the predictor (independent) variables, which are used differently by different researchers and research papers. For instance, Sala-I-Martin, Doppelhofer and Miller (2000) conclude that the following variables are in very strong correlation with the economic growth: initial level of GDP per capita, investment rate (gross investments expressed as a percentage of GDP), a number of measures for the scope and quality of the population's education, certain political indicators etc.

Taking into consideration the theoretical body of knowledge and the most frequently cited independent variables when analyzing foreign trade influence on the economic growth in the empirical literature (with particular emphasis on the works of Levine and Renelt (1992), Sala-i-Martin (1997) and Wacziarg (1997), as well as the data available(Van den Berg H. and Lewew J. J., 2007), the ensuing six basic predictor variables have been selected for the purposes of the econometric calculations in this paper:

- *Initial GDP per capital.* The initial level of GDP per capita (gdppc) tests the hypothesis for the (conditional) Beta (β) convergence. The theory of the conditional Beta-convergence predicts that poor economies grow faster than rich economies, enabling them to gain on the developed economies' performance in the long run.
- *The number of years spent in education by the population of over 25 years of age.* This is a variable which determines the human capital of a country. It is important to emphasize that the former is far from being a perfect measure of a country's human capital, however, in view of the lack of alternative education indicators, this particular measure is useful when performing growth regressions.

- *Natural population growth.* The relationship between population growth (popgr) and economic growth continues to stir up controversy among the economists who address questions related to economic growth and development. Those with a pessimist view on population growth claim that the latter impedes development, inasmuch as a larger population requires additional capital output per worker and entails considerable public expenditures for the upkeep of future generations.

- *The level of trade openness.* Trade openness (to) refers to the degree to which countries engage in trade with other countries or economies. Both developed and developing economies are becoming more and more dependent on international trade, making trade openness the major determinant of growth in the literature on economic growth.(Petrakos, G., Arvanitidis, P. & Pavleas, S, 2007)

- *The level of public expenditure.* Government consumption (govcons) is yet another predictor variable used in the panel regression analysis. Levine and Zervos (1993) have undertaken to measure the government's involvement in economic activity by way of using the government-spending-to-GDP-ratio.

- *The inflow of foreign direct investment.* Foreign direct investment (hereafter referred to as FDI) serve as both a direct capital financing method and as a way to bring about positive externalities. FDI is a medium of technology transfer, which contributes towards long-term growth, with high probability, much more so than domestic investments.

RESULTS AND DISCUSION

The results from the panel regression analysis are shown in Table 3. Namely the regression analysis confirmed the significance of the selected variable on the economic growth. *The initial GDP per capita* coefficient for the given period is statistically irrelevant in the explanation of the economic growth in the countries from the sample, which is somewhat understandable, considering the use of annual data instead of average values for specified time periods. The coefficient for the human capital influence represented by the average number of years *the over-25 population has spent in education* is in positive correlation with the economic growth and has a significance level of 5% in all regressions (except for the regression in column [4] with significance of 1%). This refers to the fact that each additional year in education is likely to increase the average annual GDP growth rate by 0.18 percentage points. Therefore, in order for economies to experience economic growth, governments should focus on quality education for the population. This is crucial, given that economies are enabled to use the expertise of the population, i.e. human capital to introduce innovations and boost productivity.

Table 3. The influence of foreign trade on average GDP growth

Regression	The dependent variable is the average growth rate of real GDP percapita				
Independent variables	[1]	[2]	[3]	[4]	[5]
Natural logarithm if initial GDP percapita	-0.271 [1.23]	-0.315 [1.45]	-0.221 [0.98]	-0.230 [1.05]	-0.257 [1.15]
Education of the population aged over 25	**0.186** **[2.51] ****	**0.192** **[2.57] ****	**0.181** **[2.45] ****	**0.151** **[2.66] *****	**0.121** **[2.02] ****
Population growth rate	-0.174 [1.05]	-0.178 [1.08]	-0.170 [1.02]	**-0.290** **[1.81] ***	**-0.295** **[1.73] ***
Trade openness	**0.006** **[2.75] *****			**0.005** **[2.38] ****	**0.004** **[2.28] ****
Government consumption	**-0.077** **[3.10] *****	**-0.075** **[3.06] *****	**-0.078** **[3.14] *****	**-0.071** **[2.99] *****	
Foreign direct investment (FDI)	**0.069** **[3.09] *****	**0.070** **[3.24] *****	**0.068** **[2.96] *****	**0.081** **[3.55] *****	**0.077** **[3.21] *****
Quality of bureaucracy	0.273 [1.56]	0.272 [1.55]	0.276 [1.57]	0.175 [1.01]	0.146 [0.85]
Corruption	**-0.256** **[2.09] ****	**-0.251** **[2.04] ****	**-0.263** **[2.15] ****	**-0.207** **[1.82] ***	**-0.288** **[2.55] ****
Real effective exchange rate				**-0.003** **[1.81] ***	**-0.003** **[1.89] ***
Constitution (polity2)					-0.005 [0.17]
Export (as a % of GDP)		**0.011** **[2.80] *****			
Import (as a % of GDP)			**0.011** **[2.56] ****		
Number of observations	1829	1829	1829	1829	1829
Number of countries	84	84	84	84	84
R^2	0.74	0.75	0.74	0.76	0.78

Note: The asterisks indicate statistical significance of *** 1, ** 5 and * 10 percentage level.

The coefficient of the *population growth rate* is unstable and statistically insignificant in all regression growth equations. It is only statistically significant (with significance of 10%) in the fourth and fifth columns, where a number of additional research variables have been introduced, however, it can be added that the value is consistent with the neoclassical theory projections, according to which a higher growth (by 1%) is related to a lower economic growth rate (by around 0.29 percentage points). The estimated coefficient for *trade openness* is statistically

significant with a level of significance of 1% and 5% in the first column and fourth and fifth columns, respectively. The findings are in favor of the hypothesis that trade openness influences and increases the likelihood of economic growth, although with a moderate overall effect.

For the purposes of our analysis, we have applied the indicators *export as a percentage of GDP* and *import as a percentage of GDP*. As a variation of the basic regression equation, with the aim to distinguish between the influence of export and that of import on economic growth, new export and import regressions have been performed. The results lead to a conclusion that both the export variable (as a %of GDP) and the import variable (as a % of GDP) are positively correlated with economic growth, i.e. they positively affect the GDP growth rate, whereby both the export and import coefficients are 0.011 and they differ only by their significance (which is 1% for exports and 5% for imports). The obtained results for the statistical significance of import and export suggest that there is a possibility of import dependence on export in the countries analyzed, starting from the assumption that this situation is due to the fact that import is intended for export processing, which subsequently leads to growth and not so much for consumption of luxury goods.

The coefficient of *government consumption* statistically differs from the zero in all four regressions. Its economic significance indicates that the volume of government consumption has a negative impact on economic growth, i.e. the coefficient has the theoretically predicted value and is statistically significant at a level of 1%. The findings greatly coincide with recent studies of the connection between government consumption and growth. The estimated coefficient of *foreign direct investment* is also stable in all growth equations, it is furthermore, statistically significant at a level of 1% and is in accordance with studies predicting a positive value of this relationship. Specifically, an increase in foreign direct investment (as a percentage of GDP) by 1% is related to a higher growth rate by 0.70 percentage points. Foreign direct investment has the role of a diffuser, facilitating the transfer of knowledge and technology, as drivers of economic growth. The transfer of technological and business know-how by means of foreign direct investment helps to close the gap among countries and can have spillover effects on the whole national economy.

Analysis of the level of corruption, the real effective exchange rate and the nature of the constitution highlighted the connection between trade and economic growth. Hence, level of bureaucracy had higher negative impact on economic growth in the transitional economies, corruption and the real effective exchange rate had an inverse relationship with economic growth. Therefore if corruption in the countries rises, economic growth will decrease and if the real exchange rate be overestimated, economic growth conditions will be hindered.

CONCLUSION AND FUTURE RESEARCH

The results arising from the research indicate that trade openness influences and increases the likelihood of economic growth, although with a moderate overall effect. The panel regression analysis carried out has verified the fact that economic openness is one of the key determinants of economic growth, in conjunction with human capital, the foreign direct investment rate and government consumption. The former indicates that countries which are successful in international trade are open to foreign direct investment, attract foreign workers and achieve higher economic growth than countries which fail to integrate into the global economy. Therefore, it is necessary to analyze the future shift in the openness of each country separately, in order to more accurately assess the sustainable future growth of these countries.

Future analysis should be focused on including additional variables such as flexible trade policies, favourable macroeconomic scenario and political stability that need to complement the gains from trade. Moreover, one need to take into account the difference between the factors which determinate the growth in developed and developing countries. Hence, developing countries can improve their growth rates through trade by importing knowledge from advanced countries. The benefits may occur through increased innovation, imitation or the use of such knowledge in production. Market size and infrastructure are dominant factors in explaining innovation in developing countries, whereas high-technology imports, human capital, and R&D expenditures appear to have a stronger impact on developed countries.

Trade composition is another variable which should be verified in future analysis when testing for developing countries because the imports of certain goods embody the knowledge of the developed country. Having in mind the latest results of New Institutional Economy, one of the key variable for the future research will be the domestic enforcement of property rights. Lax enforcement of property rights may be conducive to imitation of the developed countries' products. Alternatively, it may be that only countries who themselves have a domestic R&D sector are be able to benefit from knowledge spillovers used to develop new products.

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