Cross-border vertical integration and intra-firm trade: new evidence from Korean and Japanese firm-level data

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Motivation

Can Input-Out coefficients tell actual flows of goods within a vertically integrated firms?

What are the characteristics of firms with a positive intra-firm trade?
Our findings using Korean and Japanese firm-level data.

(1) Intra-firm trade is highly concentrated among a small number of large multinational corporations.

(2) The input–output coefficient linking the parent's and affiliate's industries of operation is not related to a corresponding intra-firm flow of goods.

Similar patterns of US

for foreign affiliates: Ramondo, Rappoport and Ruhl (2016, JIE)
for domestic affiliates: Atalay, Hortaçsu, Syverson (2014, AER)
Related literature

(1) Skewedness of intra-firm trade

Helpman, Melitz and Yeaple (2004, AER): US’s industry
Tomiura, Ito and Wakasugi (2011, EI): Japanese firms

(2) Lack of intra-firm trade of vertically integrated firms

Ramondo, Rappoport, and Ruhl (2016, AER): Foreign aff. of US
We present several tables summarizing our results

(1) Summary statistics for intra-firm trade and size
   Table 1 (Korea) and Table 2 (Japan)

(2) Result 1: Intra-firm trade of Large firms
   Table 3-4 (Korea), Table 5-6 (Japan)

(3) Result 2: IO table does not reflect intra-firm trade
   Table 7-8 (Korea), Table 9-10 (Japan)

- **Korean Firm-level Database**
  - *Survey of Business Structure and Activities (SBSA)*, Statistics Korea, 2010
  - Including all firms above 50 employees (or with more than 300 million KRW) – approx. 10,000 firms
  - Covering 70% of total value-added in the manufacturing sector of Korea
  - Providing both country and Industry Information of each foreign and domestic affiliates of Korean firms who own at least 20% of affiliates’ equity capital
  - *Can identify country and industry of each affiliate*
  - Aggregated Intra-firm trade of a firm to its affiliates
Japanese Firm-level Data

- *Basic Survey on Japanese Business Structure and Activities (BSJBSA)*, the Ministry of Economy, Trade and Industry (METI), 2010
- Including all firms above 50 employees (or with more than 30 million Yen) – approx. 30,000 firms
- Providing both regions (4) and Industry Information of foreign and domestic affiliates of Japanese firms who own at least 20% of affiliates’ paid-in capital
- **Cannot identify country to each foreign affiliates**
- Aggregated Intra-firm trade of a firm to its affiliates
Ownership (Parent-affiliate matching)
- Defining a parent firm as a firm that owns at least 50% of equity capital of its foreign affiliates
- Most of CBVI affiliates are majority-owned
- Majority-owned affiliates account for most intra-firm imports

Vertical Integration
- Backward: A parent firm owns an affiliate in the supplying industry that provides at least 5% of the total intermediate input of producing industry.
- Forward: A parent firm owns an affiliate in the producing industry that purchases at least 5% of the total intermediate input of supplying industry.

Producing-supplying-industry pairs: 1% from IO tables
Data: Intra-firm trade and controls

- **Intra-firm trade of goods**
  
The imports (exports) as a part of the purchases (sales) are the imported (exported) materials and products through customs procedure by the name of the firm. All service transactions are excluded.

  - The flows of goods can be divided to local and foreign parties.

Firm’s trade with

1. related domestic parties – domestic transaction within a firm
2. related foreign parties – intra-firm trade
3. Unrelated domestic parties
4. Unrelated foreign parties

- **Controls**
  
  - Firm characteristics: Parent firms’ employment and numbers of affiliation
  - Affiliate characteristics: Dummies of affiliates’ industry and country (local regions)
### Table 1. Intra-firm trade and size of firm - VI sample for Korea (2010)

<table>
<thead>
<tr>
<th></th>
<th>Obs. (A)</th>
<th>(+) Obs. (B)</th>
<th>(B)/(A)</th>
<th>Top 5</th>
<th>Top 10</th>
<th>Top 50</th>
<th>Top 100</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A Parent – A Foreign Affiliate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Export to Affiliates</td>
<td>1,078</td>
<td>440</td>
<td>0.40</td>
<td>0.77</td>
<td>0.85</td>
<td>0.96</td>
<td>0.98</td>
</tr>
<tr>
<td>Import from Affiliates</td>
<td>1,078</td>
<td>311</td>
<td>0.29</td>
<td>0.77</td>
<td>0.84</td>
<td>0.96</td>
<td>0.99</td>
</tr>
<tr>
<td>Intra-firm trade</td>
<td>1,078</td>
<td>481</td>
<td>0.45</td>
<td>0.74</td>
<td>0.83</td>
<td>0.95</td>
<td>0.98</td>
</tr>
<tr>
<td>Employees of parents</td>
<td>1,078</td>
<td>1,078</td>
<td>1</td>
<td>0.35</td>
<td>0.45</td>
<td>0.65</td>
<td>0.72</td>
</tr>
<tr>
<td><strong>A Parent – A Domestic Affiliate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales to Affiliates</td>
<td>804</td>
<td>303</td>
<td>0.38</td>
<td>0.78</td>
<td>0.89</td>
<td>0.97</td>
<td>0.99</td>
</tr>
<tr>
<td>Purchase from Affiliates</td>
<td>804</td>
<td>291</td>
<td>0.36</td>
<td>0.61</td>
<td>0.80</td>
<td>0.95</td>
<td>0.98</td>
</tr>
<tr>
<td>Intra-firm transaction</td>
<td>804</td>
<td>369</td>
<td>0.46</td>
<td>0.66</td>
<td>0.84</td>
<td>0.95</td>
<td>0.98</td>
</tr>
<tr>
<td>Employees of parents</td>
<td>804</td>
<td>804</td>
<td>1</td>
<td>0.38</td>
<td>0.51</td>
<td>0.70</td>
<td>0.78</td>
</tr>
</tbody>
</table>

Note: Both parents and affiliates are the matches only within manufacturing sectors. We exclude parents who are owned by other firms. VI sample contains only backward-vertical integration.
# Intra-firm trade and Size: Japan

Table 2. Intra-firm trade and size of firm – VI sample for Japan (2010)

<table>
<thead>
<tr>
<th>A Parent – A Foreign Affiliate</th>
<th>Obs. (A)</th>
<th>(+) Obs. (B)</th>
<th>(B)/(A)</th>
<th>Top 10</th>
<th>Top 25</th>
<th>Top 50</th>
<th>Top 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export to Affiliates</td>
<td>1,420</td>
<td>876</td>
<td>0.62</td>
<td>0.59</td>
<td>0.74</td>
<td>0.84</td>
<td>0.92</td>
</tr>
<tr>
<td>Import from Affiliates</td>
<td>1,420</td>
<td>789</td>
<td>0.56</td>
<td>0.56</td>
<td>0.68</td>
<td>0.79</td>
<td>0.87</td>
</tr>
<tr>
<td>Intra-firm trade</td>
<td>1,420</td>
<td>1,006</td>
<td>0.71</td>
<td>0.54</td>
<td>0.70</td>
<td>0.80</td>
<td>0.89</td>
</tr>
<tr>
<td>Employees of parents</td>
<td>1,420</td>
<td>1,420</td>
<td>1</td>
<td>0.21</td>
<td>0.34</td>
<td>0.46</td>
<td>0.59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A Parent – A Domestic Affiliate</th>
<th>Obs. (A)</th>
<th>(+) Obs. (B)</th>
<th>(B)/(A)</th>
<th>Top 10</th>
<th>Top 25</th>
<th>Top 50</th>
<th>Top 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales to Affiliates</td>
<td>1,626</td>
<td>464</td>
<td>0.29</td>
<td>0.64</td>
<td>0.80</td>
<td>0.90</td>
<td>0.97</td>
</tr>
<tr>
<td>Purchase from Affiliates</td>
<td>1,626</td>
<td>413</td>
<td>0.25</td>
<td>0.74</td>
<td>0.84</td>
<td>0.90</td>
<td>0.96</td>
</tr>
<tr>
<td>Intra-firm transaction</td>
<td>1,626</td>
<td>569</td>
<td>0.35</td>
<td>0.66</td>
<td>0.79</td>
<td>0.87</td>
<td>0.94</td>
</tr>
<tr>
<td>Employees of parents</td>
<td>1,626</td>
<td>1,626</td>
<td>1</td>
<td>0.20</td>
<td>0.32</td>
<td>0.43</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Note: Both parents and affiliates are the matches only within manufacturing sectors. We exclude parents who are owned by other firms. VI sample contains only backward-vertical integration.
Finding

- There are a large share of firms who own their affiliates (either domestic or foreign) but do not have any intra-firm trade at all.

- Intra-firm trade (either domestic or foreign) are concentrated within large conglomerates.
Intra-firm trade and Size

- **OLS regression Model**

  \[
  D(X_{ij}) = \alpha_0 + \alpha_1 \ln(\text{emp}_p) + \alpha_2 \ln(\text{aff.num}_p) + \gamma_{ai} + \delta_{ac} + \epsilon_{ij} \quad (1)
  \]

  \[
  \ln(X_{ij}) = \beta_0 + \beta_1 \ln(\text{emp}_p) + \beta_2 \ln(\text{aff.num}_p) + \gamma_{ai} + \delta_{ac} + \epsilon_{ij}. \quad (2)
  \]

Where
- \(X_{ij}\): intra-firm trade (export or imports)
  - for \(ij=ap\): imports from affiliates (Backward VI)
  - for \(ij=pa\): exports to affiliates (Forward VI)
- \(\text{emp}_p\): parent’s employment
- \(\text{aff.num}_p\): numbers of affiliates owned by a parent firm
- \(\gamma_{ai}\): dummy for industry (i) of affiliates (a)
- \(\delta_{ac}\): dummy for destination-country (c) of affiliates (a).
Intra-firm trade and size: Korea

Table 3. Intra-firm trade and Size of firms – VI sample for Korea

<table>
<thead>
<tr>
<th>Parent –</th>
<th>D(Xap) (1)import</th>
<th>Ln(Xap) (2)import</th>
<th>D(Xpa) (3)export</th>
<th>Ln(Xpa) (4)export</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Affiliate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(emp)</td>
<td>0.075***</td>
<td>0.893***</td>
<td>0.087***</td>
<td>0.980***</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.143)</td>
<td>(0.016)</td>
<td>(0.079)</td>
</tr>
<tr>
<td>ln(aff.num)</td>
<td>0.120***</td>
<td>0.745***</td>
<td>0.076***</td>
<td>0.903***</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.193)</td>
<td>(0.027)</td>
<td>(0.138)</td>
</tr>
<tr>
<td>Aff industry FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Aff country FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>2,269</td>
<td>888</td>
<td>2,269</td>
<td>1,143</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.243</td>
<td>0.513</td>
<td>0.208</td>
<td>0.703</td>
</tr>
</tbody>
</table>

Note: We use MNE cluster standard errors and the values are in parenthesis. The estimates for constant terms are not reported in the Table. The significance levels are indicated by ***, ** and * for 1%, 5%, 10% respectively.
### Domestic intra-firm trade and size: Korea

<table>
<thead>
<tr>
<th>Parent –</th>
<th>D(Xap)</th>
<th>Ln(Xap)</th>
<th>D(Xpa)</th>
<th>Ln(Xpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Affiliate</td>
<td>(1) purchase</td>
<td>(2) purchase</td>
<td>(3) sales</td>
<td>(4) sales</td>
</tr>
<tr>
<td>Ln(emp)</td>
<td>0.099***</td>
<td>1.029***</td>
<td>0.099***</td>
<td>0.960***</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.077)</td>
<td>(0.015)</td>
<td>(0.103)</td>
</tr>
<tr>
<td>Ln(aff.num)</td>
<td>0.115***</td>
<td>0.811***</td>
<td>0.129***</td>
<td>0.788***</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(0.190)</td>
<td>(0.036)</td>
<td>(0.209)</td>
</tr>
<tr>
<td>Aff industry FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Aff regional FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>1,387</td>
<td>611</td>
<td>1,387</td>
<td>646</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.247</td>
<td>0.651</td>
<td>0.266</td>
<td>0.557</td>
</tr>
</tbody>
</table>

Note: We use MNE cluster standard errors and the values are in parenthesis. The estimates for constant terms are not reported in the table. The significance levels are indicated by ***, ** and * for 1%, 5%, 10% respectively.
## Intra-firm trade and size: Japan

Table 5. Intra-firm trade and Size of firms – VI sample for Japan

<table>
<thead>
<tr>
<th>Parent –</th>
<th>D(Xap)</th>
<th>Ln(Xap)</th>
<th>D(Xpa)</th>
<th>Ln(Xpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Affiliate</td>
<td>D(Xap)</td>
<td>Ln(Xap)</td>
<td>D(Xpa)</td>
<td>Ln(Xpa)</td>
</tr>
<tr>
<td>(1)import</td>
<td>(2)import</td>
<td>(3)export</td>
<td>(4)export</td>
<td></td>
</tr>
<tr>
<td>Ln(emp)</td>
<td>-0.019</td>
<td>0.523***</td>
<td>0.000</td>
<td>0.887***</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.087)</td>
<td>(0.015)</td>
<td>(0.072)</td>
</tr>
<tr>
<td>Ln(aff.num)</td>
<td>0.045***</td>
<td>0.705***</td>
<td>0.068***</td>
<td>0.782***</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.126)</td>
<td>(0.023)</td>
<td>(0.101)</td>
</tr>
<tr>
<td>Aff industry FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Aff country FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>1,420</td>
<td>789</td>
<td>1,420</td>
<td>876</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.056</td>
<td>0.309</td>
<td>0.072</td>
<td>0.570</td>
</tr>
</tbody>
</table>

Note: We use MNE cluster standard errors and the values are in parenthesis. The estimates for constant terms are not reported in the Table. The significance levels are indicated by *** for 1%, ** for 5%, and * for 10% respectively.
### Table 6. Intra-firm trade and Size of firms – VI sample for Japan

<table>
<thead>
<tr>
<th>Parent – Domestic Affiliate</th>
<th>D(Xap) (1)purchase</th>
<th>Ln(Xap) (2)purchase</th>
<th>D(Xpa) (3)sales</th>
<th>Ln(Xpa) (4)sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln(emp)</td>
<td>0.050***</td>
<td>0.837***</td>
<td>0.059***</td>
<td>1.065***</td>
</tr>
<tr>
<td>(0.012)</td>
<td>(0.117)</td>
<td>(0.012)</td>
<td>(0.136)</td>
<td></td>
</tr>
<tr>
<td>Ln(aff.num)</td>
<td>-0.025</td>
<td>0.938***</td>
<td>0.016</td>
<td>0.736***</td>
</tr>
<tr>
<td>(0.017)</td>
<td>(0.143)</td>
<td>(0.018)</td>
<td>(0.152)</td>
<td></td>
</tr>
<tr>
<td>Aff industry FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>1,626</td>
<td>413</td>
<td>1,626</td>
<td>464</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.208</td>
<td>0.57</td>
<td>0.239</td>
<td>0.469</td>
</tr>
</tbody>
</table>

Note: We use MNE cluster standard errors and the values are in parenthesis. The estimates for constant terms are not reported in the Table. The significance levels are indicated by *** , ** and * for 1%, 5%, 10% respectively.
When parents and their affiliates are vertically related (either backward or forward), intra-firm trade (either domestic or foreign) are positively correlated with employments and numbers of affiliates.

→ Large sized firms are more likely to trade with their affiliates.
Intra-firm trade and IO coefficients

**OLS Regression Model**

Backward Vertical Integration:

\[
D(X_{ap}) = \alpha_0 + \alpha_1 \text{drxz} + \gamma_{ai} + \delta_{ac} + \epsilon_{ij} \quad (3)
\]

\[
\ln(X_{ap}) = \beta_0 + \beta_1 \ln(\text{drxz}) + \gamma_{ai} + \delta_{ac} + \epsilon_{ij} \quad (4)
\]

Forward Vertical Integration:

\[
D(X_{pa}) = \alpha_0 + \alpha_1 \text{drzx} + \gamma_{ai} + \delta_{ac} + \epsilon_{ij} \quad (5)
\]

\[
\ln(X_{pa}) = \beta_0 + \beta_1 \ln(\text{drzx}) + \gamma_{ai} + \delta_{ac} + \epsilon_{ij} \quad . \quad (6)
\]

**drxz**: direct requirement coefficient with the parent’s producing industry (z) from affiliate’s supplying industry (x).

**drzx**: direct requirement coefficient with the parent’s supplying industry (x) to the affiliate’s producing industry (z).
## Intra-firm trade and IO coefficient: Korea

Table 7. Intra-firm trade and IO coefficients - VI sample for Korea

<table>
<thead>
<tr>
<th></th>
<th>D(Xap)</th>
<th>Ln(Xap)</th>
<th>D(Xpa)</th>
<th>Ln(Xpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foreign Affiliate</strong></td>
<td>(1)import</td>
<td>(2)import</td>
<td>(3)export</td>
<td>(4)export</td>
</tr>
<tr>
<td>drxz</td>
<td>-0.046</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.186)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>drzx</td>
<td></td>
<td>-0.128</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.147)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(drxz)</td>
<td></td>
<td>-0.089</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.366)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(drzx)</td>
<td></td>
<td></td>
<td></td>
<td>-0.059</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.122)</td>
</tr>
<tr>
<td><strong>Aff industry FE</strong></td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Aff country FE</strong></td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>2,269</td>
<td>888</td>
<td>2,269</td>
<td>1,143</td>
</tr>
<tr>
<td><strong>R-squared</strong></td>
<td>0.104</td>
<td>0.173</td>
<td>0.096</td>
<td>0.212</td>
</tr>
</tbody>
</table>

Note: We use MNE cluster standard errors and the values are in parenthesis. The estimates for constant terms are not reported in the Table. The significance levels are indicated by ***, ** and * for 1%, 5%, 10% respectively.
## Domestic intra-firm trade and IO coefficients: Korea

Table 8. Intra-firm trade and IO coefficients - VI sample for Korea

<table>
<thead>
<tr>
<th>Parent – Domestic Affiliate</th>
<th>D(Xap)</th>
<th>Ln(Xap)</th>
<th>D(Xpa)</th>
<th>Ln(Xpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)purchase</td>
<td>(2)purchase</td>
<td>(3)sales</td>
<td>(4)sales</td>
<td></td>
</tr>
<tr>
<td>drxz</td>
<td>0.196</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.144)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>drzx</td>
<td></td>
<td>0.201*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.118)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(drxz)</td>
<td></td>
<td>-0.236</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.229)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(drzx)</td>
<td></td>
<td></td>
<td>-0.048</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.073)</td>
<td></td>
</tr>
<tr>
<td>Aff industry FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Aff regional FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>1,387</td>
<td>611</td>
<td>1,387</td>
<td>646</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.105</td>
<td>0.136</td>
<td>0.116</td>
<td>0.128</td>
</tr>
</tbody>
</table>

Note: We use MNE cluster standard errors and the values are in parenthesis. The estimates for constant terms are not reported in the Table. The significance levels are indicated by ***, ** and * for 1%, 5%, 10% respectively.
## Intra-firm trade and IO coefficient: Japan

<table>
<thead>
<tr>
<th>Parent – Foreign Affiliate</th>
<th>D(Xap) (1)import</th>
<th>Ln(Xap) (2)import</th>
<th>D(Xpa) (3)export</th>
<th>Ln(Xpa) (4)export</th>
</tr>
</thead>
<tbody>
<tr>
<td>dxrz</td>
<td>-0.094</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.104)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dzx</td>
<td></td>
<td></td>
<td>0.121*</td>
<td>(0.073)</td>
</tr>
<tr>
<td>Ln(dxz)</td>
<td>-0.022</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(0.210)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(dzx)</td>
<td></td>
<td></td>
<td></td>
<td>-0.058</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.050)</td>
</tr>
<tr>
<td>Aff industry FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Aff country FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>1,420</td>
<td>789</td>
<td>1,420</td>
<td>873</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.045</td>
<td>0.145</td>
<td>0.054</td>
<td>0.322</td>
</tr>
</tbody>
</table>

Note: We use MNE cluster standard errors and the values are in parenthesis. The estimates for constant terms are not reported in the Table. The significance levels are indicated by *** for 1%, ** for 5%, * for 10% respectively.
### Table 10. Intra-firm trade and IO coefficients - VI sample for Japan

<table>
<thead>
<tr>
<th>Parent –</th>
<th>D(Xap)</th>
<th>Ln(Xap)</th>
<th>D(Xpa)</th>
<th>Ln(Xpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Affiliate</td>
<td>(1)purchase</td>
<td>(2)purchase</td>
<td>(3)sales</td>
<td>(4)sales</td>
</tr>
<tr>
<td>drxz</td>
<td>-0.128</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.079)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>drzx</td>
<td></td>
<td></td>
<td>0.032</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.057)</td>
<td></td>
</tr>
<tr>
<td>Ln(drxz)</td>
<td></td>
<td>-0.257</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.267)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(drzx)</td>
<td></td>
<td></td>
<td></td>
<td>0.139*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.078)</td>
</tr>
<tr>
<td>Aff industry FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>1,626</td>
<td>413</td>
<td>1,626</td>
<td>461</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.179</td>
<td>0.192</td>
<td>0.197</td>
<td>0.211</td>
</tr>
</tbody>
</table>

Note: We use MNE cluster standard errors and the values are in parenthesis. The estimates for constant terms are not reported in the Table. The significance levels are indicated by ***, ** and * for 1%, 5%, 10% respectively.
Findings

The input–output coefficient linking the parent's and affiliate's industries of operation is not related to a corresponding intra-firm flow of goods. (either foreign VI or domestic VI)
Intra-firm trade of horizontally integrated firms

Full sample: include non-vertically integrated firms

→ We have the similar findings.
Concluding remarks

Summary of our findings

(1) The large firms in terms of employments or the numbers of affiliates explain the trade flows of goods both in Korea and Japan.

(2) The direct requirement coefficients of parent’s and affiliate’s industries are not related to the corresponding parent-affiliate’s trade at firm-levels in Korea and Japan.

→ our findings open up a challenging question about a motivation behind the lack of intra-firm trade of multinational firms.
Open research topics

(1) Firm versus Industry

Many literature on cross-border vertical integration used the intensive margin (share of intra-firm trade) at industry level, which may be fine.

When we study determinants of vertical integration at firm-level, using ‘intra-firm trade’ data may be misleading due to its skewedness toward large-sized firms.

(2) Cost-saving vertical FDI?

This finding cast a doubt on the traditional idea of cost-saving foreign direct investment and thus being able to keep up a status of comparative advantage in international trade.
Concluding remarks

- **Open research topics**

  What are the motivations behind the vertical integration with lack of intra-firm trade?

  Is there a transfer of “business capability” from acquiring firm to acquired firm?

  How do the integrated firms use third-party suppliers in foreign markets?

  Has the entire production network been restructured towards upstream or downstream industries?
Recent two papers using a more disaggregated Dataset

(1) “Hollowing Out or Filling In? Impacts of Multinational Enterprises on Domestic Plant Turnover and Job Growth in Factory Asia”.

→ Firm-Plant Matched Data

(2) “Servicification of Domestic Manufacturing: Evidence from Korean Multinational Firms”

→ Firm-Establishment Matched Data