Outbound FDI by software companies

Rudrani Bhattacharya, Ila Patnaik and Ajay Shah
National Institute of Public Finance and Policy, New Delhi

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Part I

Trade, FDI and international business organization of firms
Exporting firms and firms engaged in outbound FDI are not a random sample of the population of firms in an industry.

Firm specific characteristics define how firms choose to serve foreign customers.

Productivity differences across firms is seen to be a key determinant.
Intuition behind New trade theory

Why do some firms export and others undertake Outbound FDI?

- Firms self-select on the basis of:
  - differences in cost in serving domestic and foreign markets
  - differences in transport costs and set-up costs
- Least productive firms serve the domestic markets, more productive firms undertake exports and the most productive firms engage in outbound FDI.
Long had strong export orientation
Strict capital controls till 1999 did not allow for outbound FDI
Soon after lifting restrictions, a sharp jump in outbound FDI can be witnessed
This episode in India is a natural experiment because of the sudden relaxation of capital controls
Firms engaging in outbound FDI overtime

Number of Firms
- Only Exports
- Overseas Investment and Exports

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Unique features:

- Near-zero transport costs ==> *Discourages outbound FDI*
- Non-commoditised nature of software services ==> *encourages outbound FDI*

Need for a model to understand firm behaviour in software services industry
Consumer’s perceived risk about quality of service exported is higher than for service bought from foreign firm situated at home (Lee and Tan, 2003)

Demand faced by firm

\[ q(i) = \begin{cases} 
0 & \text{with prob } \gamma_j \\
Dp(i)^{-\sigma}, \sigma = 1/(1 - \epsilon) > 1 & \text{with prob } 1 - \gamma_j 
\end{cases} \quad j = X, I \]

\( \gamma_X > \gamma_I \)

No transport cost

demand realized after production

\( F_X < F_I \) as in HMY
Risk neutral firm maximises expected profit
Cut-off productivity level such that export and FDI firms just break even

\[
A^* X^{-1} = \frac{F_X(\sigma - 1)(\frac{\sigma}{\sigma - 1})^\sigma}{D(1 - \gamma_X)^\sigma}, \quad A^* I^{-1} = \frac{F_I(\sigma - 1)(\frac{\sigma}{\sigma - 1})^\sigma}{D(1 - \gamma_I)^\sigma}
\]

Since exporters face greater risk compared to FDI firms, threshold productivity of exporters to break even is higher than FDI firms.
Productivity ranking of export and FDI firms

\[
\begin{align*}
\frac{F_I}{(1-\gamma_I)^\sigma} & \quad \text{Optimised Profit} \\
\frac{F_X}{(1-\gamma_X)^\sigma} & \\
E(\Pi_I) & \\
E(\Pi_X) & 
\end{align*}
\]

Firm Productivity
Implications

- Less productive firms choose to undertake outbound FDI
- More productive firms remain as exporters

_This goes against the HMY Hypothesis_
Testing our Hypothesis

Need for productivity estimation
Several methods have been proposed to estimate productivity
No one method is perfect
We estimate:
  - Efficiency effect Stochastic Frontier Analysis
  - Fixed effect dummy regression Analysis
  - Time variant Stochastic Frontier Analysis
Data

- Firm level data on software industry from CMIE (Prowess)
- Break sample into two time ranges
  - 2000-2008: 9 years of data
  - 2000-2002: 3 years of data
### Result of efficiency effect SFA

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Estimate</th>
<th>Standard error</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>0.73033646***</td>
<td>0.084</td>
</tr>
<tr>
<td>Log Wages</td>
<td>0.24184873***</td>
<td>14.89</td>
</tr>
<tr>
<td>Raw material expenses</td>
<td>0.00031834</td>
<td>0.0004</td>
</tr>
<tr>
<td>Log total assets</td>
<td>0.72458337***</td>
<td>0.021</td>
</tr>
<tr>
<td>Energy expenses</td>
<td>0.00432048</td>
<td>0.003</td>
</tr>
<tr>
<td>FDI dummy</td>
<td>-0.41695749*</td>
<td>0.193</td>
</tr>
<tr>
<td>$\sigma_u^2 + \sigma_v^2$</td>
<td>1.46623764***</td>
<td>0.131</td>
</tr>
<tr>
<td>$\frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2}$</td>
<td>0.85717722***</td>
<td>0.026</td>
</tr>
</tbody>
</table>
Figure: Technical efficiency difference between DX and DXI firms in 2000
Figure: Technical efficiency difference between DX and DXI firms in 2001
Figure: Technical efficiency difference between DX and DXI firms in 2002
Coefficient of outbound FDI dummy in fixed effects regression model is -0.3724 with a standard error of 0.1716

Efficiency effect SFA results for a truncated sample of three years also gives similar result, although outbound FDI dummy is not significant

Fixed effect regression model for both large sample and truncated sample support our hypothesis
### Results - Summary

<table>
<thead>
<tr>
<th>Method (Longer Sample)</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency effect Stochastic Frontier Analysis</td>
<td>Yes</td>
</tr>
<tr>
<td>Time variant Stochastic Frontier Analysis</td>
<td>Yes</td>
</tr>
<tr>
<td>Fixed effect dummy regression</td>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method (Shorter Sample)</th>
<th>Result</th>
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<tbody>
<tr>
<td>Efficiency effect Stochastic Frontier Analysis</td>
<td>Not clear</td>
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<tr>
<td>Time variant Stochastic Frontier Analysis</td>
<td>Yes</td>
</tr>
<tr>
<td>Fixed effect dummy regression</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Exporting firms are more productive than firms participating in outbound FDI.
Thank you