

ANALYSIS OF AID AND ITS IMPACT ON DONOR'S EXPORTS WITH THE GRAVITY MODEL OF INTERNATIONAL TRADE: A CASE OF THE CZECH REPUBLIC

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Abstract

Foreign aid should be provided with the main goal to improve the economic, social, and/or natural conditions in the underdeveloped regions. However, due to the pressure of the international community to increase the level of aid provided by the developed countries, donors tend to start focusing on the return of their aid funds as well. The impact of aid on the exports of the traditional donors, such as Germany, the Netherlands or the US, has been widely analysed, mostly with the use of the augmented gravity model of international trade. By employing this model, the existing literature suggests, there is a positive and statistically significant impact of the amount of aid provided by the donor on the total amount of its exports to the developing countries. This paper focuses on the Czech Republic, an emerging donor, and employs a similar gravity model, however, suggests that in the case of the Czech Republic the provided foreign aid does not significantly influence the Czech exports to the developing countries. Moreover, it suggests that its impact on export might be even negative.

Key words: Czech bilateral development aid, export, gravity model of international trade

JEL Code: F14, F35

Introduction

The main goal of development aid should be to help the underdeveloped regions to improve the local conditions, however, from the donor's perspective, it is often seen as an opportunity to impose its own political and economic interests in the given region. One of those interests is also the growth of trade and donor's exports, which is most visible on the tied aid where donor countries provide aid under the condition that it is used for purchases of goods or services from their country (OECD, 2021).

The significance of tied aid has been declining for some time (in the 21st century, the proportion of tied aid on the total bilateral aid has decreased from 50% to 20% (Pammet, 2018)), however, the idea to combine trade and aid still remains.

Not only donors are interested in the trade-aid combination, though. As mentioned by Jankowski (2018), developing countries will represent 70% of world's consumption and 80% of middle-class population by 2030 and an economic cooperation will be more attractive for them than the relatively limited (and often conditioned) means of development aid.

This paper focuses on the Czech Republic and evaluates whether the Czech aid in its current form positively effects the exports to the developing countries. The study is divided into three main parts. The first part summarises the existing literature with the emphasis on the employed models and the results of similar papers prepared for other donor countries. The next chapter describes methodology and how the gravity model of international trade is applied in this analysis. Individual variables and source data are commented in this chapter as well. The results of the conducted analysis are discussed in the last chapter and the whole paper is concluded with a final summary.

1 Gravity model in the context of development aid

The gravity model of international trade is widely used for the analysis and explanation of trade relations between countries; however, it has few limitations. The major one is connected with zero values: variables enter into the equation in their logarithmic forms but logarithm of zero is not defined. Therefore, the literature offers three different solutions to solve this issue:

- zero values may be replaced by very small values for which logarithm can be calculated (e.g. used by Janda et al. (2012));
- zero values may be deleted from the data set (e.g. used by Věříšová (2019)) However, it may significantly reduce the data set size and may distort the results; and
- the ordinary least squares (OLS) may be replaced by Poisson estimates for gravity model (e.g. used by Golovko and Sahin (2021) and Reis et al. 2021).

As stated by Head and Mayer (2014), there is no universal solution. To evaluate which of the above-mentioned methods is the most appropriate one, it is necessary to explore the characteristics of the data set, the results of robustness tests or the type of research questions. For panel data, though, Poisson estimates are mostly recommended due to the heteroscedasticity.

The augmented gravity model is also used in the development aid context. It was used for example to analyse the aid and export nexus of the Netherlands (Martínez-Zarzoso et al. (2016)) and Germany (Nowak-Lehmann et al. (2016), Martínez-Zarzoso et al. (2009)). All of these studies proved a statistically significant and positive impact of the provided aid on the donors' exports to the developing countries.

In case of the Netherlands, one euro used for development aid increased the Dutch exports by 26 to 40 euro cents on average (data from 1964 to 1999) and in the case of Germany, one US dollar of aid increased on average German exports by 86 USD cents, with the most profitable sectors being machinery, production of electric appliances, transport vehicles and their components.

Alternative models are used to evaluate the relations between development aid and exports as well. A high return of German aid was proved by Granger causality in the research by Nowak-Lehman et al. (2013), according to which one euro provided to development aid generated 69 cents in the form of German exports in the short term and approximately 1.49 to 1.72 euros in the long term.

2 Methodology

Panel data are used in this analysis. Data from 132 developing countries (see Annex 2) for 21 years (from 1998 to 2018) have been collected, however, some data were not available and are therefore missing.

The dependent variable in the analysis is the annual volume of the Czech exports to the individual developing countries. The data come from the Comtrade database, are in current USD prices and the variable is further abbreviated as CZEXP.

The independent variables explaining the volume of Czech exports to the developing countries arise from the existing literature (see the previous chapter) and they are as follows:

- Official Czech aid (ODA) provided to developing countries is in current USD prices, it is taken from the OECD statistics and it is marked as CZODA. Despite the fragmentation of Czech aid (the Czech Republic supported 132 countries in the researched period), we assume that its impact on Czech exports is positive. Development aid can create favourable conditions as the donor country can introduce its goods in development projects and thus indirectly motivate future purchases (Martínez-Zarzoso et al., 2016). If aid missions are accompanied by business missions, exporters may have a better chance to close contacts in developing countries as well (Martínez-Zarzoso et al., 2016).
- The development aid provided to the developing countries by other states is also in current USD prices, it is taken from the OECD statistics and it is marked as RESTODA. The following member states of Development Assistance Committee (DAC) are included in this variable: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, South Korea,

Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, the United Kingdom and the United States. The influence of this variable on Czech exports may be ambiguous. Thanks to the total aid provided, the purchase power and the import volume in the Third World may increase; however, Czech exports may not be positively impacted, especially if other donors promote their own products as well.

- Next variable is the economic size measured as a gross domestic product (GDP) in current USD prices for both the developing countries and the Czech Republic (marked as DCGDP and CZGDP). The data come from the World Bank statistics. We assume that the level of GDP will influence exports positively as higher GDP means higher purchase power and higher demand for foreign goods (see the previous point). Higher GDP of the donor means also higher production and export possibilities (Nowak-Lehmann et al., 2013).
- The geographical distance between capitals of the developing countries and Prague is measured in kilometres and it comes from the CEPII database. This variable is marked as DIS. We suppose that it will influence the Czech exports negatively: the closer the capitals are, the lower the transportation costs will be and vice versa.
- The last numerical variable is the exchange rate of the Czech crown (CZK) and the local currencies. This variable comes from FXTop database and it is marked as EXCH. The historical average annual exchange rates in indirect quotations are used. We expect that the impact of this variable on exports will be negative. The appreciation of CZK will make Czech goods abroad more expensive and trade can also be negatively influenced by the exchange rate volatility.
- Last but not least, there are two binary variables, i.e., historical ties and economic relations. The variable of historical ties (marked as RVHP) has the value of 1 in case the country was a member, affiliated or observing state of the Council for Mutual Economic Assistance. Otherwise, its value is 0. We expect positive influence of this variable on exports because Czech exporters can make use of previous connections and experience as well as from a good reputation of Czechoslovak products in the Third World.
- The variable of economic relations is defined as an existence of a free trade, preference trade or economic cooperation agreement. If such treaty exists between the Czech Republic (or the European Union since 2004) and the developing country, the value of this variable is 1. Otherwise, the value is 0. Data after accession to the EU come from

the European Commission, data before that time are from the World Trade Organization. The variable is marked as FTA. We expect a positive impact on exports as trade agreements lower the barriers of international trade.

The gravity model of international trade is employed in this paper and it is augmented with the developing aid and the other above-explained variables. The equation used in the analysis is as follows:

$$\log CZEXP_{ij} = c + b_1 * \log CZODA_{ij} + b_2 * \log RESTODA_j + b_3 * \log CZGDP_i + b_4 * \log DCGDP_j + b_5 * \log EXCH_{ij} + b_{61} * RVHP_j + b_7 * FTA_{ij} + e$$

This analysis uses the Poisson estimates (PPML) to solve the zero-value issue. As explained in the first chapter, this solution is the most suitable one for panel data. Both dependent and independent variables (except the binary ones) are in their logarithmic form. Number one is added to all variables to avoid zero values.

The analysis is conducted for four options. The first option includes all countries that received any Czech aid during the researched period. The Czech aid is rather fragmented and the final result might be skewed by zero or minimal values. For this reason, the second option analyses only priority countries of the Czech Republic, as defined for the period of 2018 till 2030 (Ministry of Foreign Affairs, 2017). These countries are: Afghanistan, Bosnia and Herzegovina, Ethiopia, Georgia, Cambodia, Kosovo, Moldavia, Mongolia, Palestine, Serbia, Syria, Ukraine and Zambia. The third option analyses the data based on a four- or five-year averages. As stated by Szent-Iványi (2012), the flows of development aid may be influenced by one-off fluctuations (e.g., a developing country receives a big aid volume after natural disasters). In this option data are divided into five periods, i.e., 1998–2001, 2002–2005, 2006–2009, 2010–2013 and 2014–2018. The last option takes into account also ODA lagged by one year to test whether the development aid increases exports in the subsequent period.

3 Analysis

The results of the analysis for all options are presented in Table 1 below. P-value is indicated first with the estimation shown in brackets beneath it. Both the results and their interpretation are valid only under the *ceteris paribus* condition.

There are four columns in Table 1. The first one (1) shows results of the basic model including all countries and all years. The second column (2) provides results for priority countries only, the third column (3) shows results for all countries but averaged in the four- or

five-year long periods. The last column (4) then considers also ODA lagged by one year for priority countries only.

Tab. 1: The results of the analysis

	(1)	(2)	(3)	(4)
Intercept	0.087373 (6.609e-01)	0.003064 ** (-5.917e+00)	0.0425 * (1.269e+00)	0.939570 (-1.730e-01)
CZODA	0.258559 (-3.459e-15)	0.029588 * (-1.814e-08)	0.1547 (-9.520e-09)	
RESTODA	0.001441 ** (1.414e-02)	0.002307 ** (4.835e-02)	0.0261 * (1.789e-02)	0.000145 *** (6.909e-02)
CZGDP	0.000477 *** (5.266e-02)	0.000156 *** (3.024e-01)	0.3232 (2.416e-02)	0.637509 (4.330e-02)
DCGDP	< 2e-16 *** (2.531e-02)	0.015092 * (-1.327e-02)	< 2e-16 *** (2.894e-02)	0.013125 * (-1.673e-02)
DIS	0.894677 (-1.184e-03)	0.259126 (4.541e-02)	0.9257 (1.396e-03)	0.005291 ** (1.304e-01)
EXCH	0.467177 (-3.899e-03)	1.56e-05 *** (-1.403e-01)	0.7287 (-3.054e-03)	0.002402 ** (-1.049e-01)
RVHP	< 2e-16 *** (1.401e-01)	< 2e-16 *** (7.828e-01)	3.31e-10 *** (1.473e-01)	< 2e-16 *** (8.928e-01)
FTA	2.22e-05 *** (6.848e-02)	0.386518 (7.060e-02)	0.0107 * (7.586e-02)	0.015910 * (2.251e-01)
lagODA				0.074315 (1.464e-14)

Source: created by authors

Note: Regression coefficients are *** significant at 1% level of significance, ** significant at 5% level of significance, * significant at 10% level of significance

The results of the analysis are rather surprising. Unlike aid of traditional donors such as the Netherlands or Germany, Czech aid is not a statistically significant factor of Czech exports (model (1), (3) and (4)). It is statistically significant at 10% level of significance in model (2) for priority countries, however, it influences the exports negatively. A negative (but significant) impact on export is also suggested in models (1) and (3).

The reasons why the Czech aid is not statistically significant may only be estimated. Firstly, the Czech Republic provides only limited resources on development aid compared to traditional donors. Secondly, the Czech Republic may not be able to fully utilise the potential benefits of aid as it does not combine development and trade missions, does not promote co-operation with trade institutions, e.g. CzechTrade or the Ministry of Industry and Trade, and it does not sufficiently support the Czech exporters. Last but not least, the Czech development aid is highly fragmented: as confirmed by model (2), the development aid was statistically significant only for the priority countries.

The negative influence of aid on exports is harder to explain. Correlation might not mean causality and a spurious correlation may occur here with other factors influencing the relations

of these two variables. However, this would require a deeper analysis as the impact is negative also in models (1) and (3).

As for other variables, all models indicate that historical ties and the aid of other donors are statistically significant factors influencing Czech exports to developing countries. Initial hypotheses are thus confirmed here: ex-membership in the Council of Mutual Economic Cooperation positively influences the volumes of Czech exports as Czech producers can build on the positive reputation of Czechoslovak goods, similar language and culture, and previous experience. The aid provided by other countries increases the purchase power in developing countries and consequently positively influences Czech exports as well.

All models also show that the GDP of developing countries is also a statistically significant factor for Czech export to these states. However, the influence of this variable on exports varies based on the model used. In models (1) and (3), this variable is highly statistically significant and shows positive impact on exports. On the contrary, in models (2) and (4) the variable is statistically significant only at 10% level of significance and its impact is negative.

Models without a time lag (1), (2), (3) also indicate that the geographical distance is not statistically important for the development of Czech exports. This result does not correspond to the initial estimations that the exports would go to geographically closer countries. Because of lowering logistic barriers, it is possible that this variable is not a significant determinant anymore for the Czech trade with developing countries.

Some variables were statistically significant only in some models. As can be seen from model (1) for all countries, both the Czech GDP and the existence of trade agreement is statistically significant with a positive impact. Model (2) including only priority countries then suggests that exports is negatively impacted by the exchange rate: a finding corresponding to the initial hypothesis. Model (3) for periods suggests that the existence of trade agreement is also significant determinant. Finally, model (4) with lagged ODA shows that Czech exports are positively and significantly impacted by distance, existence of trade agreements and negatively by the exchange rate.

Conclusion

This paper focused on development aid from the donor's perspective. It aimed to evaluate whether donor countries and their businesses can also benefit from their aid funds as well.

The first part of the paper summarized the existing literature and the gravity model of international trade. Based on the recent studies, a positively and statistically significant impact

of development aid on donor's exports can be observed with the return of aid ranging from 0.26 cents to 1.7 euro per one euro provided.

The following part described the analysis for the Czech Republic. Four options were considered: option 1 for all developing countries, option 2 for priority states only, option 3 for data averaged based on four- or five-year periods and finally option 4 with lagged ODA. The results showed that the Czech development aid is not a statistically significant factor for the development of Czech exports to supported developing countries. The analysis even showed that the impact of aid on exports might be negative.

This paper is a first step in a deeper research where more options with different lags will be analysed.

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