The sophistication of Chinese exports and its impact on EU15: the case of the high-tech goods

Veronika Končiková, Robert Barca, Jakub Buček

Abstract: During the last few decades China has experienced an unprecedented economic growth and saw an immense boom of its exports. Though China is known mostly for its exports of textiles and toys, electronics and high-tech goods are becoming its major export commodity. This article combines a debate about the sophistication of Chinese goods and the research focusing on the impact China has on other economies. The aim of this paper is to examine the impact of Chinese exports of high-tech goods on the exports of EU-15 heading to the OECD markets in the period 2010-2014. This paper shows that developed countries have

1 Masaryk University, Faculty of Economics and Administration, Department of Economics, Lipová 41a, Brno 602 00, 207077@mail.muni.cz, robobarca@gmail.com.
no reason to fear Chinese competition in the high-tech sector because Chinese impact seems to be marginal.

Key words: trade, gravity model, high-tech, exports, China, European Union

JEL Classification: C01, F10

Introduction

In the last decades China has become an essential phenomenon among researchers in the field of economy. China’s important economic power accompanied by successful economic reforms which transformed into significant economic growth and boom of exports attracted attention of numerous researchers. The question which role is China playing in the world economy is in the center of plentiful studies. Lots of focus is put on the research of Chinese exports which are closely related to the economic miracle China has experienced in the last decades.

Two interesting debates have appeared especially important when it comes to Chinese exports. First of all, China seems to be very successful in the field of exports. Most importantly, Chinese exports grow not only on the intensive, but also on the extensive margin. This extensive growth is accompanied by emergence of export articles which are typical export goods of developed countries. Hence, many papers discuss to which extend Chinese export goods are more sophisticated than its income level
would suggest. Second, there is a broad range of articles which evaluate
what is China’s impact on other economies and their exports.

Our paper links these two debates. Reflecting both, the rising importance
of Chinese high-tech exports and the impact China has on other econ-
omies, we study the impact of Chinese high-tech exports on the high-tech
exports of selected European countries in the third markets.

The goal of our paper is to evaluate whether China is a competitor for the
EU-15 high-tech exports in the OECD markets. To answer our research
question we use the methodology of gravity models which is the most
widely used empirical tool to assess international economic flows.

Our paper consists of three main parts. First part in brief presents the
development of Chinese economy and its export performance. It also
analyses the structure and main features of Chinese exports. Most im-
portantly, it links the debate about sophistication of Chinese exports with
the aim of our paper. In the second part we focus on the literature review
of articles which discuss Chinese impact on other economies especially
via its export performance. The last part discusses the methodology of
gravity models and applies them in the context of competition between
Chinese and European exports in the OECD markets.
**Chinese exports**

Given that the aim of this paper is to assess the impact of selected Chinese exports on the exports of the EU-15, we need to first understand the characteristics of Chinese exports. If it was not for the remarkable growth of Chinese exports in its volume and sophistication, a research on Chinese impact on developed countries would not be well-founded.

The growth of Chinese exports is strongly correlated with the economic growth of China. Ever since the economic reforms were introduced by Deng Xiaoping, Chinese economy has undergone multiple changes which lead to notable economic growth\(^2\). Moreover, in the year 2014, measured by purchasing power parity, China has become the biggest economy in the world (IMF, 2015a). As demonstrated by the Figure 1, this development went hand in hand with China´s emergence as the world´s major trade power.

\(^2\) Between the years 1980 and 2013 China grew on average 9.87% (IMF, 2015c)
While in the sixties the Chinese exports were almost non-existent, in the year 2006 exports accounted for 35.65% GDP and in the year 2014 it was 22.61% of Chinese GDP (World Databank, 2015a). The development of the volume of the Chinese exports and imports over time is represented in the Figure 2.

*Source: World Databank, 2015*
Characteristics of Chinese exports

In order to assess whether the research question proposed by this paper is relevant, it is necessary to understand some important features of Chinese exports. First of all, our paper is going to study EU-15 and Chinese exports into OECD markets. Therefore it is necessary to ask to which countries China exports. Second, it is necessary to evaluate the product struc-
ture of Chinese exports to see if the possibility of overlap between EU-15 and Chinese exports might exist.

It is understandable that the biggest proportion\(^3\) of Chinese exports heads to Asia. However, the share of exports to Asia is lessening at the expense of other continents. In the year 2013 24% of Chinese exports went to North America and 22% went to Europe (OEC, 2015). OECD countries are among the biggest export destinations for China. As the Table 1 shows that the three biggest OECD destinations for Chinese exports (United States, Japan and Germany) accounted for 30.4% of Chinese exports.

Table 1: The most important Chinese export destinations in 2013

<table>
<thead>
<tr>
<th>rank</th>
<th>Partner country</th>
<th>% of total exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>United States</td>
<td>19</td>
</tr>
</tbody>
</table>

\(^3\) Out of total, 43% of Chinese exports headed to Asian countries in 2013 (OEC, 2015).
When it comes to product structure of Chinese exports, in Figure 3 we observe the vast change in structure of Chinese exports in the last decades. While the proportion of “Manufactured goods classified chiefly by material”\(^5\) has remained stable over the observed period, the groups of commodities “Machinery and transport equipment” and “Miscellaneous manufactured articles” has growth substantially. We can see that these

\[
\begin{array}{|c|c|c|}
\hline
2. & Hong Kong\(^4\) & 12 \\
\hline
3. & Japan & 7,3 \\
\hline
4. & Germany & 4,1 \\
\hline
5. & South Korea & 3,6 \\
\hline
\end{array}
\]

*Source: OEC, 2015*

\(^4\)Hong Kong is China’s second biggest export destination because of role as re-exporter of Chinese goods.

\(^5\)This group includes traditional Chinese export commodities such as textiles.
two groups, which also include commodities considered as high-tech, create nowadays the essential part of Chinese exports.

Figure 3: Structure of Chinese exports (SITC classification)

Table 2 presents three most important products exported by China. Together they represent approximately 60% of all Chinese exports. We can see that electronics and machinery are the most important export commodities. These types of goods are often exported also by developed countries, such as the EU-15.

Source: UN Comtrade, 2015
Table 2: Proportion of selected commodities of total exports (2013, SITC rev.3)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Commodity</th>
<th>% of total exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Electronics</td>
<td>35</td>
</tr>
<tr>
<td>2.</td>
<td>Machinery</td>
<td>14</td>
</tr>
<tr>
<td>3.</td>
<td>Garments</td>
<td>13</td>
</tr>
</tbody>
</table>

*Source: OEC, 2015*

*Chinese exports and high-tech*

In the last subchapter we have shown that the Chinese export structure and characteristics are evolving over time. The aim of this subchapter is to provide reasoning why it is interesting to study the potential impact of Chinese export growth on developed European countries and explains the motivation to select the high-tech sector as the focus of our research. In this subchapter we show that exports of China and the fifteen European countries are increasingly overlapping in the last years and that products classified as high-tech play more and more important role in the Chinese exports.
Today, China cannot be identified merely with the production and exports of cheap garments which are typical export articles of developing countries. Obviously, China keeps playing important role in its traditional export articles such as clothes and garments. However, successful Chinese companies such as lenovo or huawei prove that China is moving towards the production and exportation of more sophisticated products.

In the last decade a rich debate about sophistication of Chinese products have emerged among economists. On one hand, this debate is crucial for our research question, because it illustrates the possible interpenetration between the Chinese exports and the exports of industrialized countries. On the other hand it also presents arguments which are skeptical towards the high sophistication of Chinese exports and can be useful when interpreting the results obtained by our model.

The data about Chinese exports clearly show that we can observe a shift in Chinese export structure. Končiková and Hloušek (2014), Hloušek and Končiková (2014) and Končiková (2014) prove that in the last decades Chinese exports were growing on intensive as well as extensive margin. This means that Chinese exports grow due to two effects. First, Chinese exports growth thanks to the bigger volume of traditionally exported Chinese exports. Second, Chinese exports growth is also caused by new products being exported from China.
In the previous text we have observed on data that there is a change in the Chinese export structure. Here we should explain the motivation behind selecting the high-tech goods as the commodities we study in our paper. First of all, we study the impact on the European exports. Therefore we should select a commodity which is crucial for the export of European countries. This task is quite difficult given the heterogeneity of exports of European countries. As the Figure 4 and Figure 5 illustrate, European Union has been the world’s leader in the export of the high-tech goods, accounting for more than 30% of world’s exports each year. However, China is quickly catching up. Moreover, the high-tech exports accounted in the year 2013 for 27% of total Chinese exports, while they accounted only for 14% of total EU exports and 18% of total US exports (Worddatabank, 2015).
Figure 4: The proportion of selected countries on the world’s high-tech exports

![Proportion of Chinese, EU and US exports of high-tech on the total high-tech exports](source: World databank, 2015)

The figure 5 shows the volume of Chinese, EU and US high-tech exports. We observe that the high-tech exports were growing globally in the last two decades, however the growth rate of Chinese high-tech exports was significantly more important than that of the other countries. In the Figure 5 we also observe a decline in the volume of European high-tech exports starting from the year 2011. This could indicate a growing competition between Chinese and EU high-tech exports. In our work we focus only on the EU-15 countries because these countries export 90% of all EU high-tech exports (World databank, 2015).
When we compare the high-tech exports of China and EU-15 in bigger detail, we can find out that they focus on different types of high-tech products. However, they largely overlap in the commodities defined by SITC as "Automatic data-processing machines and units". This is the most important Chinese export commodity which in the year 2014 accounted for 37.8% of all Chinese high-tech exports. As we can see the data encourage our hypothesis that Chinese exports increasingly overlap with the exports of developed countries and China might therefore become an export competitor for the developed countries.

**Impact of Chinese export performance on other economies**

The first chapter has presented the data on the change happening in the Chinese export structure. This chapter will include literature review on
the topic how Chinese exports are influencing the development in other economies. It will be divided into two parts which are also chronological given the evolution of the Chinese export structure explained in the previous chapter. First we will study literature emphasizing the Chinese impact on developing economies and later we will highlight new studies which focus on the impact China might have on developed economies.

*Impact of Chinese export performance on developing countries*

It is understandable that first papers analyzing the impact China might have on others economies were focusing on the developing countries because in the past Chinese exports mostly overlapped with the exports of developing countries. Moreover, most of these studies focus on the Asian countries which are in the geographical proximity to China. Among the papers analyzing the impact on Asian economies are McDonald et al. (2011), Greenaway et al. (2008), Llal and Albaladejo (2004) Eichengreen et al. (2004) or Ahearne et al. (2003). However, papers focusing on the impact Chinese rise had on the Sub-Saharan Africa such as Giovanetti and Sanfilippo (2009), Jenkins and Edwards (2006) or Kaplinky and Morris (2008) have emerged. There are also papers which study the impact on Latin American countries. Among them for example Freud and Ozden (2006), Montenegro et al. (2011), Jenkins et al. (2008) or Alvarez and Claro (2008).
All this papers study the impact Chinese economic rise, most importantly its rise as world’s trade power, had on the other countries of the world. The results of these studies are mixed. Some of them find negative impact of China on the selected countries, other find positive impact which is connected with the opportunity to expand on the growing Chinese market and others, such as Eichengreen and Tong see it as a mixed blessing bringing both - the positive as well as negative impact - on the developing countries.

At first sight, it might even seem that the results of the studies bring contradictory results. However, we need to keep in mind the following:

(a) the results might be dependent on the selected time period. As we have demonstrated in the first chapter, the structure of Chinese exports was changing over time;

(b) it is very important what data and at which level we observe. If we use aggregated data and we study the total effect for one country or a region we might find statistically insignificant results or impact close to zero. This is because China might have different impact on different sectors and after summing up those impacts the total effect might be marginal. For example Montenegro et al. (2011) use aggregation for Latin American countries and found no effect. Similarly, Hanson and Robertson (2008) selected ten countries with similar export structure as China has and they found only marginal negative effect on those countries. On
the other hand, studies which focus only on selected sectors and countries often find negative effect caused by the increased Chinese exports. Freund and Ozden (2006) for example find negative impact on some industrial products exported to the countries of western hemisphere.

(c) of course it is very important which export commodities are selected and to which extend Chinese exports overlap with the exports of the selected countries.

**Impact of Chinese export performance on developed countries**

This literature is being studied only in the last few years. It is an answer on the changing structure of Chinese exports. In this subchapter we will focus on developed Asian countries, such as Japan, newly-industrialized economies (NIE) and also on the literature focusing on the European countries.

Indirectly were developed countries studied already in Eichengreen at al. (2004). They concluded that in the case of capital goods China does not have negative impact on the developed Asian countries such as Japan or NIEs. On the contrary, the growth of China enhance these economies because it brings opportunity to export to the Chinese market. On the contrary, Greenway et al. (2004) state that the countries facing the Chinese competition most intensively are those Asian countries with higher income per capita. Their work demonstrates that the final goods are being pushed out of the market due to Chinese competition, however the case is
more complicated given the global value chains which operate through the region. These results therefore indicate that when interpreting the results of our work we need to take into account the changing structure of trade and the existence of global value chains.

Bernard et al. (2006) study how the competition from countries with cheap labor impact the industrial production in the USA. They come to the conclusion that the industries which are labor-intensive vanish and the companies which survive move to the production which is more capital-intensive.

In the recent years there were also studies which assessed the impact of China on European countries. Giovannetti et al. (2011) studied the impact on France, Germany, Italy and Spain. Flückiger and Ludwig (2012) studied the impact of China on European economies.

**Chinese and EU-15 high-tech exports**

In this chapter we will study the impact of Chinese high-tech exports on the EU-15 exports to the OECD markets. In our model we explain the determinants of the EU high-tech exports to the OECD countries. We take the standard gravity models variables to explain the determinants of this trade but we add Chinese exports to the same destination as one of the determinants of EU-15 trade in high-tech. In this way we can assess whether China is a competitor to EU-15 countries in the OECD markets and if the Chinese high-tech exports have negative effect on EU-15 ex-
ports. In this chapter we first present the data used in our paper, later we explain our methodology and at the end we present the results of our estimations.

**Data**

The data used in our dataset are taken from different databases. Our dependent variable is "Exp_EU$_{it}$" - the exports of 15 European Union countries on the OECD countries in the high-tech sector. That means that we have created pair of countries in each of the commodity considered as the high-tech commodity. The data are taken from the UN Comtrade database. We have used the SITC classification.

In our model we use eight independent variable. They are the following:

"Exp_China$_{it}$" - these are exports from China in the high-tech commodities to the same OECD countries as in the case of European exports. These data also come from the UN Comtrade database and we use the SITC classification.

"GDP_EU$_{it}$" - this is the GDP of European countries in the time. These data come from World databank constructed by the World bank.

"GDP_OECD$_{it}$" - this is the GDP of OECD countries in the time. These data come from World databank constructed by the World bank.
"Pop_EU_{it}" - this is the number of population living in each of the EU-15 countries. The data were obtained from the World databank.

"Pop_OECD_{it}" - this is the number of population living in each of the importing OECD countries. The data were obtained from the World databank.

"Language_{it}" - this is a dummy variable. It comes from the CEPII database and it is "1" in case at least 9% of the population share the same language, it is "0" if it is not the case.

"Distance_{it}" - it is the distance between the capital cities of those countries which trade together. In our model it is always distance between capital of one of the EU-15 countries and one of the OECD countries.

"Borders_{it}" is a dummy variable. It is "1" if the countries observed share the same border and it is "0" if they do not.

**Methodology**

Our methodology derives from the wide literature on the gravity models. Therefore we use as main explanatory variables for high-tech trade between EU and OECD countries the GDP of exporting as well as importing countries and the distance between them. There are various estimation techniques used with the gravity models. However, Končiková et al. (2016) show that even if the results of different estimation technique differ, the main conclusions for our model stay the same. Therefore we have
opted to use the panel data model. The Hausman test has shown that the random effects are more suitable than the fixed effects. Therefore we have estimated the following panel model with random effects:

\[ \log(\text{Exp}_\text{China}_{it}) = \alpha + \beta_1 \log(\text{Exp}_\text{China}_{it}) + \beta_2 \log(\text{GDP}_\text{EU}_{it}) + \beta_3 \log(\text{GDP}_\text{OECD}_{it}) + \beta_4 \log(\text{Pop}_\text{EU}_{it}) + \beta_5 \log(\text{Pop}_\text{OECD}_{it}) + \beta_6 \log(\text{Language}_{it}) + \beta_7 \text{(Distance}_{it}) + \beta_8 \text{(Borders}_{it}) + \mu_{it} + \varepsilon_{it} \]

**Results**

The following table shows the results of our estimations. We can observe that the coefficients of the variables behave as the theory suggest. In order to answer our research question, the most crucial variable is the Chinese exports. We can see that the coefficient is negative. So when the Chinese exports growth by 1%, the EU exports of the same commodity to the same country decreases by 0.171%. Therefore our model might confirm the hypothesis that Chinese exports are becoming competition for developed countries, however, we can see that this effect is marginal.

| Variable              | estimate  | std. error  | t-value   | p(>|t|)       |
|-----------------------|-----------|-------------|-----------|--------------|
| (intercept)           | -3.6448e+01 | 2.4864e+00  | -14.6593  | < 2.2e-16    | ***          |
| ChExj,t (China exports)| -1.7149e-01 | 4.2757e-02  | -4.0108   | 6.240e-05    | ***          |
| GDP it (EU)           | 1.1598e+00  | 9.9102e-02  | 11.7028   | < 2.2e-16    | ***          |
| GDP jt (OECD)         | 1.3209e+00  | 1.1227e-01  | 11.7655   | < 2.2e-16    | ***          |
| Population it (EU)    | -2.3264e-01 | 9.0485e-02  | -2.5710   | 0.0102005    | *            |
| Population jt         | -2.3991e-01 | 9.0502e-02  | -2.6508   | 0.0080827    | **           |
(OECD)

<table>
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<tr>
<th></th>
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<th>0.0001117</th>
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<td>1.4124e-05</td>
<td>-8.1738</td>
<td>4.814e-16</td>
<td>***</td>
</tr>
<tr>
<td>Distance</td>
<td>1.0308e+00</td>
<td>2.2674e-01</td>
<td>4.5459</td>
<td>5.745e-06</td>
<td>***</td>
</tr>
</tbody>
</table>

References


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