Firm Export Heterogeneity and International Productivity Gap

Evidence from France and Japan

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April 28, 2012

Background

Questions

1. Do exporters from one country outperform those from another country?
2. Similarly, do non-exporters from one country outperform those from another country?
3. If so, are there any systematic relationships among them?

- These questions, or studies on international productivity gap in general, are nontrivial.

→ "Comparisons of productivity performance across countries are central to many of the questions concerning long-run economic growth" (Bernard and Jones, 1996, AER, p. 1216).

Related literature

- Our motivation comes from two strands of study.

1. One is the literature on firm export heterogeneity in international trade.
   - With the growing studies on firm export heterogeneity in many countries, we now know that, in general, exporters perform better than non-exporters.
   - However, the previous studies on firm export heterogeneity lack a perspective of international comparison.
   - None of the previous studies compared directly the productivity of exporters (or non-exporters) aross two different countries.

Related literature

2. The other strand is the study on international productivity gaps.
   - Although several studies have attempted to measure international productivity gaps at the firm level, they focused mainly on large listed firms.
   - The previous studies did not pay much attention to firm export heterogeneity (probably because most of the large listed firms are exporters).
   - In addition, the previous studies on international productivity gaps focus only on the **average** productivity of firms.

   → Note, however, that the average productivity gaps do not necessarily mean that the majority of firms from one country outperform those from another country.

→ The connection between firm export heterogeneity and international productivity gaps has not been fully explored yet.

Contributions of this paper

1. We propose a framework to integrate the two strands of study:
   1) Studies on firm export heterogeneity
   2) Studies on international productivity gaps

   and attempt to answer the following two questions:

   1) Do exporters from one country outperform those from another country?
   2) Similarly, do non-exporters from one country outperform those from another country?

Contributions of this paper

2. We propose a framework to balance competing goals for the international comparison of firm-level productivity and the confidentiality of firm-level data sets between two countries.
   - To compare the productivity of firms in two different countries, we would ideally need to merge the two country data sets in a unique data set.
   - However, merging is not possible because of the confidentiality of firm-level data sets.
   - This paper attempts to compare the productivity of firms in France and Japan, without merging firm-level data sets between two countries.

Theory

- Bernard, Redding, and Schott (2007, RES) showed that the productivity differences of firms in the same industry between two countries could be attributable to firm heterogeneity (**firm-specific factors**), **comparative advantage**, or **trade costs**.
- This study has important implications to the international productivity gaps of exporters (or non-exporters) between two different countries.

→ In the presence of firm heterogeneity and trade costs, international productivity gaps between two countries can be attributable to **firm specific factors**, **comparative advantage**, and **trade costs**.

Identification strategy

- Firm-specific factors mean that they are not common to firms within the same industry.
- **Firm-specific factors** are expected to affect the **average** of the productivity, but **not the entire distribution**.

→ **If the productivity distribution lies to the right of another**, we can interpret that **the differences reflect common factors within the same industry (i.e., omparative advantage and/or export costs)**.

- **If there are no export costs**, all existing firms become exporters and, therefore, **non-exporters will disappear**.
- Put it differently, **if both exporters and non-exporters exist simultaneously in the same industry in one country, the difference in their productivity distributions reflects export costs** because exporters must be more productive than non-exporters to cover export costs.

Testable implications

- If the productivity distribution of **non-exporters** within the same industry is different between two countries, we can interpret that the differences reflect the difference of **comparative advantage**.

→ Based on each country's revealed comparative advantage, we can obtain the following hypothesis:

Hypothesis 1

French non-exporters outperform Japanese non-exporters in chemical and plastic industries while Japanese non-exporters outperform French non-exporters in machinery industry.

Testable implications

- If the productivity distribution of **exporters** within the same industry is different between two countries, we can interpret that the differences reflect the difference of **export costs** as well as that of **comparative advantage**.
- It is natural to imagine that **the export costs of Japanese exporters are**, all else equal, **higher than that of French exporters** because French firms have a large European export market nearby to which then can export without much cost.

→ **Japanese exporters must be more productive than French exporters to cover larger export costs.**

Hypothesis 2

The productivity advantage of Japanese exporters (relative to French exporters) is larger than that of Japanese non-exporters (relative to French non-exporters).

Methodology: TFP index (Good, Nadiri, and Sickles, 1997, Handbook)

- The issue of confidentiality raises the challenge of estimating comparable TFP measures without pooling together firm-level data from different countries.
- We propose to implement a non-parametric methodology based on the multilateral index number approach developed by Good, Nadiri, and Sickles (1997) (hereafter GNS).
- The reason why we employ an index method to estimate TFP is that it is impossible to estimate production function, pooling together the firms in our two different countries.
- On the contrary, the productivity index method allows for separate (but comparable) estimates of individual TFP across countries.

Methodology: TFP index (Good, Nadiri, and Sickles, 1997, Handbook)

- The original GNS methodology utilizes a hypothetical reference firm for each industry that has the arithmetic mean values of log output, log input, and input cost shares over firms belonging to that industry in each year.
- Each firm's output and inputs are measured relative to this reference firm.
- The reference firms are then chain-linked over time.

→ Hence, the index measures the TFP of firm i in year t (TFP_{it}) relative to that of the reference firm r in the initial year (TFP_{r0}):

$$\ln TFP_{it} - \ln TFP_{r0} = \ln \left(\frac{TFP_{r1}}{TFP_{r0}} \frac{TFP_{r2}}{TFP_{r1}} \cdots \frac{TFP_{rt}}{TFP_{rt-1}} \frac{TFP_{it}}{TFP_{rt}} \right).$$

Methodology: TFP index (Good, Nadiri, and Sickles, 1997, Handbook)

- We extend the GNS methodology to international firm-level comparisons in using a common reference firm to compute relative TFP indexes for firms belonging to different countries:

$$\ln TFP_{it}^{JP} - \ln TFP_{r0}^{FR} = \ln \left(\frac{TFP_{r1}^{FR}}{TFP_{r0}^{FR}} \cdots \frac{TFP_{rt}^{FR}}{TFP_{rt-1}^{FR}} \frac{TFP_{rt}^{JP}}{TFP_{rt}^{FR}} \frac{TFP_{it}^{JP}}{TFP_{rt}^{JP}} \right),$$

  where TFP_{it}^{C} and TFP_{rt}^{C} are TFP for firm i and the reference firm operating in year t in country $C \in (FR, JP)$, respectively.
- **What we need to do is** not to merge firm-level data sets between two countries but **to exchange the information on French and Japanese reference firms ($TFP_{rt}^{JP} / TFP_{rt}^{FR}$)**.

→ We thus can balance competing goals for the international comparison of firm-level productivity and the confidentiality of firm-level data sets between two countries.

Methodology: *t*-test and Kolmogorov-Smirnov (KS) test

- We conduct two tests:
  1. *t*-test: To examine the difference in the average of productivity between French and Japanese exporters (non-exporters).
  2. Kolmogorov-Smirnov (KS) test: To examine the difference in the distribution of productivity between French and Japanese exporters (non-exporters).
- Because of time constraints, and to facilitate the presentation and interpretation, we focus mainly on the results of *t*-test.
- But KS-test indicates that not only average but also distribution is different between French and Japanese exporters (or non-exporters). (Figure 6)

Data

- **Sources**
  - France: *Enquête Annuelle d'Entreprises* (*EAE*)
  - Japan: *Kigyou Katsudou Kihon Chousa Houkokusho* (*Basic Survey of Japanese Business Structure and Activities*: *BSJBSA*)
- **Period**
  - 1994–2006
- **Coverage**
  - Manufacturing firms with more than or equal to 50 workers.
- **Output and inputs**
  - Real sales, capital, labor (man-hour), intermediate inputs.
- **Currency unit**
  - Output and inputs are converted to the Japanese yen, by using the sectoral purchasing power parities, so that currency units can be common between France and Japan.

Results

Hypothesis 1

French non-exporters outperform Japanese non-exporters in chemical and plastic industries while Japanese non-exporters outperform French non-exporters in machinery industry.

- French non-exporters have the productivity lead in such industries as *Chemical products* and *Rubber and plastic*.
- Japanese non-exporters have the productivity lead in such industries as *Electric machinery and apparatus* and *Motor vehicles*.

t-test results

	All firms	Non-exporters	Exporters
All manufacturing	0.02***	0.01***	0.05***
1 Textile	0.72***	0.72***	0.78***
2 Clothing	0.62***	0.62***	0.73***
3 Manufacture of wood	- 0.41**	- 0.42***	- 0.38***
4 Pulp and paper	0.18***	0.17***	0.22***
5 Printing and publishing	- 0.04***	- 0.04***	0.00
6 Chemical products	- 0.29***	- 0.29***	- 0.27***
7 Rubber and plastic	- 1.09***	- 1.09***	- 1.06***
8 Non-metallic mineral products	- 0.55***	- 0.55***	- 0.51***
9 Basic metal products	0.08***	0.07***	0.10***
10 Fabricated metal products	- 0.09***	- 0.09***	- 0.07***
11 Machinery and equipments	- 0.04***	- 0.05***	- 0.01***
12 Machinery for office and services	0.51***	0.50***	0.57***
13 Electric machinery and apparatus	0.33***	0.33***	0.37***
14 Communication equipment and related products	0.12***	0.11***	0.17***
15 Medical, precision and optical instruments, watches and clocks	0.33***	0.32***	0.35***
16 Motor vehicles	0.64***	0.68***	0.67***
17 Other transportation equipments	0.55***	0.57***	0.59***
18 Furnitures and other manufacturing	- 0.27***	- 0.23***	- 0.22***

Note: ***, **, and * indicate statistically significant at 1 percent, 5 percent, and 10 percent levels, respectively.

Results

Hypothesis 1

French non-exporters outperform Japanese non-exporters in chemical and plastic industries while Japanese non-exporters outperform French non-exporters in machinery industry.

- French non-exporters have the productivity lead in such industries as *Chemical products* and *Rubber and plastic*.
- Japanese non-exporters have the productivity lead in such industries as *Electric machinery and apparatus* and *Motor vehicles*.

→ **These findings are generally consistent with each country's revealed comparative advantage**.

Results

Hypothesis 2

The productivity advantage of Japanese exporters (relative to French exporters) is larger than that of Japanese non-exporters (relative to French non-exporters).

- Similar to the case of non-exporters, the productivity advantage of exporters is consistent with each country's revealed comparative advantage.
- Moreover, the productivity gaps between Japanese and French exporters are larger in industries in which Japanese firms have comparative advantage while they are smaller in industries in which French firms have comparative advantage.

t-test results

	All firms	Non-exporters	Exporters
All manufacturing	0.02***	0.01***	0.05***
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Results

Hypothesis 2

The productivity advantage of Japanese exporters (relative to French exporters) is larger than that of Japanese non-exporters (relative to French non-exporters).

- The results suggest that **the productivity advantage of exporters in each country reflects the difference of export costs as well as that of comparative advantage**.
- However, the productivity of advantage of exporters is not large enough to offset the productivity advantage from comparative advantage.

Concluding Remarks

- **Questions**:
  1. Do exporters from one country outperform those from another country?
  2. Similarly, do non-exporters from one country outperform those from another country?
  3. If so, are there any systematic relationships among them?
- **Main findings**:
  1. Japanese exporters performed relatively better than French exporters.
  2. Besides, the productivity advantage of Japanese exporters is larger than that of Japanese non-exporters.
- **Implications**:
  1. The productivity advantage of non-exporters reflects the difference of each country's comparative advantage.
  2. The productivity advantage of exporters reflects not only the difference of comparative advantage but also that of export costs.

Appendix: TFP index (Good, Nadiri, and Sickles, 1997, Handbook)

- A concern on the international comparison may be that firms faced various industry-country specific shocks such as the changes in real exchange rate.
- Therefore, TFP has been transformed to account for shocks common to all firms within an industry-country, by performing the following transformation:

$$\widetilde{\ln TFP_{it}^{c,k}} = \ln TFP_{it}^{c,k} - \overline{\ln TFP_{t}^{c,k}} + \overline{\ln TFP^{c,k}}, \qquad (1)$$

where c and k stands for country c $(= (FR, JP))$ and industry k, respectively.

- Hence, $\overline{\ln TFP_{t}^{c,k}}$ is the average TFP performance in industry k for country c for a given year t, whereas $\overline{\ln TFP^{c,k}}$ is the average TFP performance in industry k for country c across all years.