Discussion of Trade and Firm Dynamics Session: Econometric Society World Congress 2010

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*Fisher Hall, Department of Economics, Princeton, NJ 08544. Tel: +1 609 258 4016. Fax: +1 609 258 6419. E-mail: reddings@princeton.edu. This discussion is based on the invited papers by Jonathan Eaton and Samuel Kortum and Ariel Burstein and Marc Melitz presented in the session on Trade and Firm Dynamics at the Econometric Society World Congress 2010.
1 Introduction

In recent years, international trade has undergone a transformation from focusing on countries and industries to concentrating on firms and products. An important role in this transformation has been played by the emergence of new micro datasets on firms, plants and customs transactions, which revealed a number of features of disaggregated trade patterns that were not well explained by existing theories of international trade. Also important in this transformation has been the creation of new theoretical frameworks. Among these new theoretical frameworks are the multi-country, multi-good stochastic general equilibrium model of Eaton and Kortum (2002) and the theories of firm heterogeneity of Bernard, Eaton, Jensen and Kortum (2003), Melitz (2003) and Melitz and Ottaviano (2008). These theories of firm heterogeneity are directly motivated by the empirical challenges posed by micro data on firms and plants.¹

Both of the papers included in this session are outstanding examples of this new wave of research. In this discussion, I briefly review some of the background to the new theoretical and empirical research in international trade. I next consider each of the papers in the session in turn. A final section summarizes some of the main themes of the discussion.

2 Background

The increased availability of micro datasets on firms and plants presented a number of challenges to existing theories of international trade. Even within narrowly-defined industries, there is substantial heterogeneity in productivity, size and other characteristics across plants and firms (see, for example, the survey by Bartelsman and Doms 2000). These narrowly defined industries are also characterized by ongoing reallocations of economic activity even in the absence of trade liberalization, as plants and firms enter and exit and jobs are created and destroyed (see Davis and Haltiwanger 1991 and Dunne, Roberts and Samuelson 1989). While some firms export within any given industry, many others do not, and trade participation is systematically related to the heterogeneity in plant and firm characteristics observed within industries. Exporters are larger and more productive than non-exporters within the same industry (see, in particular, Bernard and Jensen 1995, 1999). As a result, trade liberalization induces changes in industry composition, as low-productivity firms exit and high-productivity firms expand to enter export markets, which raises aggregate industry productivity (see, for example, Pavcnik 2001 and Trefler 2004).

Many of these features sit awkwardly with representative firm models, whether they are based on comparative advantage, as in neoclassical trade theory, or on specialization and increasing returns to scale, as in the “new trade” theory following Krugman (1980). The Melitz (2003) model provides an extremely success-

¹For surveys of this recent literature in international trade, see Bernard et al. (2007) and Redding (2010).
ful explanation for these disaggregated features of micro data and isolates a new dimension of reallocation across heterogeneous firms within industries following trade liberalization.

3 International Trade: Linking Micro and Macro

The recent literature on firm heterogeneity and trade has worked almost exclusively with models of monopolistic competition, in which there is a continuum of firms and each firm is of measure zero relative to the market as a whole. Eaton and Kortum (2011) argue that the participation of a finite (and sometimes small) number of firms in international trade provides a potential source of new aggregate implications of models of firm heterogeneity and trade. To examine the implications of a finite number of firms, they consider a version of Melitz (2003), in which firm productivity $z$ is distributed Pareto and each country has access to an integer number of firm technologies. These firm technologies are sampled according to a Poisson distribution, such that the number of firms with productivity $Z \geq z$ is the realization of a Poisson random variable with parameter $T_i z^{-\theta}$.

In the presence of fixed exporting costs, a firm in country $i$ with a technology $j$ will enter market $n$ if its costs of delivering the variety to the market $C_{ni}$ are below an exporting cutoff $\bar{c}_n$:

$$C_{ni}^{(j)} = \frac{v_i d_{ni}}{Z_i^{(j)}} \leq \check{c}_n,$$

where $v_i$ captures factor prices and $d_{ni}$ denotes the iceberg variable costs of trade of supplying market $n$ from country $i$.

The exporting cutoff ($\check{c}_n$) is a function of price indices ($P_n$) and total expenditure ($X_n$) in market $n$, as well as market entry costs ($e_n$):

$$\check{c}_n = \tilde{P}_n \left( \frac{X_n}{E_n} \right)^{1/(\sigma - 1)}, \quad \tilde{P}_n = \frac{\sigma - 1}{\sigma} P_n, \quad E_n = \sigma e_n,$$

(1)

where $\sigma$ is the elasticity of substitution between varieties.

Using the productivity distribution and the exporting cutoff (1), the number of exporters ($K_{ni}$) from country $i$ to market $n$ has a Poisson distribution:

$$Pr[K_{ni} = k] = \frac{e^{-\lambda_{ni}} (\lambda_{ni})^k}{k!}, \quad \lambda_{ni} = T_i \left( \frac{v_i d_{ni}}{\check{c}_n} \right)^{-\theta}.$$

(2)

Expected bilateral exports from country $i$ to country $n$ can be decomposed into the extensive margin of the expected number of exporters and expected sales conditional on exporting:

$$\mathbb{E} [X_{ni}] = \mathbb{E} [K_{ni}] \mathbb{E} [X_{ni} | K_{ni}].$$
With a Pareto distribution for firm technologies \( z \), expected sales conditional on exporting depend solely on the entry cost and parameters:

\[
E[\bar{X}_{ni}|K_{ni}] = \frac{\tilde{\theta}}{\tilde{\theta} - 1} E_n, \quad \tilde{\theta} = \frac{\theta}{\sigma - 1}.
\]

Therefore, using the Poisson distribution of the number of exporters (2), expected bilateral exports from country \( i \) to country \( n \) can be written as:

\[
E[X_{ni}] = E[K_{ni} E[\bar{X}_{ni}|K_{ni}]] = \lambda_{ni} \frac{\tilde{\theta}}{\tilde{\theta} - 1} E_n.
\] (3)

If variable trade costs \( (d_{ni}) \) are observable, the above bilateral trade equation can be estimated using Poisson regression. More generally, if there is an unobservable component of trade costs \( (d_{ni}) \) that is gamma distributed, we obtain an analogous equation that can be estimated using negative binomial regression.

The participation of a finite number of firms in international trade provides a natural alternative explanation to Helpman, Melitz and Rubinstein (2008) for the prevalence of zeros in international trade. In Helpman, Melitz and Rubinstein (2008), zero trade flows arise because of a truncated Pareto productivity distribution, where the upper bound for a country’s productivity distribution is below the threshold required to export to a given market. In contrast, in Eaton and Kortum (2011) zero trade flows arise because of a finite number of firms, where there is a positive probability that no firm draws a productivity above the threshold to export to a given market. While the paper provides empirical evidence on the explanatory power of the model in accounting for the prevalence of zero trade flows, it would be interesting to explore further the implications of these zeros for counterfactual analyzes of changes in trade costs or other parameters. The current state of the art methodology for undertaking such counterfactuals, as developed in Deckle, Eaton and Kortum (2004), is based on a setting in which all bilateral trade flows are positive. Taking account of zeros in bilateral trade flows could potentially have a substantial impact on the predictions of such model-based counterfactuals.

The idea that the number of exporters is finite (and sometimes small) receives overwhelming empirical support in the data. For example, Bernard, Jensen, Redding and Schott (2007) report that around 4 percent of U.S. firms export, of which 40 percent export a single product to a single destination. Therefore exploring further the implications of the participation of a finite number of firms in international trade is clearly a research priority. Once there is a finite number of firms, individual firms can be sufficiently large to affect both product and labor market outcomes. It would be very interesting to extend the theoretical framework in the paper to allow individual firms to take into account their effect on price indices, factor prices and expenditures. This extension receives further motivation from the extreme concentration of trade among the relatively small numbers of trading firms with, for example, the top one percent of U.S. importers and exporters accounting for around 80 percent of the value of trade. Although some of this concentration
can be accounted for by more productive firms expanding along the extensive margins of the number of export products and destinations, its magnitude suggests the empirical relevance of the idea that individual firms can be sufficiently large to affect product and factor market outcomes. As noted in Neary (2010), this recognition that individual firms can be of positive measure suggests that theories of strategic interaction and dynamic games could prove promising avenues for further inquiry.

One striking feature of the empirical results presented in the paper is the comparisons of the negative binomial, Poisson and OLS estimates. While the Poisson specification has been pioneered as another approach to the prevalence of zeros in bilateral trade flows by Santos Silva and Tenreyro (2008), the negative binomial estimates in Eaton and Kortum (2011) are much closer to the OLS results that the Poisson estimates. Furthermore the negative binomial specification is much more successful in predicting the occurrence of zeros in bilateral trade flows than the Poisson specification. It could be interesting to discuss further the relationship between this pattern of results and the generic finding in the microeconometrics literature of overdispersion with Poisson models. The negative binomial specification introduces an additional parameter that allows the variance to be adjusted independently of the mean in fitting the observed data. By itself, this empirical finding of the comparative performance of the Poisson and negative binomial models in explaining trade flows is likely to be influential for the subsequent empirical literature in international trade. It would be interesting to also compare the empirical estimates based on a finite number of firms and a negative binomial specification to the alternative approach to taking account of zeros in bilateral trade in Helpman, Melitz and Rubinstein (2008).

4 Trade Liberalization and Firm Dynamics

Burstein and Melitz (2011) develop a general model of firm dynamics, innovation and international trade, which can be used to examine an economy’s dynamic response to trade liberalization. While much of the existing firm heterogeneity literature treats firm productivity as fixed upon entry, this framework explicitly models the endogenous evolution of firm productivity in response to intentional investments. These intentional investments in, for example, process innovation are in turn shaped by trade liberalization. The general framework developed in the paper can be used to examine how the economy’s response to trade liberalization varies with and without export market selection, with and without endogenous changes in firm productivity, with anticipated and unanticipated trade liberalization, with temporary and permanent trade liberalization, and with and without sunk export costs.

The framework developed encompasses a number of models in the existing literature as special cases, including the analysis of product and process innovation in Atkeson and Burstein (2010) and the analysis innovation and technology adoption in Constantini and Melitz (2001). Other related studies examining
the implications of trade for endogenous investments in technology include Bustos (2010) and Lileeva and Trefler (2010). A key insight that emerges from the analysis is the complementarity between entry into export markets and innovation. Exporting expands market access, which raises the return to innovation, while at the same time innovation raises the return to incurring the fixed costs of exporting.

Trade liberalization not only reallocates resources from low to high productivity firms within industries, which shapes industry dynamics, but also induces endogenous responses in firm innovative investments, which influence firm dynamics. In modeling the effect of these endogenous responses in innovative investments on firm productivity, the paper opens the black box of firm productivity, which has remained firmly closed in much of the literature on firm heterogeneity and trade. While the focus on innovation is well motivated, since it is a first-order determinant of firm productivity, modeling the microeconomic determinants of the evolution of firm productivity remains a more general research priority.

In addition to innovation, other research in the industrial organization, macroeconomics and international trade literatures has explored the role of management and internal firm organization in influencing endogenous firm productivity, as in Bloom and Van Reenen (2007), Garicano (2000), Garicano and Rossi-Hansberg (2006), and Antràs, Garicano and Rossi-Hansberg (2006). Closer to my own research interests is firms’ selection of the number and types of products to produce, their movements through the product space over time and the resulting implications for firm size and productivity, as explored in Klette and Kortum (2005) and Bernard, Redding and Schott (2010, 2011). Whereas existing research on heterogeneous firms and trade typically assumes that upon entry firms can instantaneously achieve their equilibrium size and productivity, a fundamental question remains the processes through which firms develop to become part of the one percent of firms that account for eighty percent of trade.

Returning to innovation as the source of endogenous changes in firm productivity, the paper focuses on one important channel through which trade liberalization affects incentives for innovation: the expansion in firm market access induced by entry into export markets. More generally, there are other potential channels through which trade liberalization can influence innovation. In the paper, the assumption of constant elasticity of substitution (CES) preferences implies that firm mark-ups of price over marginal cost are invariant to trade liberalization. But in other models with a variable mark-ups of price over marginal cost are invariant to trade liberalization. But in other models with a variable elasticity of substitution, such as the framework with quadratic preferences in Melitz and Ottaviano (2008), a further channel through which trade liberalization can influence innovation is its pro-competitive effect in reducing firm mark-ups. Indeed, the industrial organization literature suggests a potentially nuanced relationship between innovation and product market competition, as explored, for example, in Aghion, Harris, Howitt and Vickers (2001), Aghion, Dewatripont and Rey (1999), and Aghion, Bloom, Blundell, Griffith and Howitt (2005).

In addition to these effects in product markets, trade liberalization can influence firm technology and
productivity through input markets. A variety of recent studies have provided evidence that trade liberal-
ization can raise firm productivity through improved access to imported intermediate inputs, as in Amiti
and Konings (2007), Goldberg, Khandelwal, Pavcnik and Topalova (2010), and Halpern, Koren and Szeidl
(2009). While this mechanism is likely to be more important for developing countries and for technology
adoption than for innovation, technology adoption often itself involves intentional investments. Consid-
ering product and input markets together, trade liberalization can also influence firm technology and pro-
ductivity through the offshoring of stages of production across national borders, as in Antràs and Helpman
(2004) and Grossman and Rossi-Hansberg (2008). The resulting changes in the internal organization of pro-
duction have the potential to interact in interesting ways with firms’ incentives to engage in intentional
investments in innovation.

One interesting set of implications of the model are for firm growth and the firm size distribution, which
connects with the broader question of how these variables are influenced by access to export markets. A
growing body of empirical research provides evidence of powerful selection in export markets, both theo-
that around one half of exporters in any given year were not exporters in the previous year. Among these
new exporters, most do not survive into the next year. But conditional on survival, these new exporters
grow rapidly and account for a substantial proportion of aggregate export growth. To the extent that se-
lection in export markets differs from selection in the domestic market, these differences have the potential
to influence firm growth and the evolution of the firm size distribution, and exploring these implications
is another interesting area for further research. Differences in selection between the domestic and export
market also suggest the potential relevance of uncertainty about demand, since productivity is likely to be
largely common across markets. While in many standard models, such as those with CES preferences, de-
mand (quality) and productivity are isomorphic, exploring potential differences between heterogeneity in
demand (quality) and heterogeneity in productivity is another interesting area for further research.

5 Conclusions

The papers in this session on trade and firm dynamics are outstanding examples of the new wave of research
in international trade. Each paper pushes the boundaries of the research frontier in a different direction. The
recognition of a finite number of firms in Eaton and Kortum (2011) points to interesting further research on
market power and strategic interaction as well as on the implications of zeros in international trade for the
quantitative predictions of counterfactuals. The model of innovation in Burstein and Melitz (2011) points
to fruitful further research opening the black box of firm productivity and its evolution over time. While
much existing research assumes that upon entry firms instantaneously achieve their steady-state size and
productivity, understanding the processes through which firms grow and develop over time remains a fascinating area for research.

References


