Economic Policy Papers

Improving the Analysis of Trade Policy[1]

Accounting for product-level response to reduced trade barriers better predicts reform impact and forecasts larger gains from liberalization

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EXECUTIVE SUMMARY

The standard model that economists use to analyze the impact of trade reforms systematically underpredicts changes in trade patterns. It not only underestimates overall trade magnitudes, but also fails to predict which *industries* experience the largest trade increases. This failure results from not accounting for rapid growth in post-liberalization trade of the products that these industries produce.

This paper documents these weaknesses and demonstrates an alternative methodology.

Our modified model performs better because it accounts for the rapid growth of trade in products that were traded in small quantities prior to the reduction of trade barriers.

We offer a method for integrating this insight about least-traded products into the standard model and suggest that such models not only will produce more accurate predictions, but also will forecast larger welfare gains from trade liberalization.

We need better models of trade policy

The costs and benefits of globalization are widely and fiercely debated. Economists have tried to contribute to this discussion with analyses that rely on applied general equilibrium (AGE) models. Unfortunately, these models do not have a good track record in predicting the impact of trade reforms on production and trade flows by industry. When used to analyze the impact of the North American Free Trade Agreement (NAFTA), for example, three of the most prominent AGE models significantly underpredicted trade flow increases for previously little-traded products. (See Kehoe 2005 and Kehoe, Rossbach and Ruhl (KRR) 2015.)

In recent research, we provide a critical survey of these models and offer suggestions to improve their predictive power. (See Kehoe, Pujolàs and Rossbach (KPR) 2017.)

This essay summarizes that discussion. Our focus is on trade flows (not foreign investment), and we evaluate the performance of models in terms of their predictions for trade by individual industries. And while much of our work has focused on NAFTA predictions, we extend the discussion to more recent trade policy reforms.

The central insight of this research is that trade models can be significantly improved not simply by adjusting sensitivity of *industries* to removal of trade barriers, but by accounting for the *product composition* of industries and incorporating the lower bilateral trade costs that trade reforms create for these individual products.

We examine post-reform trade responses for over 5,200 products produced by 42 industries. The average industry produces more than 120 products. An example of an industry is food products, and an example of a product produced by the food products industry is preserved anchovies. Most products were traded in very small amounts prior to reform, and many experienced significant trade increases after barriers were reduced—a change not seen in the products that were heavily traded prior to liberalization. The transportation equipment industry produces many products, but one of them is medium-sized passenger motor vehicles, and this product accounted for a large fraction of trade flows between each pair of NAFTA countries both before and after the trade agreement.

Preliminary work with modified AGE models provides predictions far closer to actual data and indicates that trade liberalization generates significantly greater welfare gains than those predicted by standard AGE models.

Building models to predict policy impact

An AGE model used to analyze trade policy includes three "actors" in each country: consumers, producers and governments.[2] Consumers sell their labor and capital to producers in return for income that they use to purchase goods and services. Producers produce those goods and services (outputs) by purchasing labor and capital from consumers, as well as intermediate inputs from other producers. Governments impose taxes on consumers and producers to pay for public goods such as education and defense, and to provide transfers to consumers and subsidies to producers. In trade policy models, the most important government policy instruments are tariffs and other trade barriers like licenses and quotas.[3]

These models incorporate parameters—numerical values for variables like interest rates and wages—so that in a base case equilibrium, the model generates results that match real-world data for prices and quantities for goods and services exchanged by consumers, producers and governments.

Using that benchmark model, the economist can then alter a tariff, for example, and calculate the new equilibrium to predict the impact of the hypothetical policy reform.

To test the accuracy of AGE models, economists compare their model's pre-reform predictions to actual post-reform data: Do forecasts match reality? Kehoe, Polo and Sancho (1995) do this comparison for an AGE model built to analyze Spain's 1986 integration into what was then the European Community, and they find that the model performs well.[4] But their test doesn't look at trade policy; Spain's major 1986 reforms were to domestic taxes.

The tool of choice: AGE

Since the 1980s, AGE models have been the tool of choice for trade policy analysis. In 1992, when the U.S. International Trade Commission (USITC) organized a conference to examine the impact of NAFTA, 10 of the 12 studies presented used AGE models (USITC 1992). The USITC now relies on AGE models for in-house analysis, using a dynamic AGE model with 12 countries and a rest-of-the-world aggregate, for example, to examine the potential impact of the Trans-Pacific Partnership on the United States (USITC 2016). The European Commission's Directorate-General for Trade uses a static AGE model to analyze the impact of the Canada-European Union Trade Agreement, signed in October 2016 (European Commission 2011). Global Affairs Canada uses an AGE model to analyze the impact of the same agreement on Canada's economy (Global Affairs Canada 2013).

AGE models are often used for trade policy analysis because the Global Trade Analysis Project (GTAP) has made it convenient to do so, providing useful data sets and easy-to-implement AGE models. (See Hertel 1997.) The models just mentioned are all variants of the GTAP-AGE framework.

A better way

AGE models are also popular because they promise to predict which industries will benefit and which will suffer after policy changes. But that promise is often unfulfilled. As Kehoe (2005) and KRR (2015) show, the GTAP-AGE models used to analyze NAFTA predicted changes that were uncorrelated with what actually occurred.

Our recent research expands that critique by demonstrating that standard GTAP-AGE models fail to capture the effects of four more recent bilateral trade liberalizations: Australia-United States (2005 implementation), Chile-China (2006), Chile-United States (2004) and China-New Zealand (2008). Column 3 of the accompanying table reports the correlations between predicted and actual results for

2002 to 2015 trade changes.[5] The average correlation between model prediction and post-reform data (bottom row) is 0.0—that is to say, the GTAP-AGE model had essentially zero predictive accuracy.

KRR (2015) suggest that the models performed poorly because they failed to consider the fact documented by Kehoe and Ruhl (2013) that least-traded products experience much higher trade growth after policy liberalizations than heavily traded products.

This insight suggests that although standard GTAP-AGE models have done badly, more accurate predictions of industry-specific trade changes are feasible. Accounting for less-traded products makes a significant difference in forecasting accuracy, and the least-traded products (LTP) methodology developed by KRR (2015) performs much better. To demonstrate this, we use the LTP method to generate predictions for changes in trade flows due to the same four bilateral liberalizations. We use the standard GTAP-AGE model calibrated to 2004 data and eliminate the observed tariffs.[6]

LTP Models Have Higher Predictive Accuracy

Correlations between model predictions and data, 8 bilateral trade liberalizations

Exporter	Importer	(3) Standard GTAP-AGE	(4) LTP-AGE
Australia	United States	-0.14	0.53
United States	Australia	0.27	0.55
Chile	China	0.04	0.07
China	Chile	0.14	0.61
Chile	United States	0.03	0.48
United States	Chile	0.08	0.55
China	New Zealand	-0.36	0.61
New Zealand	China	-0.09	0.48
Average		**-0.00**	**0.49**

As seen by comparing column 3 and column 4, the LTP-modified AGE model does a far better job of predicting actual results, with an average correlation of 0.49. We believe that with further refinements, even better forecasts are possible. Moreover, these results suggest that the welfare gains of trade reforms are larger than previously forecast, since the GTAP-AGE model failed to predict the significant growth that occurred in least-traded products following liberalization.

More research can improve AGE models

Our analysis indicates that an AGE model that can capture the faster growth in trade in industries composed of products that are traded in small amounts before liberalization is likely to produce far more accurate predictions of the impact of the liberalization, at least on trade by industry. Embedding the LTP methodology in an AGE model would also allow us to make predictions about a wider set of variables like consumer welfare and the components of real GDP.

To introduce the LTP methodology into an AGE model, we propose adapting the model of Arkolakis (2010), who introduces marketing costs into a trade model with heterogeneous firms, a cost that increases disproportionately with the scale of consumer access.[7] This added feature means that trade costs (transportation plus consumer access) decrease more for small firms than large firms after liberalization and thus implies that firms with smaller foreign market shares increase trade more after trade liberalization.

This is but one example of the sort of progress that is possible in improving AGE trade models. Researchers need to introduce new theoretical mechanisms into their models and test these innovations by comparing predictions with data. Equally important, by better predicting which industries will experience the most growth following liberalization, we can develop models that better communicate where welfare gains from trade liberalization are likely to materialize. If the

Endnotes

[1] This paper reports on the results of a larger project that we are conducting jointly with Kim J. Ruhl of Pennsylvania State University. The data set referred to in the text and used to construct the table is available at http://www.econ.umn.edu/~tkehoe/.

[2] The AGE models whose predictions we analyze were developed in the 1970s; see Shoven and Whalley (1984) for a survey.

[3] Dynamic models emphasize the investment decisions of firms and the borrowing and lending decisions of consumers and governments. In the static models that we analyze here, investment, borrowing and lending are modeled in simple ways.

[4] Particularly when they modify the predictions that had been made before 1986 to account for two shocks that buffeted the Spanish economy in 1986—a drought that lowered productivity in agriculture and a decline in the international price of petroleum.

[5] Weighted by average trade value for the model's 42 industries.

[6] To understand the LTP predictions reported in the table, consider the case of exports from China to New Zealand. We start by dividing products into a most-traded group (about 590 products that accounted for 90 percent of trade in 2002) and a least-traded group (about 4,600 products that accounted for 10 percent). We then assign products to the GTAP-AGE model's 42 traded industries. We predict that industries with higher initial exports of LTPs will experience faster export growth; see KPR (2017) for details.

This was indeed the case. After trade reform, exports of LTPs grew from 10.0 percent of exports from China to New Zealand in 2002 to 29.9 percent in 2015, and these large increases were distributed randomly across products in different industries. The correlation between export predictions using this LTP methodology and actual data is 0.61, compared with the correlation of −0.36 for the GTAP model.

[7] A firm has access to a small set of consumers if it pays a small cost; for each new group of consumers the firm wants to reach, this cost increases disproportionately. A trade liberalization reduces the cost of transporting goods equally for all firms—to large firms that sell to many consumers and to small firms that sell to few consumers. The relevant trade cost that firms face—the sum of the cost of reaching new consumers and the cost of physically transporting goods—decreases more for small firms, however, than for large firms.

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