Identifying FDI Types : Watch What They Do, Not What They Say or Look Like*

by JaeBin Ahn† and Jee-Hyeong Park‡

January 2022

Abstract

This note compares three different schemes to identify FDI types and documents that correlation among different classification schemes is extremely low. Empirical exercises in line with the proximity-concentration tradeoff hypothesis support the sales information based scheme.

*This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundtation of Korea(NRF-2019S1A 5A2A030 53880).

†Graduate School of International Studies, Seoul National University (jaebin.ahn@snu.ac.kr).

‡Department of Economics, Seoul National University (j-hpark@snu.ac.kr).

1. Introduction

A theory of Foreign Direct Investment (FDI) provides a clear conceptual dichotomy between two main types of FDI: horizontal FDI for improving market access and vertical one for obtaining lower-cost intermediate inputs. In practice, however, classifying FDI activities can be challenging. A comprehensive firm-level foreign subsidiary dataset is rarely available. Moreover, even when such a data is available, it seldom contains direct information on operational motives for FDI.

There have been a few noteworthy studies that attempted to narrow this gap between theory and empirics. A seminal approach introduced by Alfaro and Charlton (2009) exploits information on parent and subsidiary firms' sector affiliations, focusing on whether they belong to the same sector (i.e., horizontal FDI) or not (i.e., vertical FDI).[1] We denote this classification scheme by I-scheme.

Alternatively, Ramondo et al. (2016) explore a subsidiary-level sales information, whereby a foreign affiliate can be classified as horizontal FDI if a large share of its sales goes to local unrelated firms, whereas it may be classified as vertical FDI if a large share of its sales goes to any related firms. We refer to this scheme as S-scheme.

Yet another approach is to directly ask a firm about its FDI motive, which we denote by D-scheme. For example, the IAB-ReLOC survey data ask German Multinational Enterprises (MNEs) to report the motives of their subsidiary oper-

[1] Alfaro et al. (2019) extend this approach by supplementing it with the input-output relationship between parents' and subsidiaries' industries. Del Prete and Rungi (2017) adopt the same methodology for their analysis of global value chains.

ations—market access (i.e., horizontal FDI) or cost saving (i.e., vertical FDI)—in the Czech Republic (Moritz et al., 2020).

Given the diversity of FDI classification schemes, which one better reflects actual motives of FDI is a legitimate question to ask. This note aims to compare these alternative FDI classification schemes, using the Korean MNEs database. Although Moritz et al. (2020) also investigate the relative performance of different FDI classification schemes using the IAB-ReLOC survey data, our dataset has a strong advantage over their survey data as it covers most of Korean foreign subsidiaries located across the universe of host countries.

This feature of our dataset allows us to exploit cross-country variation in checking the validity of the broadly-accepted proximity-concentration tradeoff hypothesis that applies only to horizontal FDI, which in turn enable us to rank performance of alternative FDI classification schemes. Not being able to use such cross-country variation to rank different schemes, Moritz et al. (2020) end up utilizing their conjecture of having a positive relationship between the MNE's productivity and its foreign subsidiary's size only for horizontal FDI but not for vertical FDI, a weak hypothesis at best.[2] The main finding of this note suggests that actual motives of FDI are most accurately captured by S-scheme.

The remainder of the paper is organized as follows. Section 2 introduces the

[2]Even though a firm's productivity may have a weaker positive (even a negative) effect on vertical FDI decision compared with its positive effect on horizontal FDI decision, as suggested by Head and Ries (2003) and Grossman et al. (2006), to our knowledge, there is no FDI model that predicts a non-positive relationship between the MNE's productivity and its subsidiary's size. While their empirical analysis supports their weak (or potentially wrong) conjecture only when they utilize D-scheme or S-scheme, they find a strong positive relationship between a firm's productivity and its FDI decision for all classification schemes.

dataset used in the study. Section 3 documents empirical findings. Section 4 provides the conclusion.

2. Data

2.1. Korean MNEs' Foreign Affiliate-level Data

This note employs Korean MNEs' foreign affiliates-level data covering the period from 2007 to 2018. The Export and Import Bank of Korea (Korea Eximbank; KEXIM) conducts annual survey of Korean multinational affiliates abroad, targeted at subsidiaries with their accumulated investments over one million US dollars.[3]

The main advantage of this Korean foreign affiliates-level dataset is that it covers as detailed operational information as the U.S. BEA data. Not to mention each subsidiary's sector affiliation and host country information, it provides information on each subsidiary's sales and sourcing activities broken down into geographical and customer-type dimensions: inter-firm or intra-firm local sales (purchases); inter-firm or intra-firm exports to (imports from) Korea; inter-firm or intra-firm exports to (imports from) third countries.[4] In addition, it also contains each subsidiary's self-chosen answers from nine different categories of FDI

[3] A few studies that used the Korean MNEs' foreign affiliate-level data include Cho (2018), Chung (2014), Debaere et al. (2010, 2013), and Hyun and Hur (2013) among others. The sample data employed in this note were also used for an analysis in a policy report by the authors written in Korean, entitled as "Sustainable Peace Process on the Korean Peninsula" commissioned by National Resaerch Council for Economics, Hamanities and Social Sciences (2021).

[4] To our knowledge, there are two other countries that record slightly less detailed subsidiary-

motives—whether it is for host country market penetration, cost saving, access to third countries, raw material procurement, mineral resource development, export promotion, advance technology acquisition, circumventing protectionist policies, or any other reasons.

2.2. FDI Classification Schemes

Following Alfaro and Charlton (2009), we first classify FDI types based on parent and subsidiary firms' sector affiliations. Specifically, we assign a subsidiary who belongs to the same industry as the parent firm as horizontal FDI, while those subsidiaries whose sector affiliations are different from their parents' are classified as vertical FDI. This I-scheme can be further differentiated depending on the disaggregation level of industry classification from two- to five-digit- level codes of Korean Standard Industry Classification (KSIC).

Alternatively, we may infer FDI types from detailed subsidiary-level sales information *à la* Ramondo et al. (2016). When a foreign subsidiary sells mostly to unrelated firms in the host country, we classify it as horizontal FDI. On the other hand, when a foreign subsidiary sells mostly to related firms, it is classified as vertical FDI. Specifically, we construct two versions of this S-scheme—strict version with a threshold level of 100% and loose version with a threshold level of 50%. For example, a foreign subsidiary whose sales share to local unrelated (any related) firms is higher than 50% but lower than 100% is defined as horizontal

level information. Japanese MNEs dataset used in Baldwin and Okubo (2014) and Hayakawa and Matsuura (2015) lacks information to distinguish intra-firm and inter-firm transactions. German Micro database Direct Investment (MiDi) employed in Krautheim (2013) and Tintelnot (2017) only records total sales of foreign affiliates.

(vertical) FDI in a loose version but not in a strict version.

Lastly, self-reported motives for FDI can be used to classify FDI types similarly to Moritz et al. (2020). Given that the main purpose of horizontal FDI is to serve local markets, those who select "host country market penetration" motive among nine categories are most likely to be horizontal FDI firms. Likewise, considering that vertical FDI in a standard North-South model features a Northern parent firm setting up a subsidiary in Southern countries mainly to save labor costs, "cost saving" motive is mostly likely fit vertical FDI firms. Applying this idea, we construct a strict version of D-scheme. A looser version of horizontal FDI also includes those subsidiaries who select "export promotion" or "circumventing protectionist policies", while a looser version of vertical FDI also includes those subsidiaries who report "advance technology acquisition".

2.3. An Overview of Relationship across Classification Schemes

Table 1 reports simple correlation matrix across different schemes' horizontal FDI classification. Not surprisingly, there is strong positive correlation among differential versions within the same scheme. For instance, although the horizontal FDI classification based on two-digit level industry affiliation becomes increasingly weakly correlated with other I-scheme classifications as more disaggregate level information is used, its correlation with the five-digit level classification is still as high as 0.54. More interestingly, however, it turns out that classifications based on I-scheme, irrespective of disaggregation levels, are literally uncorrelated with classifications based on S-scheme. By comparison, classifications based on

D-scheme appear to be slightly more correlated with other types of classifications at around 0.08-0.16 levels.[5]

Table 2 provides a detailed breakdown of the relationship between classifications based on I-scheme and other types of classifications, revealing several interesting patterns. First of all, it confirms the main finding in Alfaro and Charlton (2009) that more disaggregate-level industry information yields a higher prevalence of vertical FDI. In the case of Korean MNEs, the five-digit level I-scheme is almost two-times more likely to classify foreign subsidiaries as vertical FDI than the two-digit level I-scheme (19,025 vs. 10,384).

Second, a substantial share of subsidiaries classified as horizontal FDI by I-scheme tends to be classified as vertical FDI by other schemes. In the case of two-digit level classification, out of 18,496 subsidiaries classified as horizontal FDI, 5,123 subsidiaries (5,123/18,496=28%) are also classified as horizontal FDI by a strict version of S-scheme, while as many as 3,482 subsidiaries (3,482/18,496=19%) are classified as vertical FDI.

Moreover, vertical FDI subsidiaries according to I-scheme are more likely to be classified as horizontal rather than vertical by other schemes. Again, in the case of two-digit level classification, out of 10,384 subsidiaries classified as vertical FDI, 3,029 subsidiaries (3,029/10,384=29%) are classified as horizontal FDI by a strict version of S-scheme, while only 1,733 subsidiaries (1,733/10,384=17%) are classified as vertical FDI.

Next, we illustrate weak correlation across different classification schemes by

[5]By construction, while I-schemes classify all affiliates into either horizontal or vertical FDI, S-schemes and D-schemes may leave some affiliates as unclassified.

comparing distributions of foreign subsidiaries' local inter-firm sales share. Figure 1a shows that the local inter-firm sales share distribution is almost identical between horizontal and vertical subsidiaries classified by 5-digit sector affiliations. That is, when I-scheme is used, there are as many vertical subsidiaries that sell mostly to local unrelated firms as horizontal subsidiaries. Similarly, Figure 1b confirms that horizontal and vertical subsidiaries classified by D-scheme are almost identically distributed in terms of the share of sales to local unrelated firms.

3. Empirical Evaluation

Given the substantial level of heterogeneity across different classification schemes, it is critical to evaluate which one performs best in terms of reflecting actual motives of FDI. For this, we consider a horse race specification of the proximity-concentration tradeoff hypothesis, according to which the incentive for horizontal FDI should be stronger in more distant countries, countries with larger domestic markets or higher tariff barriers. In spirit of Brainard (1997) who first tested the hypothesis empirically, the specification is:

$$H^{j}_{ipct} = \beta_1 \ln Dist_c + \beta_2 \ln GDP_{ct} + \beta_3 \ln GDPPC_{ct} + \beta_4 \ln Tariff_{ct} + FE + \varepsilon_{ipct} \quad (1)$$

where the dependent variable is a horizontal FDI dummy variable defined by a classification scheme j for a parent firm p's subsidiary i located in country c in

year t.[6] Explanatory variables include bilateral distance between Korea and a host country, a host country's GDP, GDP per capita, and average tariff rates, which are available from CEPII's gravity database and the World Bank's WDI database. The proximity-concentration tradeoff predicts that the coefficient estimates on distance (β_1), GDP (β_2), and tariff (β_4) would be positive but that on GDP per capita (β_3) may be ambiguous.

We report regression results with sector- and year-fixed effects in Table 3. First four columns correspond to specifications with horizontal FDI dummy dependent variables based on, from two- to five-digit level, industry classifications. They clearly show that none of the coefficient estimates, except for the one on distance variable in column (3), are statistically significant, suggesting that I-scheme fails to identify horizontal FDI subsidiaries that satisfy the proximity-concentration tradeoff hypothesis.

Columns (5) and (6) are regression results from dependent variables constructed from two versions of S-scheme, while the last two columns are from strict and loose versions of D-scheme. Overall, they yield much stronger results consistent with the hypothesis: all the coefficient estimates from specifications with S-scheme are statistically significant and have expected signs from the hypothesis, while only two of them are statistically significant when D-scheme is used.

Table 4 confirms that the overall results are robust to stronger specifications with sector-year fixed effects and parent-year fixed effects, basically yielding qualitatively identical results to Table 3.

[6] Brainard (1997) runs industry-level regressions with the export share in total foreign sales as a dependent variable, while we run firm-level regressions.

4. Conclusion

There are three alternative ways to classify foreign subsidiaries into vertical and horizontal FDI, namely D-, I-, and S-schemes, that yield FDI classifications with little correlation. To compare them, we run a horse race test of checking which scheme performs the best in supporting the proximity-concentration tradeoff hypothesis for its classification of horizontal FDI, using the Korean MNEs' foreign affiliates data. It reveals that S-scheme performs the best, D-scheme the next, and I-scheme performs poorly.

S-scheme, relying on subsidiary firms' sales information, has the advantage of utilizing actual activities of foreign affiliates in classifying FDI types, compared to the other two schemes. Thus, this superiority of S-scheme may carry over to other FDI datasets besides the U.S. BEA data or the Korean MNEs' foreign affiliate-level data, a possible research topic given the availability of data.

References

Alfaro, L. and A. Charlton (2009). Intra-industry foreign direct investment. *American Economic Review 99*(5), 2096–2119.

Alfaro, L., D. Chor, P. Antras, and P. Conconi (2019). Internalizing global value chains: A firm-level analysis. *Journal of Political Economy 127*(2), 508–559.

Baldwin, R. and T. Okubo (2014). Networked fdi: Sales and sourcing patterns of japanese foreign affiliates. *The World Economy 37*(8), 1051–1080.

Brainard, S. L. (1997). An empirical assessment of the proximity-concentration trade-off between multinational sales and trade. *The American Economic Review 87*(4), 520–544.

Cho, J. (2018). Knowledge transfer to foreign affiliates of multinationals through expatriation. *Journal of International Economics 113*, 106–117.

Chung, S. (2014). Environmental regulation and foreign direct investment: Evidence from south korea. *Journal of Development Economics 108*, 222–236.

Debaere, P., H. Lee, and J. Lee (2010). It matters where you go: Outward foreign direct investment and multinational employment growth at home. *Journal of development economics 91*(2), 301–309.

Debaere, P., H. Lee, and J. Lee (2013). Language, ethnicity and intrafirm trade. *Journal of Development Economics 103*, 244–253.

Del Prete, D. and A. Rungi (2017). Organizing the global value chain: a firm-level test. *Journal of International Economics 109*, 16–30.

Grossman, G. M., E. Helpman, and A. Szeidl (2006). Optimal integration strategies for the multinational firm. *Journal of International Economics 70*(1), 216 – 238.

Hayakawa, K. and T. Matsuura (2015). Trade liberalization in asia and fdi strategies in heterogeneous firms: evidence from japanese firm-level data. *Oxford Economic Papers 67*(2), 494–513.

Head, K. and J. Ries (2003). Heterogeneity and the fdi versus export decision of japanese manufacturers. *Journal of the Japanese and international economies 17*(4), 448–467.

Hyun, H.-J. and J. Hur (2013). Who goes where and how? firm and country characteristics in the choice of fdi type and location. *Asian-Pacific Economic Literature 27*(2), 144–158.

Krautheim, S. (2013). Export-supporting fdi. *Canadian Journal of Economics/Revue canadienne d'économique 46*(4), 1571–1605.

Moritz, M., V. Hecht, P. Noska, J. Schaffler, et al. (2020). Types of fdi and determinants of affiliate size: the classification makes the difference. *Czech Journal of Economics and Finance (Finance a uver) 70*(4), 312–331.

Ramondo, N., V. Rappoport, and K. J. Ruhl (2016). Intrafirm trade and vertical fragmentation in u.s. multinational corporations. *Journal of International Economics 98*, 51 – 59.

Tintelnot, F. (2017). Global production with export platforms. *The Quarterly Journal of Economics 132*(1), 157–209.

Tables and Figures

Table 1: Correlation across Different Classification Scheme

	I (2digit)	I (3digit)	I (4digit)	I (5digit)	S (Strict)	S (Loose)	D (Strict)	D (Loose)
I (2digit)	1							
I (3digit)	0.76	1						
I (4digit)	0.62	0.82	1					
I (5digit)	0.54	0.71	0.86	1				
S (Strict)	-0.02	0.00	0.01	0.01	1			
S (Loose)	-0.03	-0.03	-0.03	-0.03	0.62	1		
D (Strict)	0.09	0.10	0.08	0.08	0.16	0.14	1	
D (Loose)	0.04	0.05	0.02	0.04	0.11	0.15	0.51	1

Notes: This table reports pairwise correlations among different FDI classification schemes. I, S, and D denote I-scheme, S-scheme, and D-scheme, respectively.

Table 2: Patterns of Different Classification Schemes

			S (Strict)		S (Loose)		D (Strict)		D (Loose)	
		ALL	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
I (2digit)	Horizontal	18,496	5,123	3,482	8,800	6,379	7,549	3,990	13,118	4,285
			28%	19%	48%	34%	41%	22%	71%	23%
	Vertical	10,384	3,029	1,733	5,279	3,151	3,339	2,471	6,993	2,685
			29%	17%	51%	30%	32%	24%	67%	26%
I (3digit)	Horizontal	14,568	4,073	2,770	6,869	4,953	6,183	3,198	10,490	3,394
			28%	19%	47%	34%	42%	22%	72%	23%
	Vertical	14,312	4,079	2,445	7,210	4,577	4,705	3,263	9,621	3,576
			29%	17%	50%	32%	33%	23%	67%	25%
I (4digit)	Horizontal	11,818	3,338	2,309	5,536	4,053	5,010	2,745	8,387	2,884
			28%	20%	47%	34%	42%	23%	71%	24%
	Vertical	17,062	4,814	2,906	8,543	5,477	5,878	3,716	11,724	4,086
			28%	17%	50%	32%	34%	22%	69%	24%
I (5digit)	Horizontal	9,855	2,796	1,897	4,618	3,315	4,275	2,240	7,096	2,334
			28%	19%	47%	34%	43%	23%	72%	24%
	Vertical	19,025	5,356	3,318	9,461	6,215	6,613	4,221	13,015	4,636
			28%	17%	50%	33%	35%	22%	68%	24%
Total		28,880	8,152	5,215	14,079	9,530	10,888	6,461	20,111	6,970
			28%	18%	49%	33%	38%	22%	70%	24%

Notes: This table provides summary patterns of FDI classifications from different schemes. I, S, and D denote I-scheme, S-scheme, and D-scheme, respectively.

Table 3: Proximity-Concentration Tradeoff Hypothesis (w/sector- and year-FEs)

Horizontal FDI Classification:	I-scheme				S-scheme		D-scheme	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: Horizontal=1_{ipsct}	(2digit)	(3digit)	(4digit)	(5digit)	(Strict)	(Loose)	(Strict)	(Loose)
$\ln(\text{Distance})_c$	0.015	0.026	0.028*	0.024	0.080***	0.040**	0.040**	0.037**
	(0.012)	(0.015)	(0.014)	(0.014)	(0.012)	(0.013)	(0.017)	(0.017)
$\ln(\text{GDP})_{ct}$	-0.008	-0.004	-0.005	-0.011	0.014***	0.025***	0.003	0.000
	(0.005)	(0.005)	(0.007)	(0.006)	(0.004)	(0.006)	(0.010)	(0.010)
$\ln(\text{GDP per capita})_{ct}$	-0.008	-0.023	-0.022	-0.025	0.032*	0.025*	0.024*	0.037**
	(0.012)	(0.013)	(0.017)	(0.016)	(0.015)	(0.012)	(0.013)	(0.015)
$\ln(1+\text{Tariff rate})_{ct}$	-0.017	-0.035***	-0.021	-0.018	0.066***	0.080***	0.027	0.031
	(0.013)	(0.011)	(0.012)	(0.020)	(0.021)	(0.010)	(0.021)	(0.030)
Sector Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	24,320	24,320	24,320	24,320	22,118	24,320	24,320	24,320
Adj R squared	0.064	0.046	0.042	0.036	0.076	0.100	0.099	0.054

Notes: This table reports estimation results from specification (1) with 2digit sector- and year-fixed effects. Standard errors in parentheses are clustered at two levels (2digit sector and year). Significance: *10 percent; **5 percent; ***1 percent.

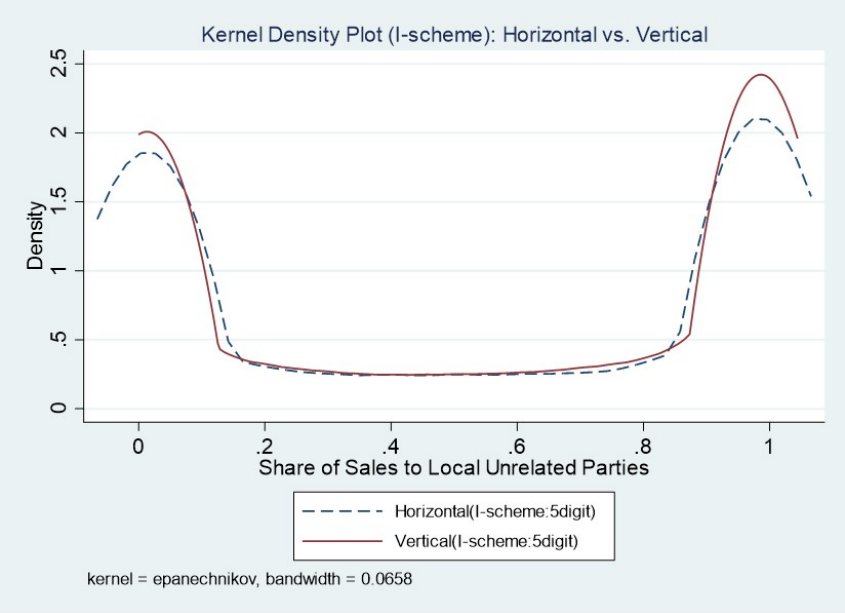
Table 4: Proximity-Concentration Tradeoff Hypothesis (w/sector-year and parent-year FEs)

Horizontal FDI Classification:	I-scheme				S-scheme		D-scheme	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: Horizontal=1_{ipsct}	(2digit)	(3digit)	(4digit)	(5digit)	(Strict)	(Loose)	(Strict)	(Loose)
$\ln(\text{Distance})_c$	0.002	0.022***	0.027***	0.027***	0.074***	0.040***	0.032***	0.023***
	(0.004)	(0.006)	(0.006)	(0.006)	(0.008)	(0.007)	(0.008)	(0.007)
$\ln(\text{GDP})_{ct}$	-0.007***	-0.003	-0.008*	-0.011***	0.017***	0.030***	0.000	-0.000
	(0.002)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
$\ln(\text{GDP per capita})_{ct}$	0.000	-0.005	0.000	0.001	0.014	0.005	0.019*	-0.004
	(0.004)	(0.007)	(0.008)	(0.008)	(0.012)	(0.011)	(0.009)	(0.010)
$\ln(1+\text{Tariff rate})_{ct}$	0.019**	0.028**	0.024	0.034*	0.024	0.053**	0.054***	-0.015
	(0.009)	(0.012)	(0.018)	(0.017)	(0.022)	(0.022)	(0.017)	(0.020)
Sector-Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parent-Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	14,312	14,312	14,312	14,312	12,698	14,312	14,312	14,312
Adj R squared	0.677	0.548	0.501	0.443	0.409	0.339	0.329	0.297

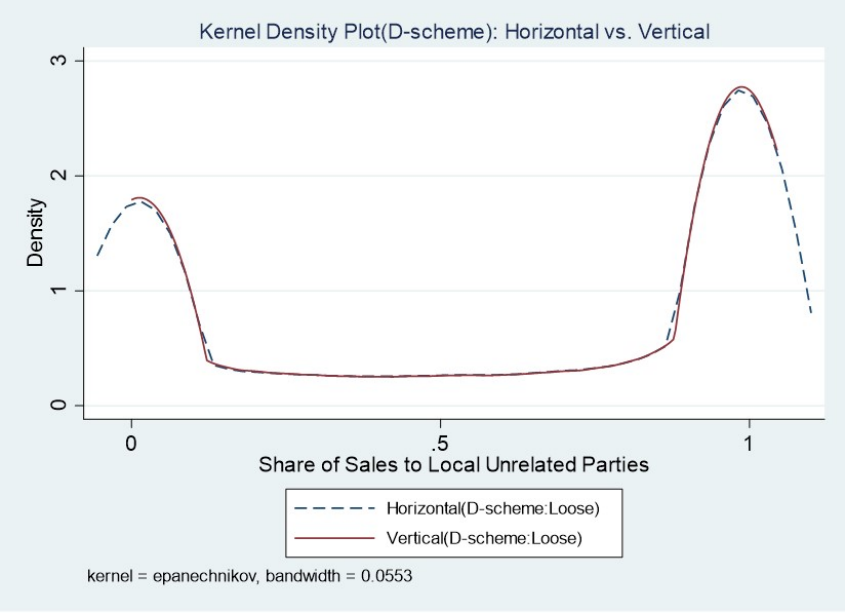
Notes: This table reports estimation results from specification (1) with 2digit sector-year- as well as parent-year-fixed effects. Standard errors in parentheses are clustered at 2digit sector-year level. Significance: *10 percent; **5 percent; ***1 percent.

Figure 1: Distributions of inter-firm sales share: Horizontal vs. Vertical

(a) Distributions of inter-firm sales share: Horizontal (I-scheme: 5digit) vs. Vertical (I-scheme: 5digit)



(b) Distributions of inter-firm sales share: Horizontal (D-scheme: loose) vs. Vertical (D-scheme: loose)



Note: This figure illustrates distributions of inter-firm sales share separately for Horizontal and Vertical FDI firms based on I-scheme at 5digit (1a) or loose version of D-scheme (1b).