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VYROBENÉ V ČÍNE: HROZBA PRE EURÓPSKY HIGH-TECH SEKTOR?

MADE IN CHINA: A THREAT TO EUROPEAN HIGH-TECH SECTOR?

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V posledných dekádach zaznamenala Čína mimoriadny nárast celkového objemu exportov a zároveň zmenu exportnej štruktúry. Z prevažne jednoduchých výrobkov, náročných na prácu, sa čínske exporty posunuli smerom k sofistikovanejším produktom. Obzvlášť významný bol nárast v sektore elekroniky a high-tech výrobkov, ktoré boli až doposiaľ doménou vyspelých priemyslových krajín. Použitím gravitačného modelu sa v tejto práci snažíme zistiť, do akej miery predstavujú čínske high-tech exporty konkurenciu pre krajiny Európskej únie na partnerskom trhu krajín OECD v roku 2013. Výsledky nášho výskumu poukazujú na fakt, že nárast čínskych exportov nemá negatívny, ale naopak pozitívny vplyv na európske exporty v sektore high-tech, aspoň pre obdobie roku 2013. [2]
Kľúčové slová: Čína, exporty, obchod, gravitačné modely, high-tech
JEL: C40, C49

In the last decades China has seen a spectacular rise in its export performance. In the same time it has experienced an important change in its export structure. Chinese exports have moved from predominantly exports of low-labor intensive goods towards higher sophistication of its export products. A particular rise was observed in the products such as electronics and other high-tech products which were for long time believed to be a domain of industrialized countries.

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Using gravity model we try to evaluate whether Chinese exports in the high-tech products during the year 2013 were competition for the European exporters in its OECD export markets. The results of our model suggest that the competition in the developed markets is not very high, in contrast, we observe that there is a small, but positive impact of rising Chinese exports on the European exports, at least in the year 2013.
Key words: China, exports, trade, gravity models, high-tech
JEL: C40, C49

1 CHINA AND TRADE

China is one of the largest economies in the world with the world's highest population. However, the main reason why China attracts attention of the researchers all around the world is its economic performance in the last decades. Ever since Deng Xiaoping has introduced the first economic reforms in China, the country underwent substantial changes which lead to an impressive economic growth. It is widely accepted that one of the main drivers of China's economic performance has been its gradual opening to the global markets.

A huge part of Chinese success can be attributed to its export performance. While in the year 1966 Chinese exports contributed by 3.53% to the GDP, in the year 2014 it was 22.61% of the GDP. In the peak year of 2006 the exports amounted to as much as 35,65% of the country's GDP (World Databank, 2015a). Hand in hand with the growth of exports, China's world trade relevance has been evolving. During the 60s Chinese international trade was mostly irrelevant from the world's perspective, as of today though China is the world's biggest exporter of goods (CIA database 2015). The following Graph 1 illustrates the immense growth of Chinese exports. We can see that the Chinese growth of the exports of goods and services was unprecedent.

Graf 1: Chinese exports of goods and services (volume in current USD)

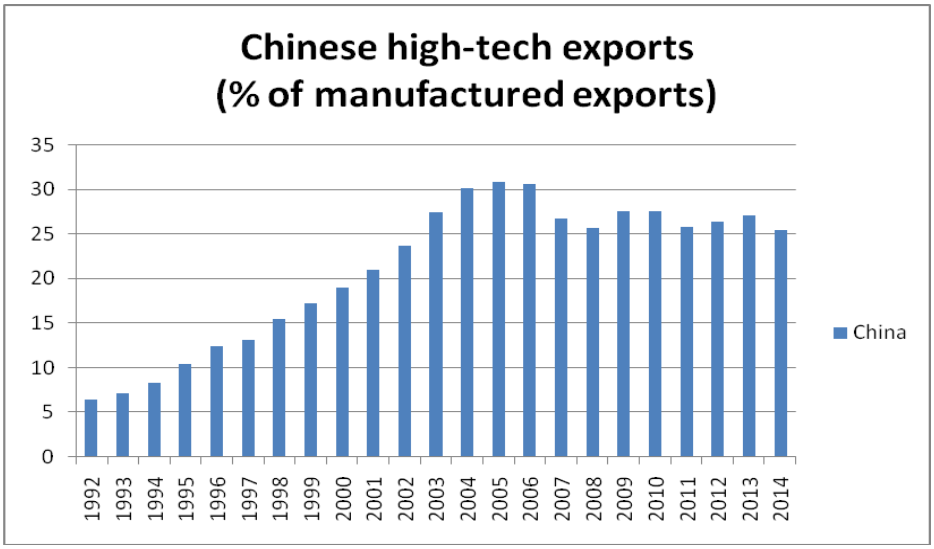
Source: World databank (2015b)

Economists have been discussing not only the growth of exports in its volume, but in its level of sophistication too. Rodrik (2006) suggested that Chinese exports were more sophisticated than we might expect based on its per capita income. This paper has opened an important discussion about the level of sophistication of Chinese exports. Many researchers have disagreed with Rodrik and they have proposed diverse explanations why Rodrik's conclusions might be mistaken. According to Schott (2008), the lower prices of the Chinese goods on world market indicate their lower quality. Xing (2012) highlights that country with such a low investment in research and development cannot become an exporter of sophisticated production and that China acts as a mere assembly line for high-tech goods. Yinug (2009) shows a case study of semiconductor production in China which failed despite the government's effort to establish a high-tech production on its territory. Xu (2010) also argues that Rodrik's results are biased because of the fact that Chinese regions are very different when it comes to the income per capita.

All those arguments however do not change the fact that over time the production has been shifting from unsophisticated to a more sophisticated one. Such shifts are confirmed by numerous studies. Nataraja and Tandona (2011) or Amiti and Freund (2007) argue that this shift is due to the China´s participation in global value chains, but they do also confirm that the shift from lower-level of sophistication to higher-level of sophistication can be observed in China. Moreover, Cui and Syed (2007) prove that we can observe delinking between Chinese final exports and its imports of sophisticated intermediate goods. Končiková and Hloušek (2014) and Hloušek and Končiková (2014) also show that the variety of Chinese exports is becoming broader.

In addition, the Graph 2 illustrates how the high-tech sectors were playing increasingly important role for Chinese exports. It is notable, that from the year 2003 until nowadays the high-tech exports created more than one quarter of total manufactured exports of China.

Graf 2: Chinese high-tech exports as % of manufactured exports



Source: World databank (2015c)

Hence, for the needs of this paper we can conclude the following:

(1) Data show that Chinese exports are becoming more and more sophisticated. China is becoming one of the major exporter of the high-tech goods. Therefore we can assume that China is likely to become a competitor for the exports of not only developing countries, as it was the case in the past, but also it can compete on the world's markets with the developed countries.

(2) When interpreting the results of our empirical analysis we need to keep in mind the nature of the contemporary world trade and the essence of the available trade data. Many studies explain that the high-tech goods exported from China are not entirely made in China. In fact, only final assembling operations of imported sophisticated intermediate goods are often performed on the Chinese territory.

Given the observations of the Chinese export performance, we decided to evaluate whether the increase in Chinese high-tech exports has become a competition for the selected developed countries, i.e. whether such increase has a negative impact on high-tech export potential of developed world. We will try to answer this research question using a gravity-type econometric model.

2 GRAVITY MODELS AND THEIR USE IN TRADE ECONOMICS

Nowadays, gravity models are widely used in the trade economics. They were first proposed by Pöyhonen (1963) and Tinbergen (1962). And as the name suggest, gravity models are inspired by the Newton's gravity theory. In trade economics,

gravity models study relationship between trade variables and other variables which either enhance trade or are barrier to the mutual trade flows.

In its basic form the gravity model looks as follows:

$$\ln(V_{ij}) = \alpha + \beta_1 \ln(HDP_i) + \beta_2 \ln(HDP_j) + \beta_3 Dist_{ij} + \epsilon_{ij}$$

V_{ij} is the trade flows between the country i and j. HDP_i is the gross domestic product of country i and HDP_j is the gross domestic product of country j and $Dist_{ij}$ is the distance between the pair of countries i and j.

The idea behind the gravity models is very intuitive. While the economic power of the countries involved is increasing their mutual trade, the distance between them is a proxy for transactions and transportation costs and therefore decreases the volume of trade flows. Other variables can be included in the regression analysis in order to test different hypothesis.

Recently, papers adding the variable of Chinese exports have emerged in order to test the impact of Chinese increasing competition on the exports of the investigated country's export. First, the literature on Chinese impact on developing countries has appeared. Ahaerne et al. (2003), Eichengreen et al. (2004), Llal and Albaladejo (2004), McDonald et al. (2006) and Greenaway et al. (2008) study the impact of China's rise on other Asian economies. Giovanetti and Sanfilippo (2009) use gravity models to assess the impact of China on Sub-Saharan economies. Nevertheless, Chinese exports were growing on the intensive as well as extensive margins. This means the volume of Chinese exports was increasing not only due to the growing exports in the traditional export commodities of China, but also thanks to the emergence of new exports products comming from China. Moreover, as pointed out by Schott (2008) Chinese exports were growingly overlapping with the exports of developed countries. These changes in Chinese export structure lead to new research questions concerning what impact Chinese export performance might have on developed countries. Is it possible that Chinese exports might in the short term become goods compeating not only with the low-tech products of low-income countries, but also with the sophisticated products from deeloped countries?

Hence, first papers about impact of Chinese exports on exports of developed countries were published. Giovanetti et al. (2011) studied the impact of Chinese exports on the exports of selected European countries (France, Germany, Italy and Spain). They found out that mostly traditional industries were impacted by the increasing Chinese exports. Therefore the impact on different countries seemed to be different. While some countries such as Italy saw decrease in its export volume due to the Chinese exports, countries such as Gemany seem even to profit from this area.

Flűckiger and Ludwig (2012) found a negative impact of Chinese competition on the exports of EU countries.

We follow this stream of literature to analyze the impact of Chinese high-tech exports on the high-tech exports of EU-15 into the OECD markets. We chose the high-tech sector because it includes important commodities such as electronics which were the fastest growing export of Chinese economy. In addition to this, European countries were for long time the leaders of the high-tech exports. The emergence of China as new producer of high-tech commodities could lead to the negative impact on the European export performance. Moreover, we have chosen as the export destination only OECD countries, because these are the most important export destinations for EU-15. The following chapter specifies the model and data used in this paper.

3 DATA AND METHODOLOGY

This paper is a first step in the research of Chinese impact on the high-tech exports of developed countries. Therefore it includes limited dataset of variables. First of all, it is important to note that we study the trade flows of only limited number of goods. Our research focuses on the trade in high-tech goods as defined by the Czech Statistical Office (CZSO 2015). This definition is based on the SITC (Standard International Classification) and includes 97 items.

We collected trade data for a pair of countries: the trade in selected high-tech items between the exporting developed countries and its destination markets. Our model will study the export performance of 15 European countries, more specifically the EU-15. The destination market is the 34 OECD countries. As mentioned in the previous chapter the choice of destination country was selected based on the volume of exports going from the EU-15 to the OECD. Therefore the explanatory variable of our model is the export flow from one of the European countries to one of the OECD countries. This dataset was constructed for the year 2013 and includes 48 015 observations after country pairs such as "Austria-Austria" are excluded from our dataset. After we excluded the observations with zero-trade-flows we obtain 22 839 observations. The trade data as well as the variable for nominal GDP were obtained from the OECD database (OECD 2015). Other gravity-type variables were used in our model as well. These were obtained from the CEPII database which is collecting datasets for gravity models (CEPII 2015).

As indicated in the previous chapter, the gravity-type model was used to find the impact Chinese high-tech exports have on the exports of EU-15. The model was specified as follows:

$$\ln(ExpEU_{ij}) = \alpha + \beta_1 \ln(ExpCHI_j) + \beta_2 \ln(HDP_{EU_i}) + \beta_3 \ln\left(HDP_{OECD_j}\right) + \beta_4 Dist_{ij} + \beta_5 \ln(Pop_{EU_i}) + \beta_6 \ln\left(Pop_{OECD_j}\right) + \beta_7 Borders_{ij} + \beta_8 Language9_{ij} + \epsilon_{ij}$$

As we can see, the model tries to explain the determinants of EU-15 high-tech exports to OECD countries (i is the exporting EU-15 country and j is the importing OECD country). To answer our research question it is important to include the explanatory variable representing the Chinese exports to the OECD markets. This variable can show us if there is a competition between the exports of EU-15 and Chinese exports in the third markets (in this case the markets of OECD countries).

Other independent variables of our model are the following:

- $\ln(ExpCHI_j)$ – logarithm of the exports of a SITC high-tech item from China to the OECD country j in the USD. We expect this coefficient to be negative. If Chinese exports in the high-tech sector are substitutes for the European high-tech sectors and in the same time the exports of these two entities are increasingly overlapping, then we should observe that rising Chinese exports should have negative impact on the European exports of the selected commodities.
- $\ln(HDP_{EU_i})$ – logarithm of nominal GDP of the EU country i in the USD. The gravity theory suggest that GDP of the exporting country positively enhance the exports of all its goods. Therefore we expect the coefficient for this variable to be positive.
- $\ln\left(HDP_{OECD_j}\right)$ – logarithm of nominal GDP of the OECD country j in the USD. A higher GDP of destination country suggests bigger market and therefore bigger demand for the imported goods. That is why gravity models suggest that the GDP of the destination country should have positive impact on the trade.
- $Dist_{ij}$ – distance between the capital cities of the EU exporting country i and OECD importing country j. The coefficient of the distance between the exporter and importer is expected to be negative. As mentioned in the previous chapter, it is the proxy for the transportation and transaction costs between exporter and importer country. Hence the distance should discourage the mutual trade flows. In our cases we used the distance between the capital cities to measure the distance between two selected countries.

- $\ln(Pop_{EU\,i})$ – logarithm of population of the EU country i. In this case there might be two possible effects population of exporting countries has on its exports. The country with bigger population is capable of exporting higher volume of export. On the other hand, the country with higher population might also use more of its production on the domestic consumption.
- $\ln\left(Pop_{OECD\,j}\right)$ – logarithm of population of the OECD country j. The number of population can indicate two things. On one hand, bigger the population, higher might be the demand for the domestic as well as foreign goods. But this information is already included in the GDP variable. On the other hand when the population of a country is bigger, the wealth of the country is spread among higher number of people. Moreover, some economic growth theories suggest that if the population is growing too fast, it might have neggative impact on the economic growth. This could go hand in hand with the imports of foreign goods. If the economic performance of a country is poor then also the amount of imported goods might be badly performing.
- $Borders_{ij}$ – dummy variable to show whether the EU country i and OECD country j share a common border. The variable is 1 if they share borders and 0 if they do not. This dummy gives us another information about the transportations and transaction costs. If countries share the same border the transportation costs are usually low and we can also expect some cultural proximity between these countries which makes the trade smoother.
- $Language9_{ij}$ – dummy variable for sharing the same language. The variable is 1 if they share a language (meaning that at least 9% of the population knows the common language) and 0 if they do not. Again, the existance of the common langauge between countries should smooth the trade between them. The common language might indicate not only the cultural proximity, but will also decrease other transaction costs. For example the companies do not necessarily need to hire translators and interpreters for business meetings and contracts.

4 RESULTS

The results of our model are summarized in the following table 1. We used the weighted least squares regression using 22 839 observations (however, 1 746 observations were omitted). The dependant variable is l_ExpEU and the weights were based on inverted fitted values of our model.

Table 1: WLS regression, dependant variable: l_ExpEU

	coefficient	std. error	t-ratio	p-value	

Const	−63,7031	1,33286	-47,7943	<0,00001	***
ln_ExpCHI	0,345609	0,00578135	59,7799	<0,00001	***
ln_HDP_EU	3,53773	0,0934686	37,8493	<0,00001	***
ln_HDP_OECD	0,670571	0,0538904	12,4432	<0,00001	***
Dist	−0,0906387	0,00379058	-23,9116	<0,00001	***
ln_Pop_EU	−2,29895	0,0862363	-26,6587	<0,00001	***
ln_Pop_OECD	−0,284658	0,0537512	-5,2958	<0,00001	***
Borders	0,993314	0,0614643	16,1608	<0,00001	***
Language	0,160701	0,0650357	2,4710	0,01348	**

Statistics based on the weighted data

Sum squared residuals	11007,63		S.E. of regression	0,722554
R-squared	0,368195		Adjusted R-squared	0,367955
F(8, 21084)	1535,879		P-value (F)	0,000000
Log-likelihood	−23070,73		Akaike criterion	46159,46
Schwarz criterion	46231,07		Hannan-Quinn	46182,83

Statistics based on the original data

Mean dependant var	12,72084		S.D. dependant var	3,180026
Sum squared resid	132782,6		S.E. of regression	2,509539

The table shows that our independent variables can explain almost 37% of the variability of dependant variable. All the independent variables we use are statistically significant. Moreover, the estimated impact is in accordance with theoretical expectations and comparable to past empirical studies within the area of gravity models. GDP of exporter as well as the importer has positive impact on the exports. Also dummy variables Borders and Language work as attractors in our model and behave as expected by the theory behind the gravity models. The same applies for the variable distance - the bigger the distance between the capitals of the countries i and j, the smaller is the traded volume.

First, we focus on the traditional regressors of gravity models and analyse the results of our model. Hence we spotlight the GDP, distance and dummy variables: We can see that the highest coefficient goes to the logharithm of gross domestic product of selected European countries. This means that the growth of GDP of the exporting country has the highest impact on exports among all the regressors we used. The positive sign of the coefficient which is higher then zero indicates that when the GDP of EU-15 grows, then the exports of the EU-15 will grow even faster. Also the GDP of importing countries - in our case the GDP of OECD countries - should have positive impact on the exports from EU-15. However, we can observe that this impact is much smaller comparing to the effect of the GDP of exporting countries. In fact, the table 1

shows that even if the effect is positive, the increase in the GDP of OECD countries will lead to relatively smaller increase in the exports of EU-15.

Another crucial variable for gravity models is the distance between the capital cities. We can see that our coefficient for distance is negative as predicted by the gravity models. However, the impact seems to be quite marginal and is much smaller then in other gravity model studies. The results in table 1 could be interpreted as follows: if the distance between capital cities increases by additional 1000km, the volume exported from one of the EU-15 decreases by approximately 0,09%. Such results might indicate several things: (a) the distance is not that crucial for the high-tech sector. This might be thanks to the dicreasing transportation costs. Moreover, the high-tech sector might easily use the low-cost transportation by sea because the high-tech goods are durable and do not require fast shiffting; (b) the distance between the capital cities is not always the best proxy; (c) we used also other variables as proxies for transactions and transportation costs.

The dummy variables also behave as the gravity models predict. The dummy variable Borders is 1 when the countries share a common border and it is 0 when it does not. We can see that the impact of sharing borders on the EU-15 exports is positive. The same applies for the dummy Language. When at least 9% of population shares the same language then the exports increase. It seems that sharing a border is more important for the trade then sharing a langauge.

When we observe the impact that Chinese exports have on the exports of EU-15 (ln_ExpCHI), we can conclude the following: in the year 2013 we cannot observe a competition effect and crowding of the European exports. On the contrary, it seems that Chinese exports go hand in hand with the growth of European exports of the high-tech goods to the OECD markets. This impact is statistically significant, however, it is quite small. One of the possible explanation is that Chinese and European high-tech goods are not perfect substitutes and both of them are driven by variables which were not reflected by our model. Schott (2008) also mentiones that even if the exports of developed countries and China are increasingly overlapping, the prices for the same products stay different. Schott´s findinds could therefore sustain the theory that the Chinese products are not perfect subsidies for the European products. However, other explanations might be possible. Today´s world trade is characterised by global value chains. Therefore it might be that China and EU-15 countries in fact cooperate in the production of the high-tech goods. Also the year we selected might be influenced by some external factors which are not included into our regressors. Our model might face ommited variables or even endogenity of the model could be observed. Moreover, our

dataset is quite limited and shoud be extended to more observations during different years and time period.

5 CONCLUSION

This paper has been evaluating the impact of Chinese export increase in the high-tech exports on the export of the same commodities from the EU-15 to the OECD markets. It contributes to the ongoing academic debate on the subject of measuring and quantifying the impact of China's industrial and economic surge of past decades.

Given the immense increase in the Chinese exports on the extensive as well as intensive margin as well as the growth of exports in the commodities classified as high-tech products, we expected that China might be crowding out exports of developed countries such as the EU-15 in its main export destinations. However, our model has shown that this is not the case. On the contrary, the EU-15 exports grow, albeit slightly, with the increase of Chinese exports to the same partner market. One of the feasible explanations is that Chinese and EU products are not perfect substitutes. However, our results are based only on one segment of the market. Further research in this field is necessary: more advanced econometric methods could be used, i.e. panel data analysis including time series observations, and the final market could be expanded up to the whole world instead of OECD market only. Therefore this paper opens the door for further discussion about how developed economies are affected by the emergence of China as the global trade power.

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