International Journal of Business, Human and Social Sciences
ISSN: 2517-9411
Vol:8, No:10, 2014

The Discriminate Analysis and Relevant Model for Mapping Export Potential

Jana Gutierrez Chvalkovská, Michal Mejstřík, Matěj Urban

***Abstract*—**There are pending discussions over the mapping of country export potential in order to refocus export strategy of firms and its evidence-based promotion by the Export Credit Agencies (ECAs) and other permitted vehicles of governments.

In this paper we develop our version of an applied model that offers "stepwise" elimination of unattractive markets. We modify and calibrate the model for the particular features of the Czech Republic and specific pilot cases where we apply an individual approach to each sector.

***Keywords*—**Export strategy, Modeling export, Calibration, Export promotion.

I. Introduction

THE identification of export potential is the most important part of defining the export strategy, which has also significant impact on country´s or firm´s competitiveness. The importance is even larger for small and open export-oriented countries such as the Czech Republic. These countries cannot use advantage of size of national market/economy. Thus they are usually limited in terms of number of strategic export industries. Such constraint as well as other specifics of small and open export-oriented countries increases the role of identification and ranking of export opportunities. Application of discrimination analysis for mapping export potential enables to take into consideration all limitations and specifics of small and open export-oriented economies and simultaneously reduces the potential costs of export strategy. Overall using modern analytical tools for definition of the export strategy results in significantly positive effect on firm´s or country´s competitiveness.

In our approach of the discriminate analysis, we emphasize both the demand side and supply side of the export opportunities. We use a multi-criteria model that identifies export opportunities for different types of goods- according to the breakdown of the Harmonized System of tariff nomenclature (HS). The model selects the appropriate export opportunities based on the absorption capacity of the import market, compatibility in relation to the Czech economy and growth potential. It takes into account the size of the import market, competitive advantage, barriers to trade, import intensity of exports, export sophistication, and other criteria.

The model uses the sequential elimination of less important markets based on selected criteria and combines this general elimination rule with additional criteria as expected growth, ease of doing business, economic complexity and political, commercial and other territorial risks as well as specific industry filters to encompass all individual differences of concrete sectors. This procedure enables besides creating the general model for prioritizing export opportunities an individual approach for different industries. This tool thus allows us to calibrate the model for specific cases such as Czech creative glass industry, Czech clean technologies or Czech pumping machinery. The paper is structured as follows: In the second section, we build the model of discriminate analysis for the Czech Republic and explain the process of prioritizing export markets based on selected criteria. The third section presents the data used in the model. The fourth section introduces the results of the model including selected pilot cases. Finally, the last section concludes the paper.

Jana Gutierrez Chvalkovská is with the Institute of Economic Studies, Faculty of Social Sciences, Charles University in Prague

Michal Mejstřík is with the Institute of Economic Studies, Faculty of Social Sciences, Charles University in Prague (e-mail: eeipmejs@iol.cz).

Matěj Urban is with the EEIP, a.s. (e-mail: matej.urban@eeip.cz)

II. The Discriminate analysis for Mapping Export Potential

The main motivation of the discriminate analysis and relevant model for mapping export potential is to identify opportunities for the Czech Republic's export promotion policy. In the first step we create the general model to specify priority markets and industries. Then we apply the modification of the model for discriminate analysis of concrete pilot cases.

The process of finding suitable export opportunities consists of stepwise elimination of unattractive markets, which are sequentially filtered based on specific elimination criteria, which are inspired by the set of papers by [4]-[9] and [13]. However the procedure is modified in order to take the specificities of Czech export into account. The Czech Republic is a small and open economy with strong focus on industry, especially machinery in its exports. Therefore we put greater emphasis on the supply side compared to the mentioned studies. The goal of the discriminate is not only to find an interesting market, but also a market, where the Czech Republic can be competitive with its production.

The discriminate analysis uses filters that eliminate less attractive market on criteria consisting of size of the import market, import growth, comparative advantage as in [2], import contents of export (in order to take value chains into account), barriers to trade, market importance and other criteria that match the supply side of export opportunities with the demand side. Besides the mentioned criteria it prioritizes the products based on export sophistication and encompasses the industry specific criteria. Fig. 1 displays the basic elimination process in general model of the discriminate analysis.

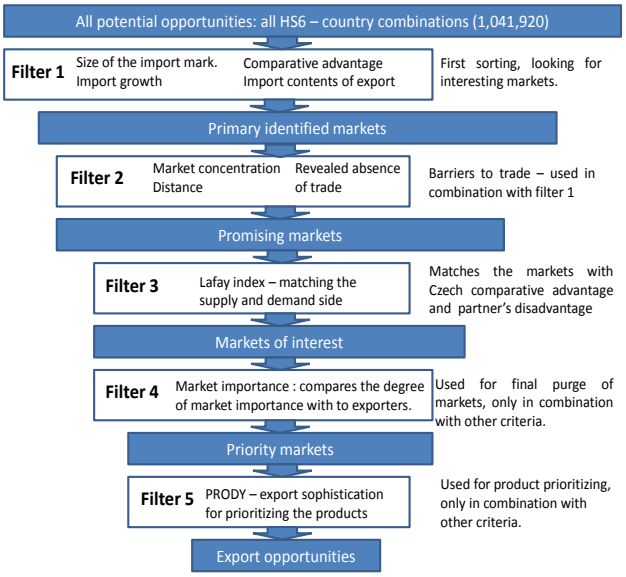

Fig. 1 Elimination process

The critical values for discriminate analysis were selected after the calibration process, where we tested the model on export opportunities for specific product groups along with specific geographical locations and selected Czech companies. The calibration method had to deal with number of parameters, whose significance could not be set in an unambiguous way. Some of the parameters showed high degree of multicollinearity, which did not allow us to do traditional regression methods. We therefore selected a reference group of exports which were successful in the past and other export opportunities identified by Czech embassies and trade promotion organizations such as CzechTrade or International Chambers of Commerce in Czech Republic. For finding optimal sensitivity to various criteria, we tried to build similar reference groups of export opportunities for various subcategories including both country-specific markets and product-specific markets. The model was also tested on a few specific Czech exporters (real-life cases). Finally, the calibration process found the critical values by minimizing the type I error for all specific cases while keeping the required number of opportunities.

After the discriminate analysis that is general for the entire portfolio of Czech production we use additional criteria which are product specific and allow individual approach. The examples of such criteria are in the pilot case of the export opportunities of Czech creative glass industry, where the target group of customers is often recruited from wealthy families, casinos or luxury hotels. We therefore added to the general model following criteria: ratio of the rich in the country, estimated number of people with financial assets over 30 million USD, number of casinos and revenue from tourism.

Besides these product specific criteria, we also use other criteria which are used in all cases, but are assigned with different weights according to the degree of importance for the specific type of business. These criteria consist of expected economic growth, index of the Ease of Doing Business by World Bank, index of Economic Complexity by the Observatory of Economic Complexity and finally the country risk measures that consist of the territorial risk of OECD, political, commercial and other country specific risks of export transactions of Office National Du Ducroire (ONDD).These measures have different importance for various products therefore we contrary to previous studies use these criteria out of the general elimination process in order to preserve the possibility of an individual approach towards various industries that differ in their exposure to country risks, expected economic development or to the barriers to doing business.

Fig. 2 visualizes the procedure of export opportunity selection and combination of the general discriminate analysis with other criteria. IEC in the figure stands for index of economic complexity, IEG for index of export growth, IDB index of doing business and IEP index of export potential, which summarizes the export potential of the country for selected products.

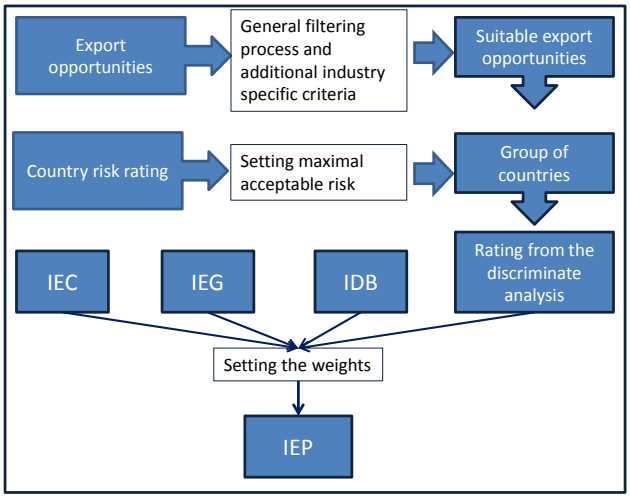

Fig. 2 Procedure of ranking export potential

III. Data

We use annual volume (in USD) of international trade among countries classified according to the 6-digit level of Harmonized System of tariff nomenclature (HS6) for 2006-2011from [1]. Furthermore, we use GDP, GDP per capita and their forecast by the IMF [3]. The import content of exports was estimated based on data from Trade in Value Added of [15]. We further use risk measures that consist of the territorial risk of [11], political, commercial and other country specific risks of export transactions of [12]. We also use the Ease of Doing Business indicator –[14] and the Economic Complexity Index –[10]. All potential export opportunities (before the filtering process) consist of the sample covering 176 countries and 5,920 products.

IV. Results

We present the general model and specific pilot cases in this section. In general model, as described in Section II, we divided the opportunities into the groups based on the industry. Our discriminate analysis identified most of the export opportunities in sector of electrical equipment and metal products. Following table summarizes export opportunities by categories of products in general model.

TABLE I
EXPORT OPPORTUNITIES FOR THE CZECH REPUBLIC BY CATEGORIES

sector	number of opportunities
machinery and electrical equipment	6,401
metal products	2,458
mixed, other	2,353
plastics/rubber	1,317
stone/glass	1,276
textile	1,171
total	19,746

unit: HS6 - country combination

We can find the most opportunities in Nuclear reactors, boilers, machinery, etc. (4,135) and Electrical, electronic equipment (2,266) when we look into more narrow categories on the level of HS2. In terms of geography, we can find most export opportunities for the Czech Republic in EU, followed by interesting markets in Asia, North and South America or European markets outside the EU. Fig. 3displays the preferred markets as a result of the general discriminate analysis in terms of IEP. Higher IEP means higher frequency of export opportunities and darker color in the map.

The model assigns the most of the export opportunities to Germany (1,016), followed by Russia (866) and Poland (650). However many opportunities in Europe have already been discovered by Czech exporters. We can therefore find many undiscovered opportunities especially outside the European continent.

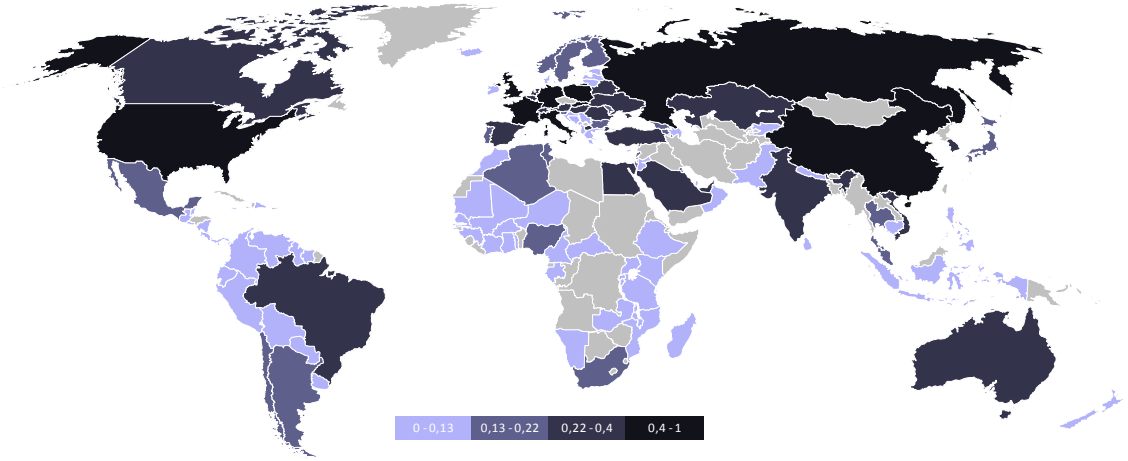

Fig. 3 Map of export opportunities of the Czech Republic given by the discriminate analysis

As mentioned in the introduction, the model enables to assess export opportunities for specific industry with individual approach. We used the discriminate analysis for the pilot case of Czech creative glass industry, where we added additional criteria, specific for the industry. We found that we can find the most of opportunities in Europe and Asia.

Generally the demand for this luxury product is influenced by the demand for luxury products and supply of the similar product in the country. Following table shows the best destination for Czech creative glass industry.

Another interesting pilot case is the pumping machinery, which is one of the sectors affected by the Russia Ukrainian conflict, including related trade sanctions. The discriminate analysis for this specific case suggested most of the export opportunities in Macedonia and United Arab Emirates, followed by Malaysia, Kazakhstan, Australia, Columbia, Canada, Vietnam, India and Brazil. Fig. 4 summarizes the export opportunities for Czech pumping machinery.

TABLE II
BEST EXPORT OPPORTUNITIES FOR CZECH CREATIVE GLASS INDUSTRY

Country	ranking
Russia	1
Germany	2
USA	3
Netherlands	4
China	5
Great Britain	6
France	7
Switzerland	8
Spain	9
Italy	10
Hong Kong	11
Turkey	12
India	13
Brazil	14

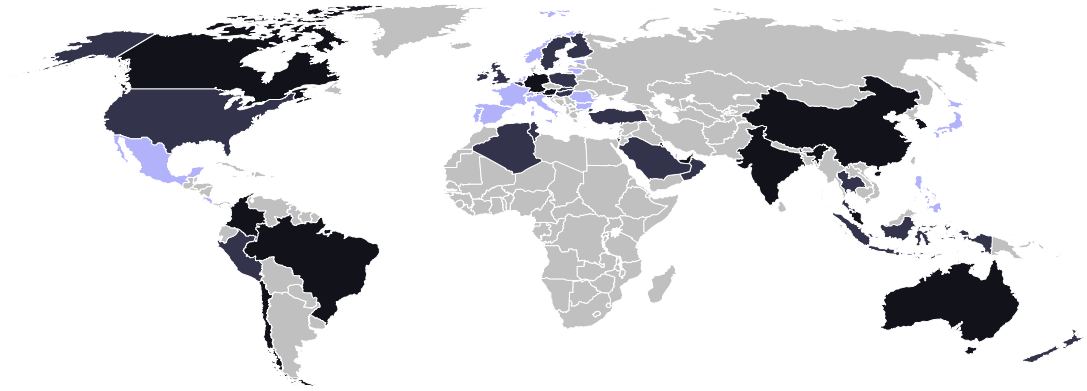

Fig. 4 Map of export opportunities of the Czech Republic for the pumping machinery

Finally, the last pilot case that we selected is the clean tech sector, where we found the most opportunities in Russia, Germany, Egypt, China, Brazil, Kazakhstan, United Arab Emirates, USA and India.

In terms of industry within the clean tech sector, we can find the most export opportunities in machinery and electrical equipment, metal products and chemicals. Fig. 5 displays the export opportunities for Czech clean tech sector by country.

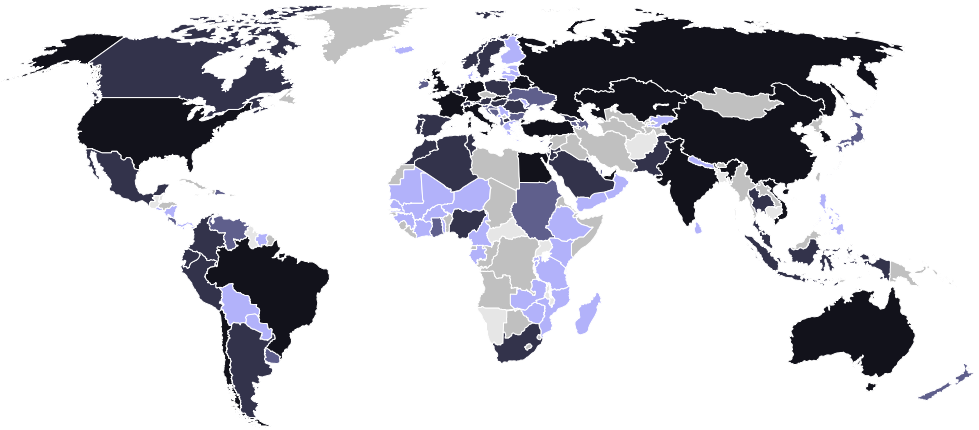

Fig. 5 Map of export opportunities of the Czech Republic for the clean tech sector

V. Conclusion

Our model for prioritizing export opportunities based on the discriminate analysis of less important markets is a useful tool for optimizing export strategy on the national or industry level. The model uses the elimination process based on growth potential, absorption capacity and compatibility in relation to the Czech economy. It comes with substantial improvements compared to previous papers and it takes into account the differences of the Czech economy in order encompass the supply side of the export sufficiently. The model can be however easily recalibrated for other countries. We found most of the opportunities in EU countries, followed by many undiscovered opportunities in Asia, South America, North America and European countries outside the EU. We could see on the specific pilot cases that the model uses the individual approach to various industries and identifies significantly different portfolio of top countries for Czech creative glass industry, pumping machinery or the clean tech sector. We created an interactive software where any user can experiment by setting desired industry and optimal sector specific weights [16].

Acknowledgment

Financial support from The Czech Science Foundation (project GACR No. P403/10/1235 - The Institutional Responses to Financial Market Failures) is gratefully acknowledged.

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