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Sources of Variation in Export Flows over Time: A Suggested Methodology of Measurement

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1. Introduction

Identification of the sources of variations in export flows over time plays an important role in the formulation of trade policy in any country. This paper suggests a methodology for identifying the sources of export growth variations. The next section describes how the variations in export flows can be decomposed into different components bearing policy implications, and overall conclusions with policy implications are given in the final section.

2. Variations in Export Flows: A Decomposition Analysis

Export flows between two countries (i and j) are determined by several types of factors. First, the demand for and supply of goods, which are usually proxied by gross domestic product (GDP), the population (POP) of the exporting and importing countries, and the geographical distance (D) between countries, may be called "natural determinants" of export flows between countries. Second, relative prices of the imported goods, which are influenced by the exchange rate (RER) and the tariff (T) structure of the importing country, may be called "explicit beyond the border determinants." Third, different kinds of institutional and infrastructural rigidities that exist in the exporting country, which are under the control of the exporting country, may be called "behind the border determinants" in the home country. Fourth, different kinds of institutional and infrastructural rigidities that exist in the importing country, which are beyond the control of the exporting country, may be called "implicit beyond the border determinants." Fifth, bilateral and multilateral trade negotiations in the form of improvement in trade promotion and facilitation

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policies of both home and partner countries may be called "mutually induced determinants" and represented with a dummy variable (D_1). Estimating the contribution of the components of each factor to the overall variations in export flows over time is important for evaluating the effectiveness of trade policy towards promoting exports in home country.

Drawing on Kalirajan (2007), a stochastic frontier gravity equation can now be modeled to explain the variations in exports of the focus country by incorporating directly the influence of natural determinants, behind the border determinants, mutually induced determinants, and the explicit beyond the border determinants, for a given level of the existing implicit beyond the border determinants:

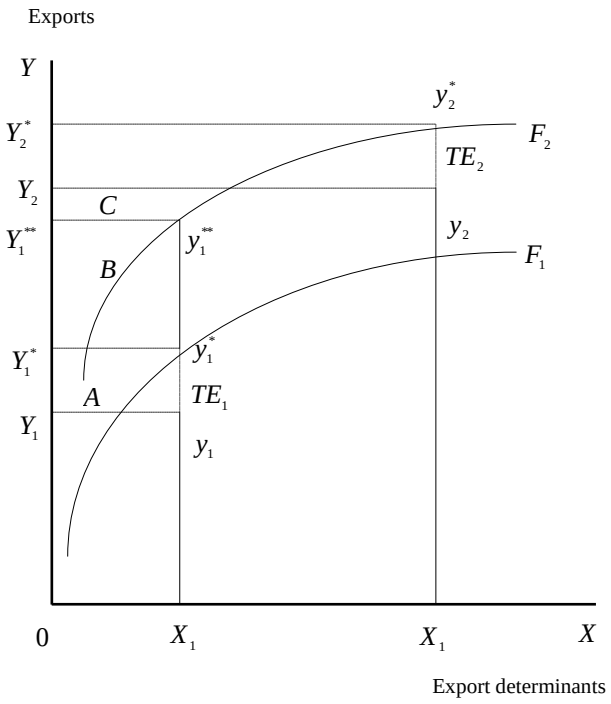
$$\begin{aligned} \ln Ex_{i,j,t} &= B_{0,t} + B_{1,t}\ln(GDP_{i,t}) + B_{2,t}\ln(GDP_{j,t}) + B_{3,t}\ln(POP_{i,t}) \\ &+ B_{4,t}\ln(POP_{j,t}) + B_{5,t}\ln(D_{i,j}) + B_{6,t}\ln(RER_{i,j,t}) \\ &+ B_{7,t}\ln(T_{j,i,t}) + B_{8,t}D_1 - u_{ij,t} + v_{ij,t}. \end{aligned} \tag{1}$$

Here D_1 takes the value 1 when there are trade agreements between home and partner country and 0 otherwise, $u_{ij,t}$ measures the negative influence of the behind the border determinants that exist in the exporting country, and $v_{ij,t}$ is a normally distributed statistical error term with mean 0 and variance σ_v^2. It is assumed that $u_{ij,t}$ is 0 if there is no significant negative influence of behind the border determinants and is positive when these determinants reduce the level of exports. Thus, drawing on the framework used in the stochastic frontier production function models (Kumbhakar and Lovell, 2000), $u_{ij,t}$ may be assumed to follow a normal distribution $N(\mu, \sigma_u^2)$ truncated at 0. Model (1) can be estimated with maximum likelihood using statistical software programs such as STATA, LIMDEP, and FRONTIER 4.1 (Coelli, 1996).

Concerning the identification of the sources of variations in export flows over time, drawing on Kalirajan et al. (1996), Figure 1 illustrates the decomposition of sources of variations in export flows. F_1 and F_2 are the export frontiers that a country faces in periods 1 and 2 for a given level of implicit beyond the border determinants, respectively. The assumption here is that there is some reduction in the negative impact of implicit beyond the border determinants in the importing country from period 1 to period 2. The potential exports, which are in logarithms, are Y_1^* and Y_2^* in periods 1 and 2 respectively. The actual exports, which are also in logarithms, are Y_1 and Y_2, and these are less than Y_1^* and Y_2^*, respectively, due to the prevalence of the negative influence of behind the border determinants to export in the home country. TE_1 and TE_2, which are also in logarithms, are the inefficiencies stemming from the negative impact of the behind the border determinants in periods 1 and 2, respectively, are the vertical distances of the actual exports from the potential exports for the given natural determinants, mutually induced determinants, and explicit beyond the border determinants, X_1 and X_2 in each period. Therefore, the export growth due to reduction in the negative impact of implicit beyond the border determinants can be measured by the vertical distance between the frontier in period 1 (F_1) and the frontier in period 2 (F_2) evaluated for

the same levels of natural determinants, mutually induced determinants, and explicit beyond the border determinants (X) of exports without the influence of any negative impact of the period 1 behind the border determinants (i.e., $Y_1^{**} - Y_1^{*}$).

Figure 1. Sources of Variations in Export Flows



The total variation in export flows can, thus, be decomposed as follows:

$$
\begin{aligned}
D = Y_2 - Y_1 = A + B + C &= [Y_1^* - Y_1] + [Y_1^{**} - Y_1^*] + [Y_2 - Y_1^{**}] \\
&= [Y_1^* - Y_1] + [Y_1^{**} - Y_1^*] + [Y_2^* - Y_1^{**}] - [Y_2^* - Y_2] \\
&= \{[Y_1^* - Y_1] - [Y_2^* - Y_2]\} + [Y_1^{**} - Y_1^*] + [Y_2^* - Y_1^{**}] \\
&= \{TE_1 - TE_2\} + EF + \Delta y_x ,
\end{aligned}
$$

where $Y_2 - Y_1$ is variation in export flows between the selected periods, $TE_1 - TE_2$ is variation in export flows due to changes in the negative influence of the behind the border determinants in the exporting country, EF is variation in export flows due to changes in the negative impact of the implicit beyond the border determinants in the importing country, and Δy_x is variation in export flows due to changes in natural determinants, mutually induced determinants, and explicit beyond the border determinants.

3. Conclusions

The proposed methodology bears important trade policy implications. For example, the variation in export flows due to changes in the negative influence of the behind the border determinants facilitates a direct measure for evaluating the effectiveness of trade policies in reducing institutional and infrastructural rigidities in the exporting country.

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