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Does High Tech Exports Really Matter for Economic Growth? A Panel Approach for Upper Middle-Income Economies

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ABSTRACT *In this study, we analyzed the data about the technological diversification of export composition of upper middle-income countries and the impact of the technological composition of exported goods on GDP growth. Using the dynamic panel data analysis techniques for 34 countries between 1995-2015, we confirmed that exports of high technological products will have a significant positive impact on economic growth for upper middle-income countries as well as medium technological products' exports which have a limited effect. The exports of low-tech products will have a negative effect for economic growth in the long run.*

ÖZ *Bu çalışmada üst orta gelir seviyesindeki ülkelerin ihracatının sektörel kompozisyonunun teknoloji çeşitliliği ve ihracatın teknolojik yapısının iktisadi büyüme üzerindeki etkisi analiz edilmiştir. Dinamik panel veri analiz yöntemleri kullanılarak 34 üst orta gelir grubunda yer alan ülkelerin 1995-2015 yılları arasındaki verileri incelenerek, yüksek teknolojili ürün ihracatının önemli bir büyüme etkisine sahip iken orta teknolojili ürün ihracatının daha sınırlı etkisi olduğu görülmüştür. Düşük teknolojili ürünler ise uzun vadede büyüme üzerinde negatif etkiye sahip olmaktadır.*

Keywords : Economic growth, export-led growth, export composition, pooled mean group estimate, dynamic panel data analysis

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Introduction

The relationship between exports and economic growth has been one of the most widely researched topics in the economics literature. International trade affects the economic growth by contributing efficient resource allocation, increased capacity utilization, product diversification, efficient management of companies, efficient production and creation of economies of scale and the technology and research and development spillovers from the companies engaged in international trade through domestic companies. (Kruger, 1975; Balassa, 1978; Bhagawati, 1982; Feder, 1983; Awokuse, 2003).

Globalization and technological change became a major factor, which affects the structure of international trade among the countries. Developed countries with their high capital accumulation level, technologic leadership and qualified human capital specialized in high technology products whereas the developing economies use the comparative advantage of abundant and low-cost labor and specialized in labor-intense industries.

In a paper for National Bureau of Economic Research, Eichengreen, Park and Shin (2013) mentions the rapid economic growth of these emerging economies and questioned the sustainability of this

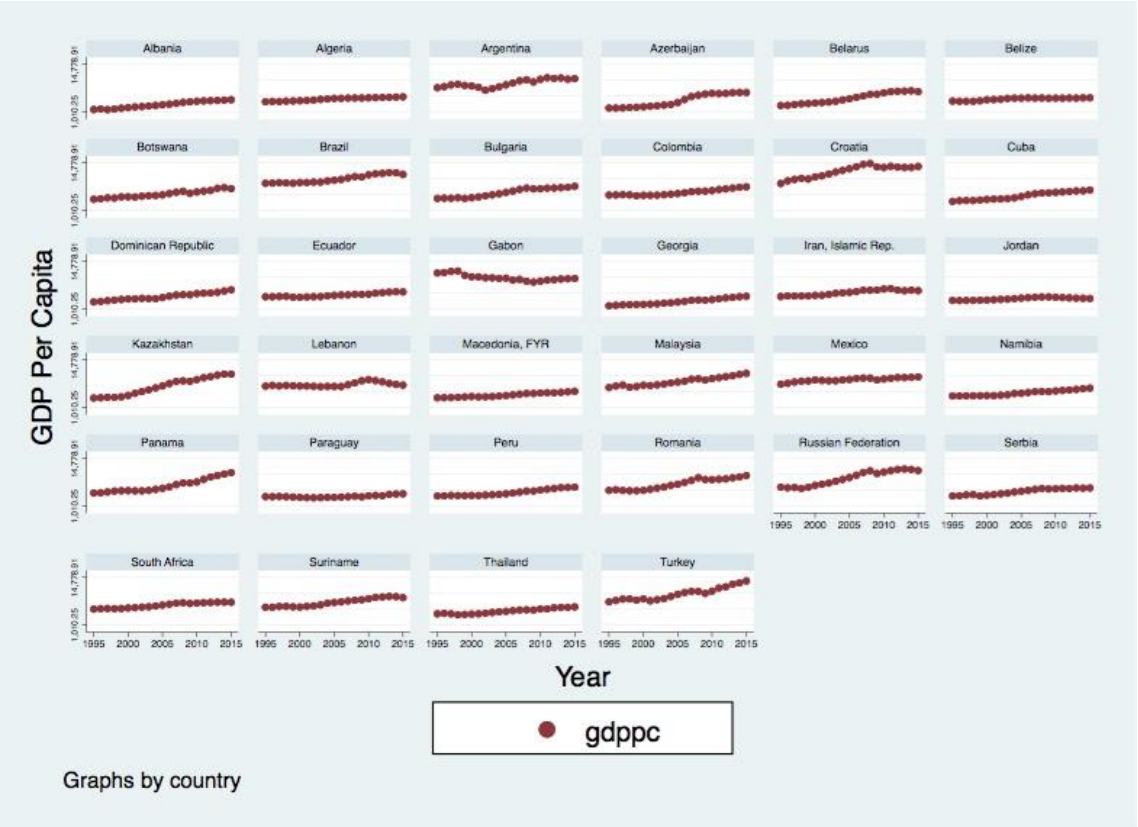
growth performance or in other words if these countries will be able to get rid of the "middle-income trap" after they achieve the middle income. They also figured out that countries where high-technology products account for a relatively large share of exports will be very likely to avoid the middle-income trap. Kharas and Kohli (2011) suggests that the middle-income trap identifies the situation for countries that avoided the poverty trap and achieved middle-income levels but failed to grow to advanced-country levels. In the same paper Kharas and Kohli underlines the importance of specialization, growth based on total factor productivity and decentralization will be the main strategies for countries to avoid middle-income trap.

In the past for some emerging economies focused on technology, research and development and human capital accumulation and they performed a higher growth rate than the others and developed faster than the others. Sustaining this growth rates like in Republic of Korea they achieved to avoid the middle-income trap and they are placed in the high-income countries with better living standards and economic development.

Regarding to this example, the main research question in the literature inspiring this paper arises as if the composition of exports and the technological level of the manufactured products matter for higher economic growth. Using Kharas and Kohli's findings that the high-technology exports and specialization -as the main strategy of getting out of middle-income trap, in this study we focused on upper middle-income countries' export composition (high-tech, medium tech and low-tech) and the impact of the composition on economic growth in long-run and short-run.

The upper-middle income countries as seen in Figure 1 have GDP per Capita around 10.000 – 14.700 US Dollars since 1995 and most of those countries are struggling to achieve a higher GDP per Capita and in the literature this problem is identified as middle-income trap. (Eichengreen et al, 2013) One of the similarities among those countries is the structure of the export composition and according to UNCTAD Data's classification the low and medium level technology products are the main export products of these countries which also have been seen as the main cause of middle-income trap. (Rodrik, 2006)

Figure 1. GDP Per Capita in Upper – Middle Income Countries (1995-2016)



This paper aims to research the relationship between the composition of international trade and economic growth by using the technology orientation of goods in international trade of developing economies. The major contribution of this paper to literature is focusing on upper-middle income countries which have been discussed as potentially stack in the middle-income trap. On the other hand, this paper also contributes to the literature by analyzing the effect of short-run and long-run effects of export diversification and the level of technology used for the products on economic growth for upper-middle income countries.

The first section of the paper includes the previous research, second section provides information about the data used in the analysis and the methodology and the third section provides the analysis results. Section four concludes.

Literature Review

Extensive literature exists on the impact of exports on economic growth, a high amount of studies has provided evidence for export-led growth (ELG). An increase in exports can lead to an increase in the productivity of not only the exporting industry but also industries which may be providing services or raw materials to these industries. Furthermore, an increase in imports of technology can also result from higher exports especially if technology advances are made in exporting industries. ELG occurs due to higher exports however, it is evidenced that high-tech exports have a greater impact on economic growth (Fagerberg, 1994; Ghatak et al., 1997; Fagerberg, 2000;

Cuaresma & Worz, 2005; Lee, 2011). It would be beneficial for countries to diversify their exports with a focus on high-tech industry however, this may only be possible for nations which already have technology available at their disposal or economies which use exports as a means to advance their industries towards growth and technological advancement.

Export diversity is an important factor in economic growth due to an increase in exports and technology spillovers which can have a positive impact on other industries (Dunusinghe, 2009). Hummels & Klenow (2005) also found that rich countries do not only have a large quantity of exports but also a wide variety of exports leading to an increase in the overall export volume of the economy. In the case of Sri Lanka, Dunusignhe (2009) found that diversification in the exports have led to economic growth, especially a growth in the manufacturing sectors have led to the growth aspects of Sri Lanka. Diversifying into manufactured sectors means an advancement in technology as well as production of higher technological products. However, Mah (2007) finds that it is not necessary to reallocate resources to the manufacturing exports in order to achieve rapid growth although the study does support ELG. Lee (2011) finds that countries specializing in high-tech products (products such as aircraft, electronics, and pharmaceuticals) experience higher growth. He also finds that economics exporting high-tech products experience rapid growth as opposed to economies exporting low-tech products. Cuaresma & Worz (2005) find that developing technology-intensive industry and exports are vital for an economy's growth in the long-term. Furthermore, they find a positive correlation between high-tech exports and output growth and a negative correlation between low-tech exports and output growth. This is true as we see many studies regarding the differences in export characteristics of the firms and their impact on the economic growth.

In the case of Malaysia, Ghatak et al. (1997) found that economic growth is led by manufactured goods as opposed to primary goods. A move towards manufactured goods for developing countries seems to be a way for them to increase their economic growth since they may not be able to go into higher technological products immediately. Hausman et al. (2007) find that countries exporting goods with higher productivity grow more rapidly given that these products are in high demand around the world due to which the transfer of resources from low-productivity industry to high-productivity would be offset by the demand. They state that policies promoting entrepreneurial activity (due to production of high-income products) are vital in the case that economies are able to control for externalities which are a result of entrepreneurial activity. The specialization of goods is just as important as other factors when it comes to the economic growth of economies; according to Hausman et al. (2007) it is better for economies to specialize in the export of products which are exported by rich countries. A quality spectrum designed by Hausman et al. (2007) to test the export baskets of different countries shows that countries producing goods higher up on this spectrum perform higher and vice versa.

Using the same test as Hausman et al. (2007), Jarreau and Poncet (2012) in the case of China found that regions producing sophisticated products lead to higher economic growth. However, they find that in terms of trade they find dissimilar evidence for domestic and foreign firms conducting foreign trade hence a difference should be observed between trade performed by domestic and foreign firms as the development of technology and export led growth is associated with domestic

firms taking part in foreign trade.

The relationship between the composition of exports and economic growth has also been studied in the case of Korea (Koh and Mah, 2013). They find a bidirectional causality between economic growth and export composition, a higher proportion of non-textile exports to textile exports has resulted in higher economic growth for Korea. Their study also finds that higher allocation of resources towards heavy and chemical industries has led to economic growth. Koh and Mah (2013) conclude that countries having a comparative advantage in textile should move towards more valued added and higher tech industries instead of specializing in textile industry.

Grancay, Grancay, and Dudas (2015) studied the link between export quality and economic growth using the quality spectrum designed by Hausman et al. (2007). Their study finds that the product sophistication does not necessarily matter when it comes to economic growth as they have found that countries exporting primary goods have shown positive relationship with economic growth due to higher prices of primary commodities in the studied period. Hence, they contradict in the conclusion of previous literature as to what is exported is not really the answer to economic growth but when it is exported. If the prices of primary commodities are on the rise, then it is beneficial for countries to export these commodities since it would lead to higher gains. In addition, the production of high-tech products does not necessarily mean higher growth for developing economies since these economies may not have the structure which complements high-tech industry. This study presents evidence in favor of any industry which may be thriving in the present global business climate. However, export diversification and resource allocation towards manufacturing sectors are key to consistent economic growth in the long-term.

Bbaale and Mutenyo (2011) find that in terms of sub-Sahara African countries, agricultural exports have led to per-capita growth as opposed to manufactured exports. They find that their sample of 35 countries have a comparative advantage in agricultural exports and should continue to invest in these as they lead to development over time. They suggest that policies should be shaped towards agriculture in the medium term and manufacturing in the long term for these sub-Saharan African countries. This study complements findings of Grancay et al. (2015) in that under developed or developing nations will not necessarily improve if they begin focusing on high tech products but they also must have the infrastructure in order to support the industries which are at work.

Therefore, it may be beneficial for countries to adopt export and production policies according to the advancement of the country and specialization of the exports. The focus should still remain towards manufacturing and high-tech industry but should follow a path which benefits from also the overall advancement of the country and its infrastructure. It is important to differentiate between the types of exports and the impact they have on economic growth among developed, developing, and under developed countries. The export composition will also help learn about the types of exports according to the development of the economies.

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Data and Methodology

In order to capture the relationship between export composition and output through the productivity channel, we followed Bbaale and Mutenyo (2011) and used the neoclassical Cobb-Douglas production function.

$$Y_{it} = A_{it} K_{it}^{1i} L_{it}^{1i} \quad (1)$$

where Y_{it} is the output of country i at time t, A_{it} is a productivity parameter and K_{it} and L_{it} are the labor and capital commitment of country i at time t. Exports and imports effect the growth via productivity parameter. So, we can identify the A_{it} as a function of different composition of exports. Following the Bbaale and Mutenyo, we assume that the effect of exports is seen in a lagged form where we will assume that s will denote the lag.

$$A_{it} = f(HT_{it-s}, MT_{it-s}, LT_{it-s}, Z_{it}) \quad (2)$$

In Equation 2; HT denotes high-technology products, MT denotes medium technology products, LT denotes low technology products and Z denotes the control variables. The control variables are gross capital formation as a percentage of GDP, government expenditures as a percentage of GDP and labor force.

We used Lall's (2000) definition of export classifications to identify the data of export composition. Using Pesaran et al (1999) approach to incorporate the error correction model using the autoregressive distributed lag ARDL (p, q) technique and following Loayza and Ranciere (2006) growth model we estimate a dynamic heterogeneous panel regression with the following equation.

$$\Delta Y_{it} = \sum_{J=1}^{p-1} \gamma_j^i \Delta Y_{i,t-j} + \sum_{J=0}^{q-1} \delta_j^i \Delta X_{i,t-j} + \varphi^i \left[Y_{i,t-1} - \left\{ \beta_0^i + \beta_1^i X_{i,t-1} \right\} \right] + \in_{it} \quad (3)$$

In the Equation 3, X denotes the vector of independent variables, the short-run coefficient of lagged Y is denoted by γ whereas δ denotes the short-run coefficients of independent variables. β denotes the long-run coefficients and finally φ denotes the speed of adjustment to the long-run equilibrium. Using together Equation 1 and Equation 2 and putting these equations in Equation 3 (X vector covers both K, L and A which A is a function of different technological level export volume of products and other control variables), we can estimate the panel by three estimators: the mean group (MG) model of Pesaran and Smith (1995), the pooled mean group (PMG) estimator by Pesaran et al (1999) and the dynamic fixed effects (DFE) estimator.

Blackburne and Frank (2007) states that the assumption of homogeneity in large cross-sectional observations (N) and the large number of time-series observations (T) will not be appropriate. They also mentioned that the non-stationarity will also be a concern. The mean group estimator allows intercepts, slopes and error variances to differ across groups whereas pooled mean group estimator offers more consistent estimates under the assumption of long-run homogeneity. Regarding MG, PMG and DFE, we used all estimation methods and then checked the test results with Hausman test.

We also used the ARDL model of order 1 for high-tech, medium-tech, low-tech and control variables as gross fixed capital formation to GDP, labor force growth and government expenditures to GDP.

We focused on 34 upper middle-income countries based on World Bank classification. We eliminated some countries due to lack of data and we also eliminated outlier countries like China as it has a different pattern of economic growth comparatively to the countries included in the data. For export composition data, we used UNCTAD's database from 1995 to 2015. The rest of the data is gathered from World Bank Development Indicators. The descriptive statistics are as follows.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
gdppc	714	5,978.88	2,709.44	1,010.25	14,778.91
high	714	5.05e+06	1.46e+07	350.40	8.79e+07
med	714	8.64e+06	2.01e+07	2,859.54	1.80e+08
low	714	4.28e+06	7.91e+06	1,158.69	5.52e+07
gcf	714	24.81	8.13	0.30	70.66
govt	714	15.95	5.44	4.58	39.88
lab_for	714	1.32e+07	2.07e+07	69,886	1.06e+08

Empirical Results

Table 2 reports the results of PMG, MG and DFE estimations. The PMG test results indicate that exports of high technology, medium technology and low technology products have a significant effect on GDP in the long run. On the other hand, among the control variables both government expenditures and labor force has statistically significant impact, but gross capital formation is not significant in the long-run.

For upper middle-income countries analyzed in this study, exports of high technology products and medium technology products will have a positive effect for GDP growth whereas low technology products' exports will have a negative impact in the long-run. On the other hand, we confirm empirically that exports of high technology products will have a higher coefficient and has a higher importance in the GDP growth than the medium technology products' exports.

In the short run PMG estimates identify only exports of low-technology products, gross capital

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formation and government expenditures are statistically significant. According to analysis results the government expenditures have a negative impact on growth whereas the gross capital formation and exports of low technology products have a positive impact for short-run economic growth which these results are confirming the data.

[Table 2. Test Results for Pooled Mean Group, Mean Group and Dynamic Fixed Effects Estimates

Variable	**PMG**		**MG**		**DFE**	
	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
Long-run Coefficients						
Exports of High Technology Products	0,1585***	0,0185	-0,0814	0,1048	-0,0876	0,0569
Exports of Medium Technology Products	0,0622***	0,0241	0,0126	0,1080	0,0635	0,0556
Exports of Low Technology Products	-0,0766***	0,0217	0,2248	0,1417	0,2833***	0,0634
Gross Capital Formation (% of GDP)	0,0084	0,0407	0,6024**	0,2976	0,3548***	0,1025
Government Expenditures (% of GDP)	0,7999***	0,0867	0,3078	0,4154	0,0222	0,1465
Labor Force	0,6955***	0,0978	1,6700**	0,6830	0,9306***	0,2021
Short-Run Coefficients						
Error Correction Coefficient	-0,0012	0,0190	-0,2836***	0,0851	-0,0666***	0,0105
Δ Exports of High Technology Products	0,0073	0,0081	0,0115	0,0127	-0,0046	0,0041
Δ Exports of Medium Technology Products	0,0177	0,1203	0,0118	0,0134	0,0138***	0,0048
Δ Exports of Low Technology Products	0,0222*	0,1245	-0,0180	0,0121	8,02e-0,6	0,0050
Δ Gross Capital Formation (% of GDP)	0,1161***	0,0197	0,1899	0,0252	0,0152***	0,0058
Δ Government Expenditures (% of GDP)	-0,0453**	0,0209	-0,0458	0,0448	-0,0508***	0,0150
Δ Labor Force	0,5869	0,3701	0,9524	0,7729	0,0823	0,0920
Intercept	0,0514	0,1955	6,0155**	2,7146	0,4171*	0,2245

*: 10%, **=5%, ***=1%

The results show that upper-middle income countries which do also have the challenge of middle-income trap to surpass the middle-income level should diversify their export composition towards

a higher technology level. This reality is also bringing a tradeoff for those countries which is either achieving a short-run growth with current low technology products or investing on high-technology products for long-run growth.

In long-run 1% increase of export volume of medium-technology products will increase the GDP per capita 0,06% and this impact will be even 2,5 times more for high technology products' exports as 0,15% (all else equal). It is also seen in the results that the government expenditures and labor force are the main determinants of the long-run economic growth in upper-middle income countries. Here there arises some further research questions that can be analyzed in the future studies regarding to the components of labor force growth and composition of government expenditures.

Apart from the results in PMG, MG and DFE, we also analyzed the efficiency of the methods used with Hausman test. Table 3 and Table 4 report the results and we figured out that PMG is more efficient than MG and DFE under null hypothesis of Hausman test.

Table 3: Hausman Test Results MG & PMG

	Coefficients			
	(b)	B	b-B	sqrt(diag(V_b-V_B))
	MG	PMG	Difference	S.E.
loghigh	-0,0814259	0,158577	-0,2400029	0,2806956
logmed	0,012565	0,0622173	-0,0496523	0,2890252
loglow	0,2247816	-0,0766215	0,3014031	0,3798221
loggcf	0,6024064	0,0084707	0,5939357	0,7979176
loggovt	0,3077684	0,7999731	-0,4922047	1,111948
loglab	1,670091	0,6955716	0,9745191	1,831052
Prob>chi^2= 0,1616				

Table 4. Hausman Test Results PMG & DFE

	Coefficients			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	PMG	DFE	Difference	S.E.
loghigh	0,158577	-0,0876912	0,2462681	2,757203
logmed	0,0622173	0,0635828	-0,0013655	3,588959
loglow	-0,0766215	0,2833064	-0,3599279	3,234606
loggcf	0,0084707	0,3548836	-0,3464129	6,076962

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loggovt	0,7999731	0,0222525	0,7777205	12,92482
loglab	0,6955716	0,9306138	-0,2350422	14,5836
Prob>chi²= 1,000				

Conclusion

The results for upper-middle income countries are consistent with the literature which emphasized the importance of high technology products' export to be more important for long-term economic growth. On the other hand, the importance of exports of low-technology products for short-run economic growth brings a tradeoff for these countries between committing their resources for achieving competitiveness in high-technology exports for long-run growth versus the current short-run low-technology growth export structure. The middle-income trap which is a common problem for upper middle-income countries are still to be discussed further with regard to the export composition and diversification of exports and the labor force and government expenditures composition are also a matter of future research with respect to their contribution the change of export composition of the upper-middle income countries.

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