

Bernard, Andrew B.

Article

Firms in international trade

NBER Reporter Online

Provided in Cooperation with:

National Bureau of Economic Research (NBER), Cambridge, Mass.

Suggested Citation: Bernard, Andrew B. (2006) : Firms in international trade, NBER Reporter Online, National Bureau of Economic Research (NBER), Cambridge, MA, Iss. Fall 2006, pp. 11-14

This Version is available at:

<https://hdl.handle.net/10419/61892>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Firms in International Trade

Andrew B. Bernard*

For most of its lengthy history the field of international trade largely ignored the role of the firm in mediating the flow of goods and services. Traditional trade theory explained the flow of goods between countries in terms of comparative advantage, that is, a variation in the opportunity costs of production across countries and industries. Even the research focusing on differentiated varieties and increasing returns to scale that followed Helpman and Krugman continued to retain the characterization of the representative firm.¹ However, the assumption of a representative firm, while greatly enhancing the tractability of general equilibrium analysis, is emphatically rejected in the data. My research over the past decade has been an attempt to explore international trade from below: to understand the decisions of heterogeneous firms in shaping international trade and their effects on productivity growth and welfare.

Firm Heterogeneity and Trade

My early work with J. Bradford Jensen was motivated by a simple question: what do we know about firms that trade? The answer at the time was “very little” and our initial efforts focused on locating firm-level data and describing the world of exporting firms. Our first study compared exporters and non-exporters for the entire U.S. manufacturing sector and established a set of facts about exporting plants and firms.² Two major results stand out. First, only a small fraction of firms are exporters at any given time. Even in sectors where

the United States is thought to have comparative advantage, such as Instruments, a majority of firms produce only for the domestic market. Similarly, some firms are exporting even in net import sectors such as Textiles and Apparel.

Second, exporters are substantially and significantly different than non-exporters, even in the same industry and region. Exporters are dramatically larger, more productive, pay higher wages, use more skilled workers, and are more technology- and capital-intensive than their non-exporting counterparts. In related work on German firms with Joachim Wagner, I again found these patterns of systematic differences between exporters and non-exporters and subsequent research by numerous authors has confirmed them to be robust across a wide range of industries, regions, time periods and countries at varied levels of economic development.³

Exporting and Productivity

The biggest question raised by this early research was the nature of the positive correlation between export status and productivity, that is, whether exporting leads to higher plant productivity. Research done with J. Bradford Jensen established that “potential” exporters have better characteristics years before they enter a foreign market, including higher productivity, higher wages, and larger size.⁴ However, the most important finding was that exporters do not have higher productivity growth even though they have higher levels of productivity. Today’s exporters have no advantage in terms of productivity growth relative to non-exporters over the next year, and over some horizons actually significantly underperform in terms of productivity growth.

As a complementary question, we

asked if higher productivity increases the probability of a plant becoming an exporter. Studies on both the U.S. and Germany find evidence for the selection of high productivity firms into exporting as well as evidence of substantial sunk costs to entering the export market.⁵ The strong conclusion from this empirical work is that high productivity firms are able to pay the sunk costs of entering foreign markets but that, once in, they do not receive an extra productivity kick.

However, the role of productivity in shaping aggregate export responses should not be overstated. Work on the determinants of the U.S. export boom cautioned that improved U.S. productivity still played a minor role relative to exchange rates and foreign income growth in the dramatic expansion of exports in the late 1980s and early 1990s.⁶

While firm-level productivity is not improved by exporting, exporting does benefit the firm in other ways. First, plant failure is dramatically less likely for exporters.⁷ In a study of the role of firm structure and multinational ownership on plant deaths, we find that exporting is strongly correlated with survival at U.S. plants, even after controlling for productivity and numerous other plant, firm, and industry characteristics. Ownership by a multinational, however, substantially increases the conditional probability that a plant will close. This relationship between multinationality and plant closure holds in other countries as well.⁸

The second major benefit of exporting for the firm is faster growth, both for output and employment. The faster output growth at exporters, combined with their higher initial productivity levels, leads to relatively large effects on aggregate productivity. A substantial fraction of overall manufacturing productivity growth is

*Bernard is a Research Associate in the NBER's Program on International Trade and Investment and a Professor of International Economics at the Tuck School of Business at Dartmouth. His profile appears later in this issue.

attributable to faster growth of high-productivity exporters.⁹

Firms and Trade — Theory

These empirical results suggested the need for a formal general equilibrium model of heterogeneous firms and international trade. Together with Jonathan Eaton, Jensen, and Samuel Kortum, I developed a model of international trade and heterogeneous firms that focuses on the relationship between plant productivity and exporting.¹⁰ Starting from the stylized facts that there are relatively few exporters, that they are much larger and more productive, and that there is little or no evidence that exporting improves firm productivity, we construct a Ricardian model of heterogeneous firms, imperfect competition with incomplete markups, and international trade.

Simulating a 5 percent worldwide reduction in geographic barriers, we find that trade volumes increase by 39 percent and aggregate productivity increases because low-productivity plants fail and high-productivity survivors expand and start to export. The model provides a rich set of additional testable implications, as the interaction of lower trade costs and product differentiation leads to a range of responses by firms within the same industry: the least productive are the most likely to fail, and the relatively high productivity non-exporters are the most likely to start exporting.

In subsequent theoretical work with Stephen Redding and Peter K. Schott, I embed heterogeneous firms into a model of comparative advantage and analyze how firm, country, and industry characteristics interact as trade costs fall.¹¹ This paper combines the heterogeneous-firm trade firm model of Melitz¹² with traditional cross-country differences in endowments and cross-industry differences in production technology.

We report a number of new and often surprising results. In contrast to the neoclassical model, we find that simultaneous within- and across-industry reallocations of economic activity generate substantial job turnover in all sectors, even while there is net job creation in comparative-advan-

tage industries and net job destruction in comparative-disadvantage industries. We show that steady-state creative destruction of firms also occurs in all sectors, but we find that it is more highly concentrated in comparative-advantage industries than in comparative-disadvantage industries. These results suggest that the effects of trade on labor market outcomes may not be confined to job losses in comparative-disadvantage sectors.

We also find that the behavior of heterogeneous firms magnifies countries' comparative advantage and thereby creates a new source of welfare gains from trade. The relative growth of high-productivity firms raises aggregate productivity in all industries, and productivity growth is strongest in comparative-advantage sectors. The price declines associated with these productivity increases inflate the real-wage gains of relatively abundant factors while dampening, or even potentially overturning, the real-wage losses of relatively scarce factors.

Firm Responses to Trade Liberalization

The empirical and theoretical work on firm heterogeneity and trade naturally leads to the question of how firms respond to trade liberalization and increased foreign competition. Jensen, Schott, and I test for the effects of competition from low-wage countries such as China on plant employment and plant survival.¹³ High levels of import competition from low-wage countries are bad for plant growth and survival but are especially problematic for low-capital, low-skill plants in any industry. In addition, we find that plants facing high levels of competition from low-wage countries are more likely to change their output mix towards products made with more capital and more skilled labor. This discovery of product switching in response to foreign competition has led to a new series of papers documenting the extraordinary amount of ongoing product switching in the U.S. economy.¹⁴

In further work on the firm-level response to falling trade barriers, we test the additional implications of the new heterogeneous-firm models of Melitz and

Bernard, Eaton, Jensen, and Kortum.¹⁵ These models predict heterogeneous responses to reduced trade costs across firms, including entry into exporting by some and increased failure rates for others. The predictions of the theory are largely supported by the data on U.S. manufacturing plants. Using a new measure of trade costs, we find that reductions in trade costs are associated with faster industry productivity growth. The effect of falling trade barriers varies substantially across firms within an industry. Low-productivity plants fail more often and higher-productivity plants start to export. This heterogeneous response leads to a reallocation within the industry towards more productive establishments and helps to account for the aggregate productivity gains. Interestingly, a result not predicted by the theoretical models is that plant productivity actually rises in response to lower trade costs. This result points to the need for a richer set of firm-based theoretical models.

Trade and Wages

My work on the interaction of firms and international trade has naturally led to a series of related papers on the role of trade in contributing to wage inequality in the United States. Starting from the observation that exporters pay higher wages than non-exporters, Jensen and I asked whether increased exports contributed to the rise in wage inequality in the manufacturing sector in the 1980s.¹⁶ The results showed that increased wage inequality was largely associated with changes in employment across plants in the same industry and that rising demand for exports played an important role in this employment shift. Related work on rising wage inequality in Mexico by Verhoogen and Robertson has also found a significant role for the interaction of firm heterogeneity and exporting.¹⁷

The empirical work on wage inequality suggested the need for a formal test of relative factor price equality across regions. Redding, Schott, and I develop a test of relative factor price equality that is robust to unobserved regional productivity differences, unobserved region-industry fac-

tor quality differences, and variation in production technology across industries.¹⁸ In a series of papers applying the test to data on the United States, the United Kingdom, and Mexico, we find that there are significant and persistent differences in relative wages across regions, with skill-abundant regions such as New York and London having lower relative wages for skilled workers, even though absolute wage levels are higher in those areas.¹⁹

Firms and Products

An emerging line of research is examining the characteristics and decisions of importing firms as well as the interactions between firms, products, and trade. However, data on importing firms has been harder to locate as governments typically are more interested in documenting exports than imports. Recent research with Jensen and Schott using data on the entire set of U.S. private sector firms and all their trade transactions highlights the fact that we still have much to learn about the differences between trading and non-trading firms.²⁰ Of the 5.5 million firms operating in the United States, only 4.1 percent engage in importing or exporting. However, these trading firms are hugely important in the U.S. economy, accounting for more than 47 percent of total employment and typically importing and exporting multiple products. Even among the firms that trade, the most globally-engaged dominate: more than 95 percent of U.S. trade is conducted by just 10 percent of the trading firms (0.4 percent of all firms) and multinationals operating in the United States account for more than 90 percent of U.S. imports and exports.

Next Steps

In spite of a decade of research, we are just beginning to explore the role of firms in mediating the effects of trade on the economy. The new detailed data on firms, products, and trade will allow us to ask important questions about firms engaged in international trade and investment. Do multinationals behave differently when they trade inside the firm or with arm's length customers? How

does the structure of the multinational firm respond to policy changes? How do domestic employment and wages respond when firms establish affiliates abroad? The dominant role of multinationals in U.S. trade means that the answers to these questions have implications for aggregate trade volumes, production and employment in the United States, wholesale and retail prices, corporate tax receipts, and a host of other issues.

¹ E. Helpman and P. R. Krugman, *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy*, Cambridge, MA: MIT Press, 1985.

² A. B. Bernard and J. B. Jensen, "Exporters, Jobs, and Wages in U.S. Manufacturing: 1976-87," *Brookings Papers on Economic Activity: Microeconomics*, 1995, pp. 67-112.

³ A. B. Bernard and J. Wagner, "Exports and Success in German Manufacturing," *Weltwirtschaftliches Archiv*, 1997, Vol. 133, No. 1, pp. 134-57.

⁴ A. B. Bernard and J. B. Jensen, "Exceptional Exporter Performance: Cause, Effect, or Both?" *NBER Working Paper No. 6272*, November 1997, and *Journal of International Economics*, 1999, 47(1), pp. 1-25.

⁵ A. B. Bernard and J. B. Jensen, "Why Some Firms Export," *NBER Working Paper No. 8349*, July 2001, and *The Review of Economics and Statistics*, 2004, Vol. 86, No. 2; and A. B. Bernard and J. Wagner, "Export Entry and Exit by German Firms," *NBER Working Paper No. 6538*, April 1998, and *Weltwirtschaftliches Archiv*, 2001, Vol. 137, No. 1.

⁶ A. B. Bernard and J. B. Jensen, "Understanding the U.S. Export Boom," *NBER Working Paper No. 6438*, March 1998, published as "Entry, Expansion and Intensity in the U.S. Export Boom, 1987-1992," *Review of International Economics*, 2004, 12(4), pp. 662-75.

⁷ A. B. Bernard and J. B. Jensen, "Firm Structure, Multinationals, and Manufacturing Plant Deaths," *forthcoming in The Review of Economics and Statistics*, revision of "The Deaths of

Manufacturing Plants," *NBER Working Paper No. 9026*, July 2002.

⁸ A. B. Bernard and F. Sjöholm, "Foreign Owners and Plant Survival," *NBER Working Paper No. 10039*, October 2003.

⁹ A. B. Bernard and J. B. Jensen, "Exporting and Productivity," *NBER Working Paper No. 7135*, May 1999, published as "Exporting and Productivity in the USA," *Oxford Review of Economic Policy*, 2004, Vol. 20, No. 3.

¹⁰ A. B. Bernard, J. Eaton, J. B. Jensen, and S. S. Kortum, "Plants and Productivity in International Trade," *NBER Working Paper No. 7688*, May 2000, and *American Economic Review*, 2003, 93(4), pp. 1268-90.

¹¹ A. B. Bernard, S. J. Redding, and P. K. Schott, "Comparative Advantage and Heterogeneous Firms," *NBER Working Paper No. 10668*, August 2004, *forthcoming in Review of Economic Studies*.

¹² M. Melitz, "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, Vol. 71, November 2003, pp. 1695-725.

¹³ A. B. Bernard, J. B. Jensen, and P. K. Schott, "Survival of the Best Fit: Exposure to Low Wage Countries and The (Uneven) Growth of U.S. Manufacturing Plants," *NBER Working Paper No. 9170*, September 2002, and *Journal of International Economics*, 2006, Vol. 68, pp. 219-37.

¹⁴ A. B. Bernard, S. Redding, and P. K. Schott, "Multi-Product Firms and Product Switching," *forthcoming as an NBER Working Paper*.

¹⁵ A. B. Bernard, J. B. Jensen, and P. K. Schott, "Trade Costs, Firms and Productivity," *forthcoming in Journal of Monetary Economics*, presented at the *Carnegie-Rochester Conference on Public Policy*, November 18-19, 2005; revision of "Falling Trade Costs, Heterogeneous Firms, and Industry Dynamics," *NBER Working Paper No. 9639*, April 2003.

¹⁶ A. B. Bernard and J. B. Jensen, "Exporters, Skill Upgrading and the Wage Gap," *Journal of International Economics*, Vol. 42, 1997, pp. 3-31.

¹⁷ R. Robertson, "Trade Liberalization and Wage Inequality: Lessons from the

Mexican Experience," *World Economy*, 2000, 23(6): pp. 827–49; and E. Verhoogen, "Trade, Quality Upgrading and Wage Inequality in the Mexican Manufacturing Sector: Theory and Evidence from an Exchange-Rate Shock," *Columbia University working paper*, 2006.

¹⁸ A. B. Bernard, S. J. Redding, P. K. Schott, "Factor Price Equality and the Economies of the United States," *CEPR Discussion Paper No. 5111*, June 2005 revision of A. B. Bernard, J. B. Jensen,

and P. K. Schott, "Factor Price Equality and the Economies of the United States," *NBER Working Paper No. 8068*, January 2001.

¹⁹ A. B. Bernard, S. J. Redding, P. K. Schott, H. Simpson "Factor Price Equalization in the UK?" *NBER Working Paper No. 9052*, July 2002; A. B. Bernard, S. J. Redding, P. K. Schott, H. Simpson, "Relative Wage Variation and Industry Location," *NBER Working Paper No. 9998*, September 2003; A. B. Bernard, R. Robertson, and P. K. Schott,

"Is Mexico a Lumpy Country?" *NBER Working Paper No. 10898*, November 2004

²⁰ A. B. Bernard, J. B. Jensen and P. K. Schott, "Importers, Exporters, and Multinationals: A Portrait of Firms in the U.S. that Trade Goods," *NBER Working Paper No. 11404*, June 2005, forthcoming in *Producer Dynamics: New Evidence From Micro Data*, T. Dunne, J. B. Jensen and M. J. Roberts, eds., *University of Chicago Press*.

Economics of the Pharmaceutical Industry

Patricia M. Danzon*

The pharmaceutical industry is important because it is a major source of medical innovation. The U.S. research-based industry invests about 17 percent of sales in R and D, and R and D drives performance of individual firms and industry structure. It is also a heavily regulated industry. Drugs are evaluated for safety, efficacy, and manufacturing quality as a condition of market access, and promotional messages must adhere to approved product characteristics. Drug prices also are regulated in most countries with national health insurance systems. My research on the pharmaceutical industry has examined issues related to R and D performance and industry structure, and the effects of regulation on prices, availability, and utilization of

drugs, and on productivity.

R and D, Firm, and Industry Structure

Regulation of market access and promotion derives from uncertainty about drug safety and efficacy. These product characteristics can only be determined from accumulated experience over large numbers of patients in carefully designed trials or observational studies. The design, monitoring, and evaluation of these studies are public goods that in theory can be efficiently produced by an expert regulatory agency.¹ The 1962 Amendments to the FDA Act extended the powers of the FDA to review safety, efficacy, manufacturing quality, and promotion. Subsequent studies concluded that the safety and efficacy requirements added to the intrinsically high cost of R and D, led to launch delay of new drugs and favored large over small firms.

However, more recently the biotechnology revolution has transformed the nature of drug discovery and the structure

of the industry. Increasingly, new drugs originate in small firms, which often out-license their products to more experienced firms for later-stage drug development, regulatory review, and commercialization. In any year the biotechnology industry may comprise a couple of thousand firms, but the identity of these firms changes, as new start-ups are formed and established firms grow, merge, or are acquired by other established companies. Although larger firms have grown in market share, because of mergers, their performance has lagged that of smaller firms, on whom the large firms increasingly rely for new products.

In a series of papers, I and my co-authors have examined the effects on R and D productivity of firm experience and alliance relationships; the nature of the market for alliances between small and large firms; and the effects of mergers and acquisitions. In a study of the determinants of drug success in clinical trials,² we find that returns to a firm's overall experience (number of drugs developed across all therapeutic categories) are small for the relatively simply phase 1 trials, but

* Patricia Danzon is a Research Associate in the NBER's Program on Health Care and the Celia Moh Professor at The Wharton School of Management, University of Pennsylvania. She is also a Chair of the Health Care Systems Department and a Professor in the Department of Insurance and Risk Management. Her profile appears later in this issue.