Firm Heterogeneity in International Trade Theory*

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Abstract

The literature of firm heterogeneity in international trade grows rapidly in recent years. This paper reviews the theoretical development of the topic, and tries to find future directions of this research agenda.

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1 Introduction

Research development has its “business cycle.” Once in a while, seminal works emerge, pioneering a new field of research. A surge of studies follow immediately, which lasts for several years. Then we enter a recess until another big wave comes. The international trade theory also experiences this business cycle. In the mid-1980s, for example, a big wave of research, which is often called new trade theory, came. James Brander and Barbara Spencer pioneered so-called strategic trade theory (e.g., Brander and Spencer, 1985); Wilfred Ethier, Elhanan Helpman, and Paul Krugman introduce monopolistic-competition international trade models (e.g., Helpman and Krugman, 1985). Studies in strategic trade policy closely examine firms’ behavior in oligopolistic industries, while those in monopolistic-competition trade models explain intra-industry trade as well as inter-industry trade in general equilibrium frameworks.

Now, we are in the midst of another big wave, which Richard Baldwin calls ‘new new’ trade theory (Baldwin, 2005), pioneered by Marc Melitz and Pol Antràs among others1. This article overviews the theoretical

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1) See Helpman (2006) and Bernard, et al. (2007a) for excellent surveys of the literature. As Helpman (2006) summarizes, ‘new new’ trade theory may be divided into two groups: one that closely examines firm heterogeneity (Bernard, et al., 2003 and Melitz, 2003) and the other that spotlights contractual environment to discuss issues of international firm boundary (Antràs, 2003 and Antràs and Helpman, 2004). This article focuses on the first group of studies.
development towards ‘new new’ trade theory, and hopefully serves to show future research directions of this important issue.

2 Path from Traditional Trade Theory to ‘New New’ Trade Theory

Traditional international trade theories, the Ricardian model and Heckscher-Ohlin model, address fundamental questions (e.g., why international trade occurs, which types of goods countries export and import, and whether or not countries gain from trade) and derive many important implications. But industrial structures described there are too simplified to explain many important features of contemporary international trade, such as a large volume of intra-industry trade between developed countries. Traditional trade theories assume that in each industry, firms produce a homogeneous good with a common, constant-returns-to-scale production technology and sell their products in a perfectly competitive market. The industry-wide output level is determined in equilibrium. But the number of firms and their individual output levels are indeterminate. Firms are represented by their common production function; their faces are covered in veils.

In the 1990s, new trade theory has been developed by Krugman (1979), Helpman (1981) and Ethier (1982) among others (this theory is presented elegantly by Helpman and Krugman, 1985). New trade theory explains intra-industry trade in monopolistic-competition models, and identifies new sources of trade gains arising from a trade of differentiated varieties and scale economies. The number of firms in a differentiated-good sector and their output levels are uniquely determined within the model. Veils are uncovered in new trade theory; but faces of all firms are identical (which of course is quite odd in reality).

Many empirical studies have recently provided ample evidences of firm heterogeneity within an industry such as in their productivities, size, and export and import activities (see Bernard, et al., 2007a). These empirical evidences have motivated trade economists to develop a new theory; dawn of a new era of international trade theory is marked. Bernard, et al. (2003) and Melitz (2003) introduce firm heterogeneity in productivity in the monopolistic-competition, general-equilibrium models, and examine the impact of international trade on firms and the entire industry. They offer theoretical frameworks in which only most productive firms within an industry export (which accords with empirical findings). In the Melitz model, every potential firm pays a cost to draw its productivity from a given distribution (R&D stage), and incurs a fixed production cost and export cost. Firms’ activities are different depending on their productivities. Firms with low productivities exit immediately without entering the market; firms with intermediate levels of productivity serve the domestic market only; firms with high productivities export their products as well as selling them domestically. Firms with different productivities coexist in an industry and engage in different activities. Opening to trade induces inefficient firms to exit the market, which is another source of trade gains identified in theory. Firms in this ‘new new’ trade theory have different faces. But these seminal works do not explain why they come to have different faces.
3 Endogenizing Firm Heterogeneity

Most recently, there has been a surge of research that theoretically describes possible causes of firm heterogeneity. This section introduces some of those studies, hoping to find future directions of research regarding firms in international trade.

3.1 Heterogeneous Timing of Technology Adoption

Ederington and McCalman (2008, forthcoming) identify heterogeneous timing in the technology adoption as a cause of firm heterogeneity in an industry. They consider ex ante symmetric firms that have opportunities of adopting a high-productivity technology. Adoption of the high-productivity technology is costly, but this cost declines over time. Firms are faced with a trade-off in the timing of the technology adoption: they earn higher profits for a longer period of time but incur higher adoption costs if they adopt the high-productivity technology earlier. In equilibrium, all firms are indifferent in the adoption timing, and as a result high-productivity technology is gradually adopted in the industry. At each moment of time, firms with different productivities coexist as in the models of Bernard, et al. (2003) and Melitz (2003). Here, decreasing adoption cost is a key to the mechanism that yields firm heterogeneity.

3.2 Heterogeneous Workers

Yeaple (2005) also provides a theory to explain why ex ante symmetric firms end up with operating with different production technologies. Although firms are ex ante symmetric, workers in his model are heterogeneous in their skills. In a manufacturing sector, firms can choose either high-productivity technology or low-productivity technology. High-skilled workers have a comparative advantage on high-productivity technology, while low-skilled workers have a comparative advantage on low-productivity technology. In equilibrium, some firms choose high-productivity technology with a high fixed cost, hiring high-skilled workers. Whereas some other firms choose low-productivity technology with a low fixed cost, hiring low-skilled workers. Only high-productivity firms export (just as in the Melitz model), because only those firms with low marginal costs (with a high fixed cost) can overcome trade costs. There are two channels through which ex ante symmetric firms become ex post asymmetric. First, matching with workers with different skills makes firms heterogeneous in their choice of technology. Second, existence of trade costs divide firms into two groups: ones that adopt high-productivity technology and export their products as well as selling them domestically and others that adopt low-productivity technology and sell their products only domestically.

3.3 Costly Innovation by Heterogeneous firms

Bustos (2005), Atkeson and Burstein (2007), and Costantini and Melitz (2007) analyze interaction between international trade and firm heterogeneity in productivity. Like Melitz (2003), productivities are exogenously
given for all individual firms. But they have an opportunity to upgrade the technology with a fixed amount of investment. Firms with high productivities export their products as well as selling them domestically. They have more incentive to invest to become more productive since their operation level is higher than firms with lower productivities. Consequently, only productive firms upgrade the technology; globalization makes strong firms become stronger and weak firms become (relatively) weaker.

3.4 Choice of Factor Intensity

Furusawa and Sato (2008) analyze the relationship between firm heterogeneity and factor endowment. They are motivated by the observations that new advanced technologies tend to be labor-saving (or equivalently, capital-intensive) and adopted in capital-abundant, developed countries. Firms have their own intrinsic productivities that come into effect only when they adopt a new technology; old technology is standardized, so productivities are the same no matter which firm uses it. Consequently, firms with higher intrinsic productivities adopt new technologies with a higher proportion, realizing higher productivities than firms with lower intrinsic productivities. Firms' choice of technology depend on the factor prices. Firms in a capital-abundant country are faced with a higher wage-rental ratio in autarky than those in a labor-abundant country, so they have more incentive to adopt new technologies. The resulting firm heterogeneity is greater in the capital-abundant country because more firms adopt new technologies with higher proportions, realizing their intrinsic difference in productivity. They also examine the impact of technological progress on firm heterogeneity. They find that technological progress induces only the firms with higher intrinsic productivities to upgrade the technology, and hence it makes strong firms stronger while weaker firms (relatively) weaker.

3.5 Financial Imperfection

Furusawa and Yanagawa (2008) relate firm heterogeneity to financial imperfection. Upgrading production technology is almost always costly. Firms often need to borrow money to carry out process innovation (i.e., productivity-enhancing investment). In the absence of financial imperfection, all firms can borrow money with equal opportunities, so they all borrow enough money to achieve the optimal productivity level. Firm heterogeneity in productivity will not arise in such cases. Under financial imperfection, however, firms with different initial assets are faced with different financial opportunities. In the situation where investors can collect only a fraction of the borrowers' profits, entrepreneurs with higher initial assets are less financially constrained, and hence invest more on the process innovation. Firm heterogeneity in productivity arises from the heterogeneity in initial asset holdings of firms. Heterogeneity is greater in a country with a higher financial imperfection.

2) Bernard et al. (2007b) also extend the Melitz model to a Heckscher-Ohlin model.
4 Concluding Remarks

So-called ‘new new’ trade theory adds firm-level micro-structures to traditional general equilibrium models. The literature expands, adding more sophisticated micro-structures such as firm dynamics (e.g., Luttmer, 2007) to the models. This trend is expected to continue as long as theoretical predictions do not match empirical findings. Dialogs between theoretical and empirical studies grow more important these days.

References


