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Determinants of Export Competitiveness: Evidence from OECD Manufacturing

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Abstract. Many of the OECD countries are known for having a substantial share of manufactures in their exports. This study aims to analyze the determinants of export competitiveness in manufacturing sector of 12 OECD countries over the period 1999-2010. For this purpose, firstly RCA index for manufactures exports is calculated. Then panel data techniques are employed to test the effects of physical capital, labor cost, infrastructure, R&D, the share of high-tech exports and FDI inflows on export competitiveness of manufactures. The results of the study indicate that conventional variables, namely physical capital, labor cost, and infrastructuremostly determine the export competitiveness of manufacturing sector in OECD countries. Furthermore, FDI inflows to the manufacturing sector has not contributed positively to the export competitiveness of OECD countries for the last decade. On the other hand, R&D variable and the share of high-tech exports have shown positive effects on export competitiveness of manufacturing sector.
Keywords. Export Competitiveness, Manufacturing Sector, OECD.
JEL. C33, F14, O14.

1. Introduction

International trade has been one of the most important drivers of economic growth in the global economy for the last few decades. Therefore it has been a major area of research to ascertain the determinants of a country's ability to export (both by means of volume and sophistication) as well as the determinants of export competitiveness.

Competitiveness research and studies analyze factors that can explain the competitiveness andaim to identify the drivers of competitiveness. Despite there is a whole strand of scientific literature on competitiveness, a consensus about a common definition of competitiveness has not exactly been reached.

In the literature the word "competitiveness" relates to different meanings when applied to an individual firm or an individual sector or total economic activity within a country or region.

For a firm, competitiveness means meeting customers' needs more efficiently and more effectively than other firms do (Edmonds, 2000). On the other hand, for an industrial sector, the main competitiveness criterion is maintaining and improving its position in the global market (Balkyte & Tvaronaviciene, 2010).

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In a broad extent, export competitiveness of industry sector is a function of the capacity to sell the product demanded in the international marketplace, at the quantity, quality, price and time required (ITC, 2016). Thus, export competitiveness is a function of many variables in the context of improved technology, better efficiency and quality, better marketing techniques.

A common measure which helps to assess a country's export potential is the RCA Index. The concept of "revealed comparative advantage" (RCA) was put forward by Balassa because of the view that cost comparisons were an inadequate surrogate for comparative advantage (Buckley et al., 1988). He used export performance to measure RCA and it indicates whether a country is in the process of extending the products in which it has a trade potential, as opposed to situations in which the number of products that can be competitively exported is static.

RCA Index is known by the description "revealed comparative advantage", which identifies product groups where the targeted country has an obvious advantage in international competition. This is of special importance in order to promote trade of products that are more likely to be competitive (ITC, 2016).

Stated simply, the revealed comparative advantage of a specific country in the trade of a given industry's products is measured by the industry's share in the country's exports relative to its share in world trade.

Balassa defines RCA Index as the ratio of a country's exports in a particular commodity category to its share in total merchandise exports (Balassa & Noland, 1989):

$$\left(XRCA_{ij}\right) = \frac{X_{ij}}{\sum_i X_{ij}} \Bigg/ \frac{\sum_j X_{ij}}{\sum_i \sum_j X_{ij}}$$

Where X stands for exports, the subscript $i$refers to industry and j refers to country.

Another way to show the RCA of a specific industry $i$of a country j is:

$$RCA_{ij} = \left(X_{ij} / X_j\right) / \left(X_{wi} / X_w\right)$$

Where;

X_{ij} : the value of exports of commodity $i$by country j

X_j : the value of total exports by country j

X_{wi} : the value of world exports of commodity$i$

X_w : the value of total world exports.

As seen in the equation, the value of the Balassa's RCA Index is the result of the ratio of the share of national industry's exports in total national exports to the share of world industry's export in total world's exports.

The RCA Index takes values between 0 and +∞. If it takes a value less than 1, this implies that the country is not specialized in exporting the product. If the index takes a value more than 1, this implies that the country is specialized in exporting that product (ITC, 2016: 42).

Table 1 shows the RCA values of manufactures exports of 12 OECD countries. The values are calculated based on the sector-specific export data of the WTO.

According to the RCA Index values in Table 1, for manufacturing sector exports; Finland, France, Germany, Hungary, Italy, Japan, Poland, South Korea, Spain, Turkey and USA are specialized in manufacturing. This is not the case for Netherlands. This country has RCA values less than 1, meaning that it is not specialized in exporting manufactures. However, Netherlands has ascending index values which may imply that this country is close to specialization in the following periods.

Table 1: *Export Competitiveness by Country, 1999-2010*

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Finland	1.15	1.17	1.17	1.16	1.16	1.09	1.17	1.15	1.15	1.21	1.17	1.12
France	1.10	1.15	1.15	1.13	1.14	1.14	1.17	1.17	1.17	1.21	1.19	1.18
Germany	1.17	1.21	1.20	1.20	1.20	1.22	1.25	1.26	1.27	1.32	1.29	1.32
Hungary	1.16	1.19	1.17	1.19	1.21	1.23	1.18	1.29	1.27	1.31	1.29	1.33
Italy	1.19	1.22	1.21	1.20	1.19	1.22	1.24	1.26	1.26	1.30	1.25	1.26
Japan	1.26	1.29	1.27	1.27	1.28	1.29	1.32	1.33	1.32	1.37	1.31	1.35
Netherlands	0.91	0.93	0.92	0.91	0.92	0.95	0.96	0.95	0.96	0.93	0.93	0.94
Poland	1.06	1.10	1.11	1.12	1.14	1.12	1.15	1.17	1.19	1.25	1.21	1.21
Korea Rep.	1.20	1.24	1.24	1.25	1.26	1.27	1.31	1.31	1.31	1.34	1.33	1.35
Spain	1.05	1.07	1.06	1.06	1.06	1.07	1.10	1.11	1.11	1.13	1.10	1.10
Turkey	1.06	1.11	1.12	1.14	1.15	1.17	1.17	1.19	1.19	1.22	1.15	1.19
USA	1.11	1.14	1.13	1.13	1.12	1.14	1.17	1.17	1.15	1.16	1.14	1.13

Source: Authors' calculations.

All countries except for Netherlands seem to have similar RCA values. Nevertheless Japan and South Korea are more specialized in exporting manufactures than other countries in analysis while Spain is the least specialized country amongst others in the list.

2. Theoretical Links and the Model

Building export competitiveness is a long, costly, and risky process, as it calls for large investment in research and development, advanced technology, high-quality infrastructure and close interactions between firms and research institutes (Zhang, 2015). From this point of view, in this study, a set of variables including physical capital, labor cost, R&D, mobile phone subscriptions as a proxy for telecommunication aspect of infrastructure, the share of high-tech exports in total manufacturing exports ad inward FDI inflows are selected for the analysis.

As the stock of physical capital increases, a country experiences capital deepening which provides for a more productive labor force and thus enhances industrial upgrading. We used gross fixed capital formation to manufacturing sector output ratio in this framework to capture the share of physical capital in manufacturing sector output. Labor costs make up a large portion of total production costs for many industries, especially labor-intensive sectors. We used wages to manufacturing sector output ratio which indicates the share of wages in the total value of manufacturing sector output. The low ratio is a possibility of low level of average wage rates which implies stronger advantage in international markets for given labor productivity.

On the other hand, both capacity and technology of industry depend on the availability and quality of infrastructure, ranging from roads and ports to telecommunication. Poor transport and communications infrastructure isolate countries, limiting their participation in global economy (Limao & Venables, 2001). Sometimes, the costs of telecommunications may be more important than the costs of shipment of products (Radelet & Sachs, 1998). Moreover, the increase in outsourcing activity in the last decades was in part related to improvements in communication technology (Feenstra, 1998). So we used mobile cellular phone subscriptions per 100 people as a proxy for telecommunications aspect of infrastructure.

Similarly, domestic technological effort is an important determinant of both quality (exports upgrading) and quantity (exports capacity) which highlights the importance of domestic R&D. There is a circular loop of self-reinforcing relations between R&D, new products and exports. This suggestion has the following dynamics: R&D efforts lead to successful innovations; new products drive the acquisition of export market shares; strong exports enhance R&D efforts (Bogliacino & Pianta, 2013a, 2013b; Guarascio et. al., 2015). We used R&D expenditures as its share of GDP.

Another explanatory variable is the share of high-technology exports in total manufacturing exports. High-tech is a common term for industries that use relatively large shares of their resources on R&D and develop new products and processes (Fagerberg, 1995). The strategies pursued by countries to build industrial competitiveness exhibit some similarities. While a part of export growth has certainly based on the better exploitation of natural resources and unskilled or semi-skilled labor, the most dynamic performers have relied on the creation of new advantages in complex products. This has been based, in turn, on new domestic skills and technologies (Lall & Urata, 2003). This suggestion highlight the significance of both R&D and high-tech products in manufacturing exports.

Following Hausman, Hwang & Rodrik's (2007) "what a country exports matters" suggestion, we aim to test the effects of the share high-tech exports in manufacturing exports, i.e. export upgrading on RCA in OECD countries. This modern view of specialization is an important driver of this study.

FDI has a more complex relationship with trade and export competitiveness. In general terms, FDIhas been blamed for reducing employment in home countries while it is said to increase employment, to generate transfers of technologies, to encourage growth and exports in host countries. In theory, FDI can be either trade creating or trade replacing. Trade creation occurs when FDI opens access to a new market and facilitates exports from the home country to the recipient country/region. FDI can be realized to establish marketing and distribution channels that in turn facilitate exports of final goods and services to recipient country. When this is the case, FDI and exports are complementary.

On the other hand, trade diversion occurs when trade and FDI are substitute modes of supplying, therefore previous exports of final products from the home country are displaced by local production, or home country exports to third countries are replaced by a foreign affiliate's exports (Rivera-Batiz & Oliva, 2003).

Furthermore, it is also suggested that FDImay lower or replace domestic savings and investment for indigenous exporting firms; transfer technologies that are low level or inappropriate for the host country's factor proportions; target primarily the host country's domestic market and thus not increase exports; inhibit the expansion of indigenous firms that might become exporters; and not help develop the host country's dynamic comparative advantages by focusing solely on local cheap labor and raw materials (Zhang, 2015).

And sometimes a country which is comparatively advantageous can attract FDI inflows rather than give rise to internationally competitive national firms. The presence of competitive foreign firms in a country may prevent or delay the development of indigenous firms, who cannot compete against foreign firms (Nachum, Dunning & Jones, 2000). This is the crowding out effect of FDI in the host country that also counts as substitute modes of supply.

So we used FDI as one of our explanatory variables to find out its effects on export competitiveness of countries in analysis. We used sector specific data of FDI net inflows to countries in analyze. Our variable is the ratio of FDI (of manufacturing sector) to manufacturing sector output.

The dependent variable of the model is the RCA values of manufacturing sector exports.

Thereby, our model is as follows:

$$rca_{it} = \beta_0 + \beta_1 fdi_{it} + \beta_2 gfcf_{it} + \beta_3 w_{it} + \beta_4 htech_{it} + \beta_5 rd_{it} + \beta_6 m_{it} + \varepsilon_{it}$$

Where *rca* is revealed comparative advantage index, *fdi* is foreign direct investment to output, *gfcf*is gross fixed capital formation to output, *w* is wage to output, *htech* is the share of high-technology exports in manufactured exports, *rd* is the share of research and development expenditures of GDP and *m* is the number of mobile cellular subscriptions per 100 people. β_0 is the constant and ε_{it} is the error term of the model.

3. Data

Manufacturing sector-specific data is used in this study. Because sector-specific FDI data is relatively limited, we have 12 OECD countries for analysis. These countries are Finland, France, Germany, Hungary, Italy, Japan, Netherlands, Poland, South Korea, Spain, Turkey and USA. The analysis covers 1999-2010 period.

The sources of data are presented in Table 2.

Table 2. *Data Sources*

RCA (manufacturing exports)	WTO
FDI Inward (manufacturing sector)	OECD
Gross fixed capital formation (manufacturing sector)	UNIDO
Output (manufacturing sector)	UNIDO
Wages and salaries	UNIDO
Research and development expenditure (% of GDP)	World Bank
Mobile cellular subscriptions (per 100 people)	World Bank
High-technology exports (% of manufactured exports)	World Bank

Moreover, Table 5 in Appendix A presents the summary statistics of the data.

4. Methodology

We used static panel data techniques to carry out the estimations. We employed both fixed-effects model and random effects model. The fixed-effects model and random effects model can handle systematic tendency of individual specific components to be higher for some units than for others and possible higher in some time periods than others. Furthermore, these models have the advantage to adjust for heteroscedasticity. To deal with the problem of outliers, we used robust regression, which minimizes the influence of the outliers.

5. Empirical Results

First of all, thedecision between fixed effects model (FEM) and random effects model (REM)is confirmed with Hausman Test.

Hausman's statistic is defined as,

$$H = (b_{FE} - \hat{\beta}_{RE})'[V_{FE} - V_{RE}]^{-1}(b_{FE} - \hat{\beta}_{RE})$$

where b_{FE} and V_{FE} are the coefficient vector and estimated asymptotic covariance matrix estimators from the FEM; $\hat{\beta}_{RE}$ and V_{RE} are estimators from REM model. If the null hypothesis is rejected, it means that the random effects model is not consistent. Our results show that REM is consistent, but FEM is not (Table 3).

Then, Breusch-Pagan Lagrange Multiplier (LM) test is used to test for random effects. Rejection of the null hypothesis means that REM is a better estimator than pooled OLS. The LM test statistic looks like this:

$$LM = \frac{nT}{2(T-1)}\left[\frac{T^2\bar{e}'\bar{e}}{\bar{e}'\bar{e}} - 1\right]^2$$

Our test statistic of Breusch-Pagan Lagrange Multiplier (LM) test indicates that REM is more efficient (Table 3).

Depending on the results of both tests, we prefer to use the random effects model. The results of FEM and REM are shown in Table 3.

In the last step, we employed robust regression of REM, which is our main model and is summarized in Table 4.

Table 3. *Model specifications (Dependent variable: rca)*

Variables	FEM	REM
Fdi	- 0.3435[-2.21]**	- 0.4050[-2.38]**
Gfcf	0.3207[1.84]*	0.3792[2.00]**
W	- 0.9087[-3.91]***	- 0.8711[-3.72]***
Htech	0.0038[4.64]***	0.0025[3.21]***
Rd	0.0527[4.04]***	0.0374[3.33]***
M	0.0009[9.30]***	0.0009[8.63]***
Constant	1.0123[26.26]***	1.0613[26.54]***
R^2: within	0.70	0.69
R^2: between	0.07	0.10
R^2: overall	0.11	0.16
Observations	135	135
Number of countries	12	12
LM test = 379.21(0.0000)		
Hausman test =10.16(0.1181)		
Pasaran CD test =0.892(0.3725)		
Wooldridge test for autocorrelation = 0.711(0.4169)		

Notes: (i)***, ** and * denotes significant at 1%, 5% and 10% level; (ii) t-statistics are in brackets; (iii) corresponding critical values are in parentheses.

As presented in Table 3, the results show that all variables are statistically significant in both FEM and REM regressions. The signs of *fdi* and *w* are negative, whereas *gfcf, htech, rd* and *m* are positive.

Table 4. *Model specifications (Dependent variable: rca)*

Variables	REM
Fdi	- 0.4050[-2.67]***
Gfcf	0.3792[1.89]*
W	- 0.8711[-3.17]***
Htech	0.0025[2.07]**
Rd	0.0374[2.01]**
M	0.0009[8.40]***
Constant	1.0613[18.08]***
R^2: within	0.69
R^2: between	0.10
R^2: overall	0.16

Notes: (i)***, ** and * denotes significant at 1%, 5% and 10% level; (ii) Robust t-statistics are in brackets.

The results of our model show that all variables are statistically significant. The signs of *fdi* and *w* are negative and they are statistically significant at 1% level, whereas the sign of *m* is positive and is also statistically significant at 1% level. The signs of *htech* and *rd* are positive and they are statistically significant at 5% level. The sign of *gfcf* is also positive and is statistically significant at 10% level.

6. Conclusion

The aim of this study is to analyze the determinants of export competitiveness in manufacturing sector exports of OECD countries. For manufacturing sector, one of the main competitiveness criteria is maintaining and improving its position in the global market. In this context, we used a 12 country-12 year panel data set with 6 explanatory variables. We calculated the manufacturing sector RCA Index values of the selected countries which showed that most of them are specialized in manufacturing exports. Then we used a panel data random effects model. The results of our analysis suggest that conventional variables such as physical capital and labor cost mostly determine the export competitiveness of manufacturing sector in OECD countries. Furthermore, FDI to the manufacturing sector has not contributed positively to the export competitiveness of OECD countries in 1999-2011 period. When multinational firms target the same markets with the host country via FDI, it does not create an increase in host country's exports. FDI might have a crowding-out effect on domestic firms either. In case of the selected 12 OECD countries, FDI to manufacturing sector has a negative impact on host country exports, probably because domestic production and FDI have been substitute modes of supplying. Infrastructure variable has a positive effect on RCA which is an expected result. The share of high-tech exports in total manufacturing exports also has a positive effect on RCA. This finding is related to industrial upgrading which is an important component of export competitiveness. Following Hausman, Hwang & Rodrik (2007), we emphasize the importance of export upgrading. If these countries promote high-tech products by increasing R&D, enhancing modern infrastructure and capital deepening, they may maintain and increase their level of manufacturing export competitiveness.

Appendix A

Table 5. *Summary statistics*

Variables	Mean	S.D.	Min	Max
rca	1.1736	0.1033	0.9056	1.3721
fdi	0.0108	0.0156	-0.0446	0.0978
gfcf	0.0472	0.0182	0.0243	0.1397
w	0.1137	0.0302	0.0666	0.2085
htech	18.0064	10.2847	1.4740	35.8065
rd	1.9379	1.0070	0.4676	3.9383
m	82.4150	30.8568	10.3060	156.3055

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