International Trade
Empirics of Firm-Level Productivity: a Survey

Stefania Garetto

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Introduction

When introducing models with **heterogeneous firms**, we motivated them with a series of facts highlighting **differences in firm-level performance** between exporters and non-exporters.

Today: a **survey of empirical articles** that study different aspects of the relationship between firm-level productivity, other measures of performance, and export status.

References:

- Bernard, Jensen, Redding and Schott (2007) JEP, “Firms in International Trade”
- Bernard and Jensen (1999) JIE, “Exceptional Exporter Performance: Cause, Effect, or Both?”
- Tybout (Forthcoming) HIT, “Plant- and Firm-Level Evidence on the ‘New’ Trade Theories”
Bernard, Jensen, Redding and Schott (2007)

- JEP article: put the literature into perspective, linking empirical evidence with the “new trade theory”.

- Establish and describe three main facts:
  1. **LIMITED PARTICIPATION**: not all firms export.
  2. **SELECTION**: exporters are “better” than non-exporters along a number of dimensions.
  3. Effects of trade on **REALLOCATIONS AND PRODUCTIVITY** (à la Melitz).
Limited Participation

- Among all firms in the U.S. in 2000:
  - only 4% export;
  - the top 10% exporters account for 96% of total exports.

- Among manufacturing firms:
  - only 18% export;
  - large variation in participation within manufacturing: only 5% of firms export in “printing and related support”, 38% of firms export in “computer and electronic products”;
  - exports are a small share of firms’ total sales: from 7% of total sales in “beverages and tobacco” to 21% in “computer and electronic products”. The average across sectors is 14%.
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⇒ Higher export intensity in more “skill-intensive” sectors? Could be in line with H-O models... But H-O cannot explain limited participation or intra-industry trade. These aspects call for variety-motivated trade.
Selection

Exporters are different:

1. employ more workers (119% more);
2. have higher sales (148% higher);
3. have higher value-added per worker (26% higher);
4. have higher TFP (2% higher);
5. pay higher wages (17% higher);
6. are more capital-intensive ($K/L$ 32% higher);
7. are more skill-intensive (employ 19% more skilled vs unskilled labor).

Evidence for selection: exporters were different prior to start exporting.

Very limited evidence in favor of “learning by exporting”, see BJ (1999).

This suggest the existence of entry costs: see Roberts and Tybout (1997), Das, Roberts and Tybout (2007).

[Differences in factor intensity do NOT support H-O: we observe the same differences between exporters and non-exporters across countries.]
Reallocations and Productivity

Trade liberalization induces:

- exit of domestic low-productivity firms
- entry of foreign high-productivity firms

As a result, aggregate productivity increases.

Empirical evidence in support of this mechanism in Pavcnik (2002), looking at Chilean data, BJS (2006) for the U.S.

Tybout (Forthcoming) is a survey of other studies on the topic.

[All this evidence is consistent with the mechanism in Melitz-type models.]
Data

BJRS assembled one of the best existing datasets to study U.S. trade: LFTTD (Linked-Longitudinal Firm Trade Transaction Database)

- merges data from U.S. Census and U.S. Customs
- contains all U.S.-related international trade transactions, 1992-2000
- for each transaction, it records:
  - product
  - value and quantity
  - date
  - trading partner country
  - transport mode
  - identity of US firm involved
- ideal to distinguish between firms’ extensive margins (number of products sold/bought, number of export destinations) and intensive margin (quantity/value traded).
Other Facts

The detail of LFTTD allowed to uncover more detailed statistics:

- **Concentration of trade:**
  - the top 1% of trading firms by value account for 80% of the total value of trade
  - the top 10% of trading firms by value account for 95% of the total value of trade
  (need a productivity distribution with huge dispersion and/or very high elasticity of substitution to account for this).

- **Small trade flows:**
  - firms trade small fractions of their total sales
  - most firms trade with a small number (often 1) of countries (see EKK):
    - 64% of U.S. exporters export to 1 destination, and their total export account for 3.3% of total U.S. exports;
    - 13.7% of U.S. exporters export to 5 or more destinations, and their total export account for 92.9% of total U.S. exports.
Other Facts (II)

- **Multiproduct firms:**
  - 42.2% of U.S. exporters sell only 1 product abroad, and they account for 0.4% of U.S. total exports
  - 25.9% of U.S. exporters sell 5 products or more abroad, and they account for 98% of U.S. total exports
  - positive correlation between the number of products a firm sells and the number of countries it sells to. Both are correlated with other firm characteristics.

  (New papers on multiproduct firms: BRS (2009), Melitz and Ottaviano (2009), Arkolakis and Muendler (2009)).

- **Importers:**
  - many of the characteristics found for exporters also hold when looking at importing firms
  - many exporters are also importers (see literature on the fragmentation of production).
On the direction of causality between productivity advantage and export status: are ex-ante good firms that become exporters, or they become better by exporting?

The evidence points towards selection, but to establish it we need to look at differences in performance before-during-after periods of export.

Important question, also for export-promotion policy.

Success and Export Status

3 possibilities:

1. **SUCCESS LEADS TO EXPORT**: exporting is costly, so only larger and more productive firms can afford it. Hence larger and more productive firms become exporters. (SELECTION, modeled in Melitz-type frameworks).

2. **EXPORT LEADS TO SUCCESS**: exporting is “good for a firm”. Since competition is tougher in foreign markets, firms must “improve their performance” to survive there.

   ↓

   If true, post-entry performance with respect to pre-entry performance should be better for exporters than non-exporters.

3. **EXPORT ENCOURAGES IMPROVEMENT THAT LEADS TO SUCCESS**: firms know that exporting is “good for a firm”, so they decide to export. Before starting though, they have to undertake performance improvements to succeed abroad.

   [Notice: 2. and 3. are NOT consistent with optimal behavior!]
Success and Export Status (II)

To distinguish among the 3 possibilities above:

- Look at **measures of performance before entry**:
  - divide sample period in 2 sub-periods, and compare:
    1. non exporters
    2. firms that do not export in the 1st sub-period, but do in the 2nd.

  ⇒ they find that firms that become exporters in the 2nd sub-period are **ex-ante larger, more productive, and pay higher wages** that all-time non-exporters (supports hypothesis 1., but does not exclude 2., 3.).
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- Look at **growth in measures of performance** in the years immediately before entry into export

  ⇒ they find that growth is higher for firms that will start exporting (could support both 2.,3.).
Success and Export Status (III)

- Is there an effect of exporting on firm performance? (hyp. 2.)
  To find out, run reduced-form regressions of changes in performance measures on initial export status, controlling for other plants characteristics.

Findings:

  - exporters display higher growth in employment and sales over a 1-year period;
  - no significant results for other measures of performance and over longer periods.

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- **Switching pattern:** the data display a lot of entry in/exit from the export market, suggesting that initial export status is poorly correlated with subsequent exporting.
  ⇒ No much support for the hypothesis that exports lead to improved performance (hyp. 3.).
Identify the **factors that induce a firm to start exporting**. They examine:

1. size
2. labor force composition (quality of workforce)
3. product mix (introduction of new products)
4. past performance
5. entry costs
6. spillovers
7. Government intervention

Census data 1984-1992. Export boom in late 80s generates around 10% of switches into and out of exports every year. Probit empirical model to evaluate the effects of the factors above on the probability of exporting.
Identify the **factors that induce a firm to start exporting**. They examine:

1. **size** $\Rightarrow$ pos. corr. with export
2. labor force composition (quality of workforce) $\Rightarrow$ pos. corr. with export
3. product mix (introduction of new products) $\Rightarrow$ pos. corr. with export
4. **past performance** $\Rightarrow$ most important factor
5. entry costs $\Rightarrow$ significant effect (see also RT 1997, DRT 2007)
6. spillovers $\Rightarrow$ no effect
7. Government intervention $\Rightarrow$ no effect

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Attempt to test **trade-induced reallocations** and their effect on **aggregate productivity** (the Melitz’ mechanism).

Link plant-level U.S. manufacturing data with industry measures of tariffs and transportation costs.

As trade costs fall:

1. industry productivity increases
2. higher probability of plant death
3. higher probability of successful exports
4. existing exporters increase their export shipments.

(all the empirical findings are in line with the Melitz’ mechanism).
Survey of firm-level and plant-level evidence on the relationships between pricing, firm size, export status, productivity and profitability.

RESULTS AND “STATIC” EVIDENCE:

1. **mark-ups** fall with import competition;

2. trade competition has effects on **firm-level sales** (on average, they decline);

3. trade **rationalizes production**: the most efficient plants expand, while the least efficient contract;

4. trade **increases aggregate productivity**, via both scale effects and reallocations;

5. trade competition **can** also affect intra-firm efficiency (mixed evidence).
EVIDENCE ON TRANSITIONAL DYNAMICS:
Interaction between sunk costs, firm heterogeneity, and uncertainty.
(More complex issue to address, rely on dynamic stochastic optimization).

  - history-dependence: decisions depend on whether a firm is in or out of the market;
  - aggregate outcomes depend on the % of firms in each state.
  - hysteresis.
  - sunk costs are important, and more so for small firms;
  - aggregate exports are rel. insensitive to history and expectations.

[In progress: Fillat and Garetto (2009): sunk-cost dyn. model with export and FDI. Relate trade/FDI dynamics to firms’ financial variables.]