

# Heterogeneity and Sorting in International Trade

Julia Cajal Grossi\*

October 2017

First Version: May 2016 †

## Abstract

This paper separates out the unobserved heterogeneity of exporters from that of their buyers along four dimensions: appeal or quality, productivity, market power and access to inputs. I use customs records from Bangladesh over the period 2005 - 2012, containing information on the inputs used for the production of individual export orders placed by international buyers with local garment manufacturers. I propose a system of equations characterizing equilibrium prices and quantities, compatible with a broad class of demand and production models. I discuss and, where possible, test the matching protocol that allows for identification of the two sides of heterogeneity on each of the four dimensions and construct suitable instruments exploiting the structure of the production network. I offer a set of stylized facts that can be grouped in: (i) the dispersion in performance across exporters is mainly explained by the volumes traded with their buyers, rather than the number of buyers; sorting into relationships with large buyers is the main driver of exporters' revenues; (ii) buyer-specific heterogeneity explains two and ten times more variation in demand (quantities) and markups, respectively, relative to seller-specific heterogeneity; while productivity is mostly explained by seller effects, a non-negligible share of the residual variability in productivity is accounted for by the buyer; and (iii) buyers and sellers sort positively on their appeal characteristic; sorting patterns on supply-side unobservables vary across products, with the price elasticity of demand and the returns to scale in the production of each category.

---

\*Department of Economics, Graduate Institute, Geneva (IHEID). Email: julia.cajal@graduateinstitute.ch. Website: <https://sites.google.com/site/juliacajalgrossi/home>.

†An earlier version of this paper circulated as the second part of *Searching for Trade Partners in Developing Countries: Testing Firms in the 'Fast-Fashion' Industry*, which has now been superseded by two separate papers. I have benefited from valuable feedback from Chris Woodruff, Guillermo Noguera, Mirko Draca, Jan Eeckhout, Rocco Macchiavello, Richard Baldwin, Greg Crawford, Carlos Noton, Michele Pellizzari, Kala Krishna, Ken Teshima, Monika Mrazova and Wiji Arulampalam. All errors are mine. Financial support from a PEDL/CEPR Grant is gratefully acknowledged.

# 1 Introduction

A large body of literature in international trade has focussed on identifying the sources of exporter heterogeneity.<sup>1</sup> From a trade perspective, understanding the empirical drivers of dispersion in firms' performance is important for quantifying equilibrium models of trade, on the basis of microeconomic fundamentals. From a development perspective, understanding exporters' heterogeneity amounts to uncovering the *who* and the *how* of the development strategies of countries reliant on their export sectors.

In recent years, the availability of transaction level records of international trade has facilitated the study of the two-sided nature of trade flows.<sup>2</sup> These flows occur, at large, as the result of firm-to-firm interactions, where heterogeneity is present on both the buyer and seller sides.<sup>3</sup> Equilibrium outcomes of these interactions - this is, traded volumes and prices - emerge from the idiosyncratic characteristics of the exporter, that of its buyers and some sorting protocol. This entails a fundamental departure from setups that 'load' all heterogeneity exclusively on supply-side determinants (typically, productivity) or on demand-side determinants (typically, tastes for quality).

This paper uses unique data on quantities and prices of both material inputs and outputs to separate out heterogeneity of buyers and sellers along four dimensions: an *appeal* or demand characteristic conditional on price, a productivity characteristic, firm-specific market power and heterogeneity on the access to inputs. The paper offers a system of equations that is compatible with a broad class of structural models of demand and production in international trade. It recovers attributes that correspond to the buyer and the seller in those four dimensions - appeal, productivity, markups and access to inputs -, allowing for unrestricted correlations across them. The paper offers six novel stylised facts on the drivers of dispersion in exporters' performance and the patterns of sorting of buyers and sellers.

Under fairly mild assumptions, the system of equations exhausts all possible two-sided variation in observed prices and quantities. Considering the appeal margin of heterogeneity, an exporter may trade larger than average volumes, given prices and the product category, both due to an inherent vertical attribute appealing to all buyers or

---

<sup>1</sup>See Manova and Zhang (2012), Hottman et al. (2016), Pavcnik (2002), Bernard et al. (2007), Bernard et al. (2012), Eaton et al. (2011), de Loecker and Goldberg (2014), de Loecker et al. (2016), among others.

<sup>2</sup>See Wagner (2016) for a survey on studies using this customs data.

<sup>3</sup>Throughout, I use the term *buyer* to refer to importers and will refer to exporters as *sellers*, *suppliers* or *manufacturers*. In the setup of this study, this simplification on semantics is innocuous.

due to sorting into trade relationships with buyers that are particularly large. Turning the attention onto the supply side, if buyers affect the production process of their suppliers, marginal costs reflect the productivity of the exporter and a buyer-specific shifter to it. Conditional on marginal costs, equilibrium prices result also from the combination of heterogeneity on both sides of the trade interactions: markups might be low as a result of optimal pricing of the seller against the entirety of its demand or due to bilateral bargaining with buyers that pay low markups to their suppliers. Finally, exporters might exhibit marginal cost advantages if they have differential access to cheap inputs, while such access might be induced by buyers with market power upstream or strong pressure for cost reductions.

The econometric approach in this paper hinges on three main devices. First, I use granular data of every export order of ready made garment produced in Bangladesh for foreign buyers over 2005 - 2012, featuring input-output matches for each shipment. This allows for the construction of buyer-seller specific markups and marginal costs. Second, I exploit the structure of the bipartite network of observed trade to construct suitable instruments needed in the demand, pricing and production equations. Third, as the separation of buyer and seller effects in this context is akin to comparable exercises on employer-employee matched data, the decomposition here adapts an extensively used set of techniques in labor economics.

The main findings can be summarized as follows. First, while sales exhibit high dispersion across exporters, almost 70% of this variation is accounted for by the intensive margin, this is how much a given seller trades with its buyers, rather than the number of trade partners the seller has. Second, 94% of the variability in buyer-seller sales is explained by volume rather than price. Taken together, these two pieces of evidence suggest that high revenue exporters correspond, to a large extent, to sellers that manage to trade large volumes with their buyers, few or many. Third, conditional on price, the seller-side heterogeneity explaining variation in volumes is about half of the buyer-side heterogeneity. This amounts to observing that the share of the demand that each exporter captures is largely determined by sorting into relationships with large buyers, rather than by the seller exhibiting an appealing vertical attribute. Fourth, on the supply side, 28% of the variation in marginal costs is explained by seller's productivity and 5.3% by buyer's productivity, both net of product and time effects, input usage and prices, which account for the remaining variation. Although the buyer's contribution is comparatively small, its *existence* is novel in the literature: a seller operating a given technology when producing for two different buyers does so with different productivities. Fifth, the wedge between marginal costs and prices is almost entirely driven by the buyer, whose incidence in markups is about ten times that

of the seller. The residual variability in input prices within a product category and time combination can be attributed to the buyer and seller in roughly equal amounts. Sixth, there is evidence of positive assortativity in the appeal characteristic between buyers and sellers. Sorting patterns on the supply-side characteristics is mediated by the product-specific price elasticity of the demand and the product-specific returns to scale.

This paper is framed in a growing body of literature on two sided heterogeneity in international trade. It provides evidence of sorting into relationships as a main driver of exporter's performance and as such, it is related to a set of papers on the formation of trade relationships. With models of search, learning or switching, Tybout et al. (2016), Eaton et al. (2014), Monarch (2014), Benguria (2015), Monarch and Schmidt-Eisenlohr (2016) and Cajal Grossi (2017) explain the formation of buyer-seller networks in United States, Colombia, France, China and Bangladesh. Carballo et al. (2016) and Bernard et al. (2016) study the implications of buyer heterogeneity within destination countries in the response of exporters to macro shocks. While this paper focuses on unobservable attributes of either side of the trade relationship, Dragusanu (2014) and Sugita et al. (2015) characterize the matching patterns over observables between exporters and importers in supply chains and derive conclusions on sorting patterns. Matching and sorting on the number and size of partners is also studied in Bernard et al. (2016) and Blum et al. (2010), respectively. Finally, Cajal Grossi et al. (2017) and Heise (2016) focus on pricing and heterogeneous markups across trade relationships.

In its methodology, this paper builds on the tradition in labor economics working with employer-employee matched data, and more recently exploited in the trade context (Kramarz et al. (2016)). The recovery of unobserved heterogeneity follows Abowd et al. (1999) and Abowd et al. (2002), and the robustness exercises and discussion on identification follow Card et al. (2013) and Hagedorn et al. (2017). The construction of the relevant instruments exploits the connections of buyers and sellers through the trade network and, as such, is related to the literature on identification of peer effects via overlapping ties, as in Bramoullé et al. (2009) and De Giorgi et al. (2010).

The body of the paper is organized as follows. Section 2 presents the empirical context, the data and offers some preliminary patterns on heterogeneity and sorting on observables. Section 3 presents the system of equations and establishes its connection with standard models of trade. Section 4 discusses the restrictions for identification of buyer and seller effects and section 5 presents the instruments. Section 6 discusses the results and organizes the findings into six stylized facts. Sections 7 and 8 are devoted to robustness and conclusions, respectively.

## References

- ABOWD, J., F. KRAMARZ, AND D. MARGOLIS (1999): “High Wage Workers and High Wage Firms.” *Econometrica*, 67, 251–333.
- ABOWD, J. M., R. CREECY, AND F. KRAMARZ (2002): “Computing Person and Firm Effects Using Linked Longitudinal Employer-Employee Data.” Mimeo.
- BENGURIA, F. (2015): “The Matching and Sorting of Exporting and Importing Firms: Theory and Evidence,” *Working Paper*.
- BERNARD, A. B., J. B. JENSEN, S. J. REDDING, AND P. K. SCHOTT (2007): “Firms in International Trade,” *Journal of Economic Perspectives*, 21, 105–130.
- (2012): “The Empirics of Firm Heterogeneity and International Trade,” *Annual Review of Economics*, 4, 283–313.
- BERNARD, A. B., A. MOXNES, AND K. H. ULLTVEIT-MOE (2016): “Two-Sided Heterogeneity and Trade,” *Discussion papers, Research Institute of Economy, Trade and Industry (RIETI)*.
- BLUM, B. S., S. CLARO, AND I. HORSTMANN (2010): “Facts and Figures on Intermediated Trade,” *American Economic Review*, 100, 419–23.
- BRAMOULLÉ, Y., H. DJEBBARI, AND B. FORTIN (2009): “Identification of peer effects through social networks,” *Journal of Econometrics*, 150, 41–55.
- CAJAL GROSSI, J. (2017): “The Search for Trade Partners in Developing Countries,” *mimeo*.
- CAJAL GROSSI, J., G. NOGUERA, AND R. MACCHIAVELLO (2017): “International Buyers and Firm Performance: Dressing Up in Bangladesh,” *mimeo*.
- CARBALLO, J., G. I. P. OTTAVIANO, AND C. VOLPE MARTINCUS (2016): “The Buyer Margins of Firms’ Exports,” *Working Paper*.
- CARD, D., J. HEINING, AND P. KLINE (2013): “Workplace Heterogeneity and the Rise of West German Wage Inequality,” *The Quarterly Journal of Economics*, 128, 967–1015.
- DE GIORGI, G., M. PELLIZZARI, AND S. REDAELLI (2010): “Identification of Social Interactions through Partially Overlapping Peer Groups,” *American Economic Journal: Applied Economics*, 2, 241–75.

- DE LOECKER, J. AND P. K. GOLDBERG (2014): “Firm Performance in a Global Market,” *Annual Review of Economics*, 6, 201–227.
- DE LOECKER, J., P. K. GOLDBERG, A. K. KHANDELWAL, AND N. PAVCNIK (2016): “Prices, Markups and Trade Reform,” *Econometrica*, 84, 445 – 510.
- DRAGUSANU, R. (2014): “Firm-to-Firm Matching along the Global Supply Chain,” *mimeo*.
- EATON, J., M. ESLAVA, C. J. KRIZAN, D. JINKINS, AND J. TYBOUT (2014): “A Search and Learning Model of Export Dynamics,” *Working Paper*.
- EATON, J., S. KORTUM, AND F. KRAMARZ (2011): “An Anatomy of International Trade: Evidence from French Firms,” *Econometrica*, 79, 1453–1498.
- HAGEDORN, M., T. H. LAW, AND I. MANOVSKII (2017): “Identifying Equilibrium Models of Labor Market Sorting,” *Econometrica*, 85, 29–65.
- HEISE, S. (2016): “Firm-to-Firm Relationships and Price Rigidity: Theory and Evidence,” *mimeo*.
- HOTTMAN, C. J., S. J. REDDING, AND D. E. WEINSTEIN (2016): “Quantifying the Sources of Firm Heterogeneity,” *The Quarterly Journal of Economics*, 131, 1291–1364.
- KRAMARZ, F., J. MARTIN, AND I. MEJEAN (2016): “Volatility in the Small in the Large: The Lack of Diversification in International Trade,” *Working Paper*.
- MANOVA, K. AND Z. ZHANG (2012): “Export Prices across Firms and Destinations,” *The Quarterly Journal of Economics*, 127, 379–436.
- MONARCH, R. (2014): ““It’s Not You, It’s Me”: Breakups in U.S.-China Trade Relationships,” *mimeo*.
- MONARCH, R. AND T. SCHMIDT-EISENLOHR (2016): “Learning and the Value of Relationships in International Trade,” Working Papers 16-11, Center for Economic Studies, U.S. Census Bureau.
- PAVCHNIK, N. (2002): “Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants,” *The Review of Economic Studies*, 69, 245–276.
- SUGITA, Y., K. TESHIMA, AND E. SEIRA (2015): “Assortative Matching of Exporters and Importers,” *mimeo*.

TYBOUT, J., D. JINKINS, D. Y. XU, AND J. EATON (2016): “Two-sided Search in International Markets,” *Working Paper*.

WAGNER, J. (2016): “A survey of empirical studies using transaction level data on exports and imports,” *Review of World Economics (Weltwirtschaftliches Archiv)*, 152, 215–225.