

Online Appendices: Partial ownership, financial constraint, and FDI

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Appendices

A TFP estimation

We estimate the parent firms' production functions based on the DBJ data. Using the methods of [Levinsohn and Petrin \(2003\)](#) and [Akerberg et al. \(2015\)](#) to estimate the production functions, we obtained insignificant coefficients for the production functions in major industries. Therefore, we employ the method of [Wooldridge \(2009\)](#) to estimate production functions, using the approach of [Rovigatti and Mollisi \(2018\)](#), namely “prodest” add-on of Stata. We find that the method of [Wooldridge \(2009\)](#) works well with our data. We estimate industry-specific production functions for large industries, whereas we had to estimate the production function for the economy as a whole for small industries because we obtained insignificant coefficients of the production function for these small industries owing to the small number of observations. We use value-added as the output variable, the number of workers, and total fixed assets as inputs. Moreover, we utilize intermediate inputs as proxy variables. We deflated nominal variables, such as the value added by the GDP deflator from the World Bank's *World Development Indicators*. Following [Pavcnik \(2002\)](#), we subtract the reference firm's log productivity in the base year from that of each firm. This satisfies the transitivity and insensitivity of the measurement unit.

B List of host countries

Table 1: N. of Newly established subsidiaries in OECD Countries

| Code | Name | 1989–1993 | 1994–2003 | 2004–2016 | Total |
|------|-----------------|-----------|-----------|-----------|-------|
| AUS | Australia | 8 | 10 | 1 | 19 |
| AUT | Austria | 0 | 0 | 1 | 1 |
| BEL | Belgium | 9 | 3 | 5 | 17 |
| CAN | Canada | 11 | 9 | 7 | 27 |
| CHE | Switzerland | 1 | 1 | 3 | 5 |
| COL | Colombia | 0 | 0 | 1 | 1 |
| CZE | Czech Republic | 0 | 14 | 10 | 24 |
| DEU | Germany | 18 | 11 | 22 | 51 |
| DNK | Denmark | 1 | 0 | 0 | 1 |
| ESP | Spain | 4 | 6 | 3 | 13 |
| FIN | Finland | 1 | 0 | 0 | 1 |
| FRA | France | 13 | 13 | 10 | 36 |
| GBR | United Kingdom | 41 | 29 | 8 | 78 |
| HUN | Hungary | 3 | 7 | 2 | 12 |
| IRL | Ireland | 2 | 3 | 2 | 7 |
| ISL | Iceland | 1 | 0 | 0 | 1 |
| ISR | Israel | 3 | 0 | 0 | 3 |
| ITA | Italy | 8 | 7 | 8 | 23 |
| KOR | Korea, Rep. | 22 | 57 | 45 | 124 |
| LUX | Luxembourg | 1 | 1 | 0 | 2 |
| MEX | Mexico | 7 | 4 | 46 | 57 |
| NLD | Netherlands | 7 | 5 | 5 | 17 |
| NOR | Norway | 1 | 1 | 0 | 2 |
| NZL | New Zealand | 3 | 2 | 1 | 6 |
| POL | Poland | 0 | 6 | 8 | 14 |
| SVK | Slovak Republic | 0 | 1 | 2 | 3 |
| SWE | Sweden | 1 | 4 | 1 | 6 |
| TUR | Turkey | 0 | 3 | 5 | 8 |
| USA | United States | 120 | 131 | 58 | 309 |
| ALL | All (29) | 286 | 328 | 254 | 868 |

Note: This table tabulates the number of FDI projects only where both the Japanese parent firm and their foreign subsidiary are in the manufacturing sector.

Table 2: N. of Newly established subsidiaries in Non-OECD Countries

| Code | Name | 1989–1993 | 1994–2003 | 2004–2016 | Total |
|------|--------------------|-----------|-----------|-----------|-------|
| ARG | Argentina | 1 | 3 | 0 | 4 |
| BGD | Bangladesh | 0 | 0 | 2 | 2 |
| BHR | Bahrain | 0 | 0 | 1 | 1 |
| BRA | Brazil | 4 | 14 | 21 | 39 |
| CHN | China | 124 | 778 | 606 | 1508 |
| EGY | Egypt, Arab Rep. | 0 | 0 | 1 | 1 |
| IDN | Indonesia | 44 | 97 | 88 | 229 |
| IND | India | 7 | 37 | 71 | 115 |
| IRN | Iran, Islamic Rep. | 1 | 1 | 0 | 2 |
| KAZ | Kazakhstan | 0 | 0 | 1 | 1 |
| KEN | Kenya | 0 | 0 | 2 | 2 |
| KHM | Cambodia | 0 | 0 | 4 | 4 |
| LAO | Lao PDR | 0 | 0 | 1 | 1 |
| MAC | Macao SAR, China | 0 | 1 | 0 | 1 |
| MMR | Myanmar | 0 | 0 | 3 | 3 |
| MYS | Malaysia | 69 | 55 | 25 | 149 |
| PAK | Pakistan | 1 | 0 | 1 | 2 |
| PAN | Panama | 2 | 0 | 0 | 2 |
| PHL | Philippines | 17 | 56 | 15 | 88 |
| ROU | Romania | 0 | 0 | 1 | 1 |
| RUS | Russian Federation | 1 | 2 | 8 | 11 |
| SAU | Saudi Arabia | 0 | 0 | 7 | 7 |
| SGP | Singapore | 17 | 29 | 12 | 58 |
| SLB | Solomon Islands | 0 | 0 | 1 | 1 |
| THA | Thailand | 87 | 176 | 131 | 394 |
| TWN | Taiwan | 27 | 49 | 26 | 102 |
| VEN | Venezuela, RB | 1 | 1 | 0 | 2 |
| VNM | Vietnam | 1 | 47 | 97 | 145 |
| ZAF | South Africa | 0 | 3 | 1 | 4 |
| ALL | All (29) | 404 | 1349 | 1126 | 2879 |

Note: This table tabulates the number of FDI projects only where both the Japanese parent firm and their foreign subsidiary are in the manufacturing sector.

Table 3: Average ownership ratio in OECD Countries

| Code | Name | 1989–1993 | 1994–2003 | 2004–2016 | Average |
|------|-----------------|-----------|-----------|-----------|---------|
| AUS | Australia | .81 | .78 | .76 | .79 |
| AUT | Austria | | | .5 | .5 |
| BEL | Belgium | .71 | 1 | 1 | .85 |
| CAN | Canada | .83 | .74 | .98 | .84 |
| CHE | Switzerland | 1 | .51 | .84 | .8 |
| COL | Colombia | | | .7 | .7 |
| CZE | Czech Republic | | .91 | .86 | .89 |
| DEU | Germany | .72 | .83 | .92 | .83 |
| DNK | Denmark | 1 | | | 1 |
| ESP | Spain | .56 | .67 | .57 | .61 |
| FIN | Finland | .42 | | | .42 |
| FRA | France | .81 | .7 | 1 | .82 |
| GBR | United Kingdom | .72 | .78 | 1 | .77 |
| HUN | Hungary | .36 | .84 | .75 | .7 |
| IRL | Ireland | 1 | 1 | 1 | 1 |
| ISL | Iceland | .5 | | | .5 |
| ISR | Israel | .53 | | | .53 |
| ITA | Italy | .53 | .62 | .92 | .7 |
| KOR | Korea, Rep. | .51 | .62 | .75 | .65 |
| LUX | Luxembourg | .5 | .5 | | .5 |
| MEX | Mexico | .62 | .73 | .86 | .82 |
| NLD | Netherlands | .75 | .8 | .9 | .81 |
| NOR | Norway | .33 | .2 | | .27 |
| NZL | New Zealand | .63 | .76 | .5 | .65 |
| POL | Poland | | .84 | .92 | .89 |
| SVK | Slovak Republic | | 1 | 1 | 1 |
| SWE | Sweden | .45 | .58 | 1 | .63 |
| TUR | Turkey | | .63 | .62 | .63 |
| USA | United States | .73 | .81 | .94 | .8 |
| ALL | All (29) | .7 | .76 | .87 | .77 |

Note: This table tabulates the number of FDI projects only where both the Japanese parent firm and their foreign subsidiary are in the manufacturing sector.

Table 4: Average ownership ratio in Non-OECD Countries

| Code | Name | 1989–1993 | 1994–2003 | 2004–2016 | Average |
|------|--------------------|-----------|-----------|-----------|---------|
| ARG | Argentina | .25 | .51 | | .44 |
| BGD | Bangladesh | | | .55 | .55 |
| BHR | Bahrain | | | .49 | .49 |
| BRA | Brazil | .58 | .8 | .84 | .8 |
| CHN | China | .52 | .63 | .77 | .68 |
| EGY | Egypt, Arab Rep. | | | 1 | 1 |
| IDN | Indonesia | .53 | .65 | .73 | .66 |
| IND | India | .39 | .62 | .74 | .68 |
| IRN | Iran, Islamic Rep. | .5 | .44 | | .47 |
| KAZ | Kazakhstan | | | 1 | 1 |
| KEN | Kenya | | | .8 | .8 |
| KHM | Cambodia | | | .92 | .93 |
| LAO | Lao PDR | | | .86 | .86 |
| MAC | Macao SAR, China | | .5 | | .5 |
| MMR | Myanmar | | | .72 | .72 |
| MYS | Malaysia | .77 | .76 | .81 | .77 |
| PAK | Pakistan | .51 | | .35 | .43 |
| PAN | Panama | .5 | | | .5 |
| PHL | Philippines | .68 | .86 | .85 | .83 |
| ROU | Romania | | | 1 | 1 |
| RUS | Russian Federation | .25 | .47 | .83 | .71 |
| SAU | Saudi Arabia | | | .48 | .48 |
| SGP | Singapore | .76 | .84 | .97 | .84 |
| SLB | Solomon Islands | | | 1 | 1 |
| THA | Thailand | .52 | .61 | .84 | .66 |
| TWN | Taiwan | .57 | .76 | .84 | .73 |
| VEN | Venezuela, RB | .25 | 1 | | .63 |
| VNM | Vietnam | .6 | .67 | .91 | .83 |
| ZAF | South Africa | | .57 | .85 | .64 |
| ALL | All (29) | .58 | .66 | .79 | .7 |

Note: This table tabulates the number of FDI projects only where both the Japanese parent firm and their foreign subsidiary are in the manufacturing sector.

C Non-manufacturing subsidiaries

In the main text, we analyze only foreign manufacturing subsidiaries owned by Japanese manufacturing firms. However, Japanese manufacturing firms have non-manufacturing foreign subsidiaries. Table 5 describes the sector distribution of foreign subsidiaries owned by Japanese manufacturing firms. Manufacturing subsidiaries account for approximately 60%, whereas wholesale and retail subsidiaries account for approximately 22%. Service subsidiaries account for approximately 12%.

Table 5: Sector Distribution of Subsidiaries

| | (1) Freq. | Percent |
|--------------------|--------------|---------|
| Agriculture,Mining | 44 | 0.7 |
| Manufacturing | 3747 | 59.6 |
| Wholesale | 1330 | 21.1 |
| Retail | 90 | 1.4 |
| Service,Others | 762 | 12.1 |
| HeadQuarter | 318 | 5.1 |
| Total | 6291 | 100.0 |

In Table 6, we estimate the equations by sector to which foreign subsidiaries belong. Firm productivity, TFP, is positive and significant for wholesale/retail but insignificant for services. The parent firms' financial constraints and debt ratios are negatively significant for services but insignificant for wholesale/retail. The top bank ratio of the parent firms is insignificant in all non-manufacturing sectors. The intangibles ratio is negatively significant for services but insignificant for wholesale/retail. Overall, we find large sectoral heterogeneity. At the same time, our main results on manufacturing subsidiaries are close to those for all sectors the last column of Table 6 displays.

The results in Table 6 suggest that parent firm TFP affects FDI in wholesale/retail and debt ratios affect FDI in services, similar to manufacturing FDI. However, the top banks' influence on FDI disappears for non-manufacturing investments. This may be because these investments are viewed as less risky than manufacturing subsidiaries. They are typically smaller in size (both in total assets and employment), resulting in lower fixed establishment costs and marginal operational costs while often being established to provide services and facilitate exports. Establishing these subsidiaries may be less costly for the parent firm, requiring less funding and investment from its main lending (and owning) bank.

Table 6: Fractional logit results by subsidiary industry

| | Wholesale Retail | Service | Total |
|-------------------------|---------------------|----------------------|----------------------|
| log TFP (t-2) | 6.719*** [1.935] | -2.829 [2.106] | 1.909** [0.871] |
| Debt ratio (t-2) | 0.146 [0.411] | -0.847* [0.506] | -0.731*** [0.169] |
| Top bank ratio (t-2) | 3.610 [2.319] | 1.798 [2.268] | -0.700 [0.784] |
| Intangibles ratio (t-2) | 2.635 [4.722] | -6.403*** [2.291] | 1.441 [2.059] |
| Observations | 1310 | 722 | 5853 |
| Mean of Dep. Var. | 0.882 | 0.858 | 0.781 |
| Country FE | YES | YES | YES |
| Parent Induistry FE | YES | YES | YES |
| Year FE | YES | YES | YES |

Robust standard errors are clustered by parent firm.

Dep. var.: Parent firms' ownership ratio of foreign subsidiaries (t).

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

References

- Akerberg, Daniel A, Kevin Caves, and Garth Frazer**, “Identification Properties of Recent Production Function Estimators,” *Econometrica*, 2015, *83* (6), 2411–2451.
- Levinsohn, James and Amil Petrin**, “Estimating production functions using inputs to control for unobservables,” *The Review of Economic Studies*, 2003, *70* (2), 317–341.
- Pavcnik, Nina**, “Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants,” *The Review of Economic Studies*, 2002, *69* (1), 245–276.
- Rovigatti, Gabriele and Vincenzo Mollisi**, “Theory and practice of total-factor productivity estimation: The control function approach using Stata,” *The Stata Journal*, 2018, *18* (3), 618–662.
- Wooldridge, Jeffrey M**, “On estimating firm-level production functions using proxy variables to control for unobservables,” *Economics Letters*, 2009, *104* (3), 112–114.