Journal of International Economics 96 (2015) 289–297

Contents lists available at ScienceDirect

Journal of International Economics

journal homepage: www.elsevier.com/locate/jie

Using the new products margin to predict the industry-level impact of trade reform[☆]

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ARTICLE INFO

Article history:
Received 26 November 2013
Received in revised form 7 December 2014
Accepted 17 March 2015
Available online 2 April 2015

JEL classification:
F13
F14
F17

Keywords:
Trade liberalization
Industry
Product

ABSTRACT

This paper develops a methodology for predicting the impact of trade liberalization on exports by industry (3-digit ISIC) based on the pre-liberalization distribution of exports by product (5-digit SITC). We evaluate the ability of our methodology to account for the industry-level variation in export growth by using our model to "predict" the growth in industry trade from the North American Free Trade Agreement (NAFTA). We show that our method performs significantly better than the applied general equilibrium models originally used for the policy evaluation of NAFTA. We find that the most important products in our analysis are not the ones with zero pre-liberalization trade, but those with positive, yet small amounts of pre-liberalization trade.

1. Introduction

When policy makers debate trade liberalization, the worry is not over the aggregate increase in trade, but over the unequal impact of freer trade across industries: Which industries will expand and which will contract? When policy makers have turned to economic models for answers to these questions — most notably during the lead up to the North American Free Trade Agreement — they have been given industry-level forecasts (U.S. International Trade Commission, 1992) that were largely inaccurate (Kehoe, 2005). Can we improve our ability to forecast the industry-level impacts of trade policy?

In the last 20 years, several important advancements in trade theory have revolved around the idea that trade liberalization not only brings about trade in products already being traded but also brings about trade in new kinds of products as well — what we call the extensive trade margin. Less work, however, has been done in incorporating these insights into models that can be used to predict the impacts of trade liberalization for use in policy analysis.[1] In this paper, we show that a very simple predictive model that incorporates the extensive trade margin performs quite well — beating several workhorse models — in accounting for the industry-level response of trade following the North American Free Trade Agreement (NAFTA).

Our methodology is based on the finding in Kehoe and Ruhl (2013) that products that were not traded or were traded very little before liberalization, what we call the least traded products, grow faster than the relatively heavily traded products following trade liberalization. Our model posits that industries — a collection of products — with relatively more of these least traded products will grow faster than industries with relatively fewer least traded products. Our model can be written as a linear function with two parameters, and we show how to find these two parameters using cross-sectional variation in trade data.

We evaluate our model by "forecasting" the industry-level effects of NAFTA using only data that would have been available in 1989 — several years before the implementation of NAFTA. We compare our forecasts with the actual growth in trade that occurred from 1989 to 2009 and

☆ The data used here are available at http://www.econ.umn.edu/~tkehoe/. The authors thank the editor, Robert Staiger and two anonymous referees for their helpful comments and suggestions. We also thank the National Science Foundation for support through grant SES-0962993. The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

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[1] A notable exception is Yaylaci and Shikher (2014), who use a model based on Eaton and Kortum (2002) to make predictions about the Korea–U.S. free trade agreement. We discuss their forecasts, and compare them to our own forecasts of the Korea–U.S.-free trade agreement, in the appendix.

http://dx.doi.org/10.1016/j.jinteco.2015.03.004
0022-1996/

find that the model does quite well: the weighted correlation between our forecasts and the data averages 0.39 across all six NAFTA country pairs. This result is even more striking when we compare our forecasts with those from general equilibrium models actually used to forecast the effects of NAFTA, whose weighted correlation with the data averages 0.00. We repeat this exercise using alternative measures of accuracy, and the conclusion remains the same. Our simple statistical model performs substantially better.

The failure of the general equilibrium models so often used in policy analysis is driven by the underlying structure that typically does not allow for an extensive margin. Models built from Armington (1969) assumptions about national product differentiation imply that countries already import all the available products from other countries. This leaves no role for products with little or no trade to have an impact on the model outcomes. Instead, the response to trade liberalization in these models is set by home bias parameters and elasticities of substitution between products.

In the workhorse heterogeneous agent trade models — variants of Eaton and Kortum (2002) and Melitz (2003) — the extensive trade margin is made up of goods that go from zero trade to positive trade following liberalization. In our model, a product with zero trade in the base year will not show up in the share of least traded products in an industry, so products with no trade in the base year do not factor into our predictions. What matters for our model are the products that are traded in small amounts before liberalization. This means that these workhorse trade models are not the theoretical analogue of our statistical model. Instead, a model like that in Arkolakis (2010), in which small firms react more to falling trade costs, is appropriate. Similar ideas can be found in Eaton et al. (2014) or Ruhl and Willis (2013), which focus on the growth of small firms growing larger in export markets.

In the following section, we describe our methodology and show how to estimate the parameters of the model using only pre-liberalization data. In Section 3, we use the model to "forecast" the effects of NAFTA on industry-level exports, and we evaluate our forecasts using the observed changes in trade flows. In Section 4, we compare our forecasts to those from general equilibrium models that were actually used to forecast NAFTA in the 1990s, and we show that our simple model outperforms them.

2. A predictive model based on the extensive margin

In this section, we develop a methodology based on the insight from Kehoe and Ruhl (2013): much of the growth in trade following a trade liberalization occurs within the set of products that were previously not traded or were traded very little. We refer to growth in trade from products that were not previously traded or were traded very little as growth on the extensive margin or the new products margin. We refer to growth in trade from products that were previously traded in relatively large amounts as growth on the intensive margin. Our methodology, based on that of Kehoe and Ruhl (2013), allows the cutoff for what products we consider to be least traded to vary across country pairs in order to take into account the relative importance of each product for a country's trade.

We define a product to be a 5-digit SITC Rev. 2 code. We sort all of the products from lowest to highest by their average value of trade over the first three years in our sample. (We average over three years to minimize the measure's dependence on any particular year.) Starting with the products with the least trade in the first three years, we then sum the value of trade in the base year until we accumulate a set of products that accounts for 10% of total trade in the base year. If a product is in that set, we classify it as a least traded product. In the appendix, we show that our results are robust to using 5% or 20% of total trade as the cutoff instead of 10%. Within the set of least traded products are products from different industries, where an industry is a collection of products. Adapting a concordance developed by Muendler (2009), we map each of the 1836 5-digit SITC products into one of 37 3-digit ISIC industries. In what follows, we use the industry classification system from Brown et al. (1995) to keep our results comparable to theirs. This classification system is a more aggregated version of the 3-digit ISIC.

Once we have mapped the products to industries, we can compute the share of trade in each industry that is accounted for by least traded products within the industry. How prevalent are these least traded products across industries? Consider the Canada–U.S. trade relationship before NAFTA, which we study in Section 3 as a way to evaluate our methodology. In Table 4 we report the fraction of trade in an industry accounted for by the least traded products in 1989, the year before NAFTA was implemented. There are substantial differences across industries. For example, least traded products made up 77% of total textile exports from Canada to the United States in 1989, but only 1% of exports in the wood products industry.

How is the share of least traded products in an industry related to the growth in trade in that industry following liberalization? Kehoe and Ruhl (2013) show that growth in least traded products can be explosive after liberalization, so it follows that industries with more least traded products would be expected to grow faster after liberalization than industries with fewer least traded products. Our prediction is that industries with higher shares of least traded products will experience more growth than industries with lower shares of least traded products.

We formulate our model of trade growth by industry as a simple linear function of the share of exports accounted for by least traded products in that industry. Specifically, we predict that the growth between periods T_0 and T_1 in industry j will be

$$z_{ij}^{k} = \left(1-s_{ij}^{k}\right)\alpha_i^k + s_{ij}^{k}\left(\alpha_i^k + \beta_i^k\right), \tag{1}$$

where z_{ij}^k is the growth in exports, $x_{ij,t}^k$, from country i to country k in industry j deflated by the growth in GDP, y_{it}, of the exporting country,

$$z_{ij}^{k} = 100\left(\frac{x_{ijT_1}^{k}/y_{iT_1}}{x_{ijT_0}^{k}/y_{iT_0}} - 1\right), \tag{2}$$

s_{ij}^k is the share of exports accounted for by least traded products in that industry, and α_i^k and β_i^k are constants. Here α_i^k is the average growth rate of non-least traded products, and β_i^k is the additional growth generated by least traded products.

Notice that as long as $\beta_i^k > 0$, all values of α_i^k and β_i^k give the same predictions for the relative ordering of growth across industries. This means that any series of predictions by industry of the form (1) generates the same correlation with a series of observations by industry if β_i^k is positive. Therefore, correlations offer a way of evaluating the general merit of our simple statistical model in a way that does not depend on its particular parameterization. If the correlation was low, that would indicate that there is little hope for success regardless of the parameterization.[2] As we will show, however, our predictions perform much better in terms of correlation with observed changes than the general equilibrium models originally used to predict the effects of NAFTA. In the following sections, we lay out our methodology for parameterizing Eq. (1) and show that, as indicated by these correlations, our methodology does indeed deliver substantially improved industry-level predictions in the case of NAFTA.

2.1. Parameterization

We need to choose values for α_i^k and β_i^k in order to use Eq. (1) to predict industry-level trade growth. Given our interest in industry-level

[2] In addition to using correlation coefficients to evaluate the model, we consider other metrics in Sections 3 and 4.