Physical Productivity and Exceptional Exporter Performance: Evidence from a Chinese Production Survey

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Motivation

- Changing nature of manufacturing and international trade has lead to an increased fragmentation of the supply chain
- A particular form of fragmented production is processing trade
  - Since 2000, at least 18% of exports from developing countries come from processing trade
  - By 2006, 130 countries had established 3500 export processing zones
  - China: 50% of exports are processing trade
- However little is known about the link between firms’ performance and the fragmentation of production
  - Hard to answer because of new measurement issues introduced by the fragmentation of production
This paper

- We investigate whether firm’s performance (productivity) is affected by participating in a fragmented production network
  - We study the role of processing trade and its pricing implications on firm-level productivity using a unique combination of datasets from China
  - We provide evidence of a large bias toward firms engaged into processing trade, mostly explained by prices differences

- We show that
  - Exporters have higher physical productivity but not necessarily higher revenue productivity
  - Exporters charge lower prices
  - Those effects are mostly driven by processing trade

- This suggests that it is important to take into account the type of trade transactions firms have with their foreign buyers
To estimate productivity, most researchers use revenues as a proxy for the output firms produce.

While revenues is a function of output, it also depends on output price \( R_{it} = P_{it} Q_{it} \).

If firms price differently, estimating TFP using revenues (TFPR) will lead to an "output price bias".

TFPR will be a combination of technical efficiency and demand.

Solution proposed in the literature is to use quantity for output instead of revenues (TFPQ).

Easy to implement for single products firms (e.g. Foster et al. (2008)).

More complicated for multi product firms (e.g. de Loecker et al. (2016), Dhyne et al. (2017)).
Productivity estimation and pricing heterogeneity

- A similar story holds for inputs, especially materials
  - If firms buy materials at different prices, their measured productivity will also reflect those input prices differences
- Solution proposed in the literature is to find a proxy for input prices
  - Augment the usual productivity estimation by adding a function of output prices and market share in the control function (de Loecker et al. (2016))
- The price bias on both the output and input side has been shown to seriously affect estimates of productivity
- The problem may be even more severe for firms involved in different modes of trade, especially processing trade
  - Systematic differences between modes of export, technical efficiency and pricing
  - E.g. selection into processing, product market competition, provision/purchase of inputs under certain conditions, network externalities
China development policy and institutions

- Offshoring to China encouraged through processing trade
  - Specific type of institution where goods are assembled from inputs which are exempted from tariffs (FTZs)
- Several modes of processing trade
  - Supplier is freely provided the inputs by the buyer
  - Supplier acquires the inputs himself
- Different types of firms cohabit in the same product market
  - Regular trade
  - Processing trade
  - Combination of both (hybrid)
- Those types of firms may exhibit very different level of efficiency as well as different pricing policy
Empirical strategy

- Estimate TFPR and TFPQ for Chinese firms engaged in various mode of exports
- Rely on most recent methods to address potential biases in TFP estimations
  - Simultaneity bias: Wooldridge LP estimator
  - Input price bias: de Loecker et al. (2016)
  - Use translog functional form for flexibility
- Relate differences between TFPR and TFPQ to output pricing differences
A few papers have investigated the link between revenue productivity and exporting for Chinese firms

- Lu (2010) documents a negative premium for Chinese exporters
- Lu et al. (2010) associate the negative export premium to the role of multinationals
- Dai et al. (2016) associate the negative export premium to the role of processing trade

Previous papers focus only on TFPR

- We compare TFPR and TFPQ for exporters and firms involved in processing trade
- We show that the previous result reverses while taking into account prices differences
Data

- **Balance sheets**
  - NBSC, 2000-2006
  - Sales, materials, capital, labor, ownership, location
  - 186,000 manufacturing firms

- **Production data**
  - NBSC, 2000-2006
  - Quantity produced
  - Firm-product survey for 800 most important products
  - 100,000 manufacturing firms
  - Match on firm ID with balance sheets

- **Trade**
  - Firm-product transactions data at HS8
  - Transaction mode: processing trade, only ordinary trade or a mix of the two (hybrid trade)
  - Merge with other datasets based on firm name and contact information (Wang and Yu, 2012)
Sampling strategy

- Chinese product classification is more aggregated than usual (roughly corresponds to HS6)
  - Products: "main industrial products" as defined by the Chinese government at the country level
  - Some products are reported some years, other not
- Our strategy is to identify products
  - Reported consistently over the years
  - Where most firms are single-product
  - With very little carry along trade
  - Dominated by Chinese firms
  - That are export oriented
  - Where processing trade widely used
- Focus on leather shoes (shirts, suits)
Getting a proxy for price

- We know physical quantity by product but not revenue (from production survey)
- For single product firms, we know firm revenue (from balance sheets)
- Dividing revenue by quantity is a good proxy for price if little revenue comes from other sources (CAT or services)
- Good assumption for leather shoes
The Link between TFPR, TFPQ and Exporting

<table>
<thead>
<tr>
<th></th>
<th>TFPR</th>
<th>TFPQ</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exporter</td>
<td><strong>-0.020</strong>*</td>
<td><strong>0.001</strong></td>
<td><strong>0.209</strong>*</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.008)</td>
<td>(0.028)</td>
</tr>
<tr>
<td>Log firmsize</td>
<td><strong>0.022</strong>*</td>
<td><strong>0.018</strong>*</td>
<td><strong>-0.106</strong>*</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>Years dummies</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Location and ownership controls</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>N</td>
<td>3,754</td>
<td>3,731</td>
<td>3,754</td>
</tr>
</tbody>
</table>

Wooldridge LP, Translog, with price correction
The Link between TFPR, TFPQ and Exporting

Without controls
- TFPR lower for exporters (as found in other studies) but TFPQ higher
- Very large price differences of 23%

Controlling for ownership and location
- Exporters are no different than domestic firms in TFPR but exhibit premium in TFPQ
- Price differences of 9%

\[ \text{corr}(TFPR_{it}, p_{it}) > 0 \text{ but } \text{corr}(TFPQ_{it}, p_{it}) < 0 \]

Important to control for location and ownership
## The Link between TFPR, TFPQ and Modes of Exports

<table>
<thead>
<tr>
<th>Mode of Trade</th>
<th>TFPR</th>
<th>TFPQ</th>
<th>Price</th>
<th>Price Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary trade</td>
<td>-0.030***</td>
<td>-0.012</td>
<td>0.236***</td>
<td>-0.014</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.010)</td>
<td>(0.039)</td>
<td>(0.033)</td>
</tr>
<tr>
<td>Processing trade</td>
<td>-0.037***</td>
<td>0.050***</td>
<td>0.333***</td>
<td>0.148***</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.018)</td>
<td>(0.053)</td>
<td>(0.057)</td>
</tr>
<tr>
<td>Hybrid trade</td>
<td>0.021*</td>
<td>0.038***</td>
<td>0.051</td>
<td>0.043</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.014)</td>
<td>(0.045)</td>
<td>(0.043)</td>
</tr>
<tr>
<td>Log firmsize</td>
<td>0.022***</td>
<td>0.018***</td>
<td>-0.106***</td>
<td>-0.104***</td>
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<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.011)</td>
<td>(0.013)</td>
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<tr>
<td>Years fixed effects</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Location and ownership controls</td>
<td>x</td>
<td>x</td>
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<td>x</td>
</tr>
<tr>
<td>N</td>
<td>2,558</td>
<td>2,548</td>
<td>2,558</td>
<td>2,548</td>
</tr>
</tbody>
</table>

Wooldridge LP, Translog, with price correction
The Link between TFPR, TFPQ and Modes of Exports

- Systematic differences between the effect of mode of trade on TFPR vs. TFPQ
  - TFPR underestimates the effect of various modes of trade
  - Bias is especially serious for processing trade
- Using TFPR, processing trade is associated with 5% productivity gains, while using TFPQ, it is associated with 15% productivity gains
- Pricing differences explain the discrepancy between those two effects
- While processing trade is marginally more efficient than hybrid trade when using TFPR, differences are large when using TFPQ
Four additional facts: FDI, export prices, imports and ownership

1. Export prices correlate highly with our price proxy
2. Processing trade is associated with lower export prices (9%)
3. The share of imports going to processing trade is 95% in value but 61% in the number of transactions
4. Processing trade firms are more likely to be owned by foreigners (FDI more likely than JVs or domestically private)
Conclusion

- Firms’ performance is affected by participating in a fragmented production network
  - We provide evidence of a large bias toward firms engaged into processing trade
  - In the Chinese footwear industry, exporters are not less efficient; they price differently, which is reflected by large differences between TFPR and TFPQ
- This suggests it is important to take into account the type of trade relationships firms have with their foreign buyers
- Next steps
  - Generalize to other products
  - Seriously model fragmented production network in the production function