

# The micro economics of trade patterns and firm performances\*

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## Abstract

In this short note we present works we have been doing exploiting a long and fruitful collaboration with ISTAT. We organize the presentation along two different levels of micro patterns, i.e. exploring firm level properties and, in the case of trade data, also transaction level information on products and destinations. Firm level analysis allow for an unprecedented opportunity to uncover heterogeneities. These have been hidden for long by aggregate data, but are indeed the fundamental feature of industrial dynamics of modern economies. Transaction level trade data provide invaluable information for the analysis of the micro economics of trade flows, also separating out the variation in export and import prices.

**Keywords:** exports, productivity, unit values, integrated product and firm data

## 1 Introduction

Fundamental drivers of the evolution of contemporary economies are the activities of search, discovery and economic exploitation of new products, new production processes, new organizational arrangements within and amongst business firms. Such processes ultimately entail the emergence and development of novel bodies of technological knowledge, novel “ways of doing things” and novel organizational set-ups. In turn, the ubiquitous presence of technological and organizational innovation entails equally ubiquitous forms of heterogeneity across firms in their characteristics and their performances. And indeed the availability of large longitudinal micro data finally allows the analysis of such properties. This is what we have began to do on the grounds of the databank Micro.3, for firm level data and COE-ASIA, for transaction level trade data. In particular, four basic questions have been addressed.

*First*, are there distinct characteristics of the micro-entities (in primis, business firms) and their distributions which systematically persist over time? *Second*, how do such characteristics within the population of competing firms affect their relative evolutionary success over time? *Third*, what are the export patterns disaggregated by product and by firms and how do the characteristics of the latter influence the former? *Fourth*, amongst the foregoing statistical properties and relations between them, which ones are invariant across industries, and, conversely, which ones depend on the technological and market characteristics of particular sectors?

Our researches draw upon different sources of data, combining information on firms' characteristics, trade transaction flows and innovation activities.<sup>1</sup> A first dataset used for the empirical analyses, Micro.3, is an integrated system

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<sup>1</sup>The datasets have been made available for work after careful screening to avoid disclosure of individual information. The data were accessed at the ISTAT facilities in Rome.

of data, largely based on the census of Italian firms yearly conducted by ISTAT.<sup>2</sup> Micro.3 contains information on a number of variables appearing in a firm's balance sheet for firms with more than 20 employees in all sectors of the economy for the period 1989-2007. Further, it has been possible to link Micro.3 with other information collected by ISTAT as international trade and patent data (see Grazzi et al, 2009 for more details). While the use of firm-level data, as Micro.3, allows to successfully address many topics, the availability of microdata on individual trade transactions provides invaluable information for the analysis of the micro economics of trade flows, as they allow to account both for the country and product dimensions. However, in order to investigate the dynamics of those firms originating the trade flow it is necessary to link transactions data to the firm. That is possible by linking two firm-level datasets collected by the Italian statistical office (ISTAT), namely Statistiche del Commercio Estero (COE) and Archivio Statistico Imprese Attive (ASIA). The COE dataset is the official source for trade flows of Italy. It records separately the f.o.b. value (in Euros) and the quantity (in kilos) involved in each export and import cross-border transaction performed by a firm allowing to compute export and import prices (unit values). The ASIA register covers the universe of Italian firms active in the same time span, irrespectively of their export status.

## 2 The microeconomics of firm level data

Aggregate - country or industry - level data have been hiding some relevant facts for long. In the absence of firm (plant) level information companies within a country (industry) could be assumed to be all alike, in terms of size, production technology, performance, etc. On the contrary, microdata provide an unprecedented opportunity to uncover firm level heterogeneities, along many of the dimensions of the firms' activities.

### *Firm level Productivity dynamics*

Looking at firm's productivity dynamics, in Dosi et al. (2011) we show that firm productivities are relatively stable over time with autoregressive coefficients close to one. Further, the analysis of the transition probabilities across productivity quantiles confirms the high persistency in the performance of firms, as denoted by the high probabilities on the main diagonal. The transition probabilities do not vary much among different sectors. Moreover, the probabilities are higher for the persistently low/ high performance firms: the probabilities of remaining in the quartile 1 or 4 are roughly equal to 70%. In order to indirectly insulate the property of the dynamics of those firms that are and continue to be incumbents throughout the period, the analysis takes into account the properties of the transition probability matrices (TPMs) over the period 2000-04 of all firms that were already present in 1995 (not shown in the paper). Symmetrically we have studied the TPMs over the period 1998-2002 of firms that continued to be in the database until the end of the period of observation. However the dynamics of firms in the productivity distribution, as represented in terms of TPMs, did not change significantly.

Which are the characteristics of the groups of firms that one may identify with the help of the transition probability matrix? In particular the analysis considers firms that lie persistently at the bottom of the productivity distribution, the "productivity laggards" (A); those that on the contrary succeed in jumping to the top, i.e. the "productivity climbers" (B); those that have been persistently in the top of the productivity distribution, the "productivity leaders" (C); and finally "falling back" (D), those that fall behind in the productivity ranking. The research shows that, in terms of distinguishing features, first the leaders tend to be bigger than laggards (size is measured by the log of employment). Further, climbers are, on average, much bigger than laggards, and occasionally, even bigger than leaders. That is, climbers are already bigger at the beginning of the reference period, before the productivity "take off" actually occurred. Second, both climbers and leaders are more active exporters than laggards. Third, climbers and leaders distinguish themselves from laggards also in terms of patenting activities. What is however rather puzzling is the difference in profitability, as proxied by Gross Operating Margin over total sales, in the four groups of firms. It turns out, indeed, that laggards are more profitable than climbers in all sectors considered. That is, laggard firms remain behind in the productivity distribution but their profit margins, though somewhat smaller than leaders, are larger than those of productivity climbers.

Summing up, the analysis reveals an "ecology" of diverse co-existing types, also different in terms of export propensities and degrees of innovativeness, which tend to be rather persistent notwithstanding significantly different performances.

### *The contribution of productivity to growth at micro level*

Another area of research where microdata at firm level can improve our understanding upon sectoral or country level data pertains the analysis of the transmission mechanism between productivity and growth. Diverse theories of

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<sup>2</sup>Micro.3, has been built as a result of collaboration between the Italian statistical office, ISTAT, and a group of researchers from the Scuola Superiore Sant'Anna, Pisa.

industry dynamics tend to agree that heterogeneity in production efficiency is the driver of firms' growth, survival and industrial change, through the processes of innovation, selection and competition. These occurs either through a direct link between efficiency and growth, or through an indirect effect via profitabilities, whereby more productive firms can enjoy higher profit margins which allow them to invest and grow more, especially under imperfect capital markets. Does the empirical evidence bear such predictions?

Exploiting Micro.3 data, Bottazzi et al. (2010) analyze the relationships between Italian firms' productivity and profitability, and between the latter and firm growth. The firm level nature of the data allow to explore such relationships within narrowly defined industrial sectors (3 digit level), that is focusing on firms that are likely to actually compete with each other. Both contemporaneous relations and longer term structure are investigated, and the study also offer comparative analysis on French data, trying to illuminate on the degrees to which the properties of the productivity-profitability-growth relationships depend on country-specific institutional characteristics. The main finding tells that the productivity-profitability relation turns out as the only strong link, while at best weak association is found along the productivity-growth and the profitability-growth links.

The evidence on efficiency breeding profits is expected. It is well in tune with heterogeneous firms competing with each other and, given input and output prices (possibly firm-specific or location-specific), obtaining "quasi-rents" or, conversely, losses above/below the notional "pure competition" profit rates. At the same time, however, and in contrast with common presumption, market selection among firms does not seem to be particularly powerful. That is, markets do not appear to deliver rewards and punishments in terms of relative sizes or market shares according to differential efficiencies. Moreover, the absence of any strong relationship between profitability and growth militates against the "naively Schumpeterian" or "classic" notion that profits feed growth (by plausibly feeding investments). Selection amongst different variants of a technology, different vintages of equipment, different lines of production does occur and is a major driver of industrial dynamics. However, it seems to occur to a good extent within firms, driven by the implementation of "better" processes of production and the abandonment of older less productive ones. Finally, as panel estimates tend to suggest, the links between efficiency (and innovation), on the one hand, and corporate growth, on the other, are likely to be profoundly mediated by large degrees of behavioural freedom, in terms e.g. of propensities to invest, export, expand abroad, pricing strategies, patterns of diversification.

### **3 Transaction level evidence on trade patterns**

While the emerging theoretical and empirical literature on firms heterogeneity in international trade has successfully addressed many topics, the availability of transaction trade level data has stimulated empirical research on a whole host of new issues, including the extensive and intensive margins of trade, the characteristics of multi-products firms, the role of intermediaries, the importance of firm's access to external finance, the systematic variation in export prices across firms, products and trade partners. Access to ISTAT data has given the opportunity to address some of the issues also on the Italian case. We sketch some of the main findings, while other research lines are still on-going and left out for future research.

#### ***Direct versus indirect modes of export***

Over the last 40 years, there has been a fundamental increase in the importance of services in general and of wholesale and retail trade in particular. The prominence of intermediaries appears in aggregate trade statistics. In the U.S., for instance, wholesale and retail firms account for approximately 11 and 24% of exports and imports, respectively. Exploiting the ISTAT datasets, the available information on the universe of active firms allows us also to examine how wholesalers differ from manufacturing firms that export directly, to detect the factors that give rise to intermediaries in exporting and explores the implications for trade volumes.

The research in Bernard et al. (2011) shows that an increasing share of exports is conducted by the 27 percent of exporters that are wholesalers, rising from 9.9 percent in 2000 to 11.3 percent of Italian exports in 2007. However, there is substantial variation across both destination countries and products. At the country level, for instance, intermediary export shares range from zero to 88 percent. The analysis reveals that both country and product characteristics play a crucial role in explaining the choice of the mode of export. Indeed, wholesalers are more likely to export to countries characterized by high fixed entry export costs and to smaller markets. In addition, exports through an intermediary are more likely when the quality of the general contracting environment of the country is weak. Also, greater product homogeneity, and higher product-level sunk costs of exporting are associated with a greater reliance on intermediaries in exporting.

The differences in fixed costs across destinations and products have important implications for firm-level and aggregate responses to exogenous changes in profitability. A common shock to profits across destinations, e.g. a common tariff cut, may have different effects both across types of exporting firms and in the aggregate across countries

due to variation in the composition of exporters. Using annual fluctuations in bilateral real exchange rates as measures of exogenous changes in export profitability, the study by Bernard et al. (2011) considers the impact on firm exports to a certain destination, distinguishing between manufacturers and wholesalers, as well as on the number of exported products and the average value of exports to that destination. Exchange rate movements have the expected effects: an appreciation of the Euro is associated with a decrease in firm exports. However, firm exports fall less (3.7-8.4 percent) for intermediaries than for manufacturers when the Italian currency appreciates. In general, the fall is driven both by a decrease in the number of products exported and by a decline in the firm's average exports per country. However, for wholesalers, the adjustment on the extensive margin of the number of products is greater, while the response of average exports is more muted. These results suggest that wholesale exporters face lower fixed costs and are thus able to adjust more easily along the extensive margin than direct exporters. By further disentangling firms' export values in quantity and unit value, the research shows that for direct exporters the adjustment to a stronger home currency is primarily due to reductions in export quantities rather than in unit value (10 percent). For wholesalers, the overall adjustment is smaller due to a much smaller quantity response. Wholesalers drop their unit values more as the currency rises, pass-through is lower, and quantities fall less.

Given the big difference in the role of intermediated exports across countries and products, the findings suggest that there are potentially large differences in aggregate exports response to exchange rates movements. Such differences are linked to the type of the exporting firm, with significantly smaller responses for destinations served primarily by wholesale exporters.

### ***Financial frictions and trade activities***

A growing body of work has established that weak financial institutions at the country level severely impede countries' international trade activity and distort the sectoral composition of their export flows. However, direct firm-level evidence has been limited and elusive. Does access to external finance affect firm's exporting activities? How important are financial frictions in explaining firms' ability to enter foreign markets, the volume of trade and their geographical or product diversification? Do credit constraints influence firms' export price strategies?

Exploiting the Italian transaction trade level data merged with the accounting dataset (*Bilanci civilistici*) that collects annual reports for all limited liability firms, the research in Secchi et al. (2011) provides a comprehensive analysis of the role that financial constraints play in shaping firms' export performance. The analysis moves beyond this static picture to consider also the role of financial frictions on the probability of product/country switching, i.e. of adding or dropping products or destinations over time. This adds new insights on the role of financial constraints within a dynamic framework where firms potentially export multiple products to multiple countries and their profitabilities evolve over time. Indeed, product and geographical diversification change over time in response to shocks to firm specific characteristics (ability, productivity, competences) and to product specific attributes (technology, demand for product characteristics), with the latter possibly idiosyncratic also across destinations. Financing constraints can make firms more vulnerable to negative shocks and preventing them to fully catch the benefits from positive shocks. The evidence in the study documents that financing constraints increase the probability to drop products or destinations, and decrease the probability to add new products or new destinations. Therefore, financing constraints tend to hamper an effective reallocation of resources from (product or destination) markets that over time become less profitable to markets that becomes more profitable.

The work also considers whether there is any relationship between financing constraints and export pricing. The predictions on pricing and financial constraints might follow different reasonings, according to the recent literature. In models where prices reflects differences in product quality, constrained firms, which are less able to afford the additional costs of quality related to new fixed costs or to the purchase of higher quality inputs, are expected to export lower quality goods at lower prices as compared to unconstrained firms. Productivity-driven models would suggest the opposite: to the extent that constrained firms are also less productive, they operate at higher marginal costs, and thus are expected to set higher prices. In both quality or efficiency sorting models, however, prices are not explicitly modeled as a strategic variable that firms directly manipulate. In contrast, models developed outside the international trade literature show that prices represent an important strategic variable *per se* under financing problems. Constrained firms have indeed an apparent incentive to raise short term revenues in order to sustain cash flow, to provide enough guarantees to creditors, as a way to ultimately relax the constraints. To achieve higher revenues, firms can either try to attract additional demand via price cuts, or to raise the price per unit sold. The empirical analysis shows the interplay between firm-level credit conditions and export prices. Constrained firms set higher prices as compared to unconstrained firms which perform transactions in the same product to the same destination market. This is consistent with models of efficiency sorting and also in line with the idea that prices are indeed a strategic variable that constrained firms adjust. Our evidence instead contrasts with theories of quality sorting into export.

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