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Abstract: Several studies using firm-level data could not find significant evidence to support that exporting activities promote productivity growth. However, few studies have considered whether exporting companies can create spillovers to domestic firms. In fact, exporting companies create positive productivity spillovers to their domestic peers (horizontal spillovers), suppliers (backward linkage spillovers) and buyers (forward linkage spillovers). This paper investigates the existence of productivity spillovers via backward, forward and horizontal linkages from exporting firms to other firms, based on Thai firm-level data. In contrast to existing literature on firms' productivity, which uses a firm-level dataset to conclude that exporting activities make no contribution to productivity growth of firms, the authors find that backward linkages are the most important spillover channel for exporting firms. Also, the current study finds that export destinations are an important factor in supporting linkage spillovers; only exporting to developed countries creates backward linkage spillovers. Moreover, exporting firms gain most spillovers from backward linkages. Finally, the authors show that productivity spillovers from domestic suppliers are more important than outsourcing.

JEL Classification: F14, F61

Keywords: Exports, Forward linkages, Backward linkages, Productivity, Spillovers

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1. Introduction

It is widely believed that international trade is an important instrument in the promotion of economic growth via knowledge and technology spillovers as well as technology upgrading. The theoretical development for trade-led growth via international spillovers is based on endogenous growth models such as Helpman (1981) and Grossman and Helpman (1991). Such models broadly explain how trade and international spillovers promote productivity on the aggregate level. However, these models do not specify micro channels through which the international spillovers occur.

Empirical literature investigates the relationship between trade and technology spillovers on various levels. Studies using country-level and industry-level data, such as those by Coe and Helpman (1995), Eaton and Kortum (1997), and Keller (2004), support the trade-led productivity growth hypothesis. These studies show that international trade increases technology transfers, knowledge spillovers, innovation stimulation and learning-by-doing process. As a result, trade liberalization brings about higher productivity growth.

However, studies using firm-level data report ambiguous results. Bernard et al. (2003) as well as Clerideset al. (1998) found no evidence to support that exporting activities promoted productivity. Melitz (2003) proposed a theoretical model that could reconcile the different results from the studies using firm-level and aggregate level data. According to Melitz, although exporting did not increase firm-level productivity, it could increase productivity at the industry level. In his model, it is only profitable for firms with high productivity to export. When a country is more open to trade, high productivity firms produce and export more. Consequently, the productivity of industry increases. It is therefore important to understand the heterogeneity of firms in order to understand how exporting activities affect productivity.

Another strand of literature studies the channel by which trade and openness affect firms' productivity. International production networks are regarded as one of the spillover channels. Various studies of international production networks support the fact that production fragmentation promotes productivity growth in home countries. Feenstra and Hansen (2001) as well as Egger and Egger (2006) showed that production fragmentation shifted a demand for unskilled labour to higher-skilled labour within manufacturing sectors. Such movement in demand leads to improvement in wages for skilled labour and higher productivity. In the long term, an increase in the wage gap causes a country to specialize in higher value-added sectors and relocate unskilled labour-intensive sectors abroad, resulting in firms' productivity upgrading.

Other studies, such as Kasahara and Rodrigue (2008) and Gorget al. (2008), have indicated that international outsourcing via imports of intermediate goods can improve productivity of firms. However, Gorget al. (2008) showed that the positive effect of productivity upgrading occurred only with firms who engaged in exporting activities, either domestically-owned or foreign-owned. If the firms do not enter the export market, outsourcing activities cannot improve their productivity. As a result, exporting activities are an important channel through which the firms in international production networks acquire productivity improvement.

In addition to importing and exporting, recent studies have focused on the role of foreign direct investment (FDI) in productivity spillovers. Studies of FDI spillovers to local firms in the same sectors have provided ambiguous results. Using Malaysian data, Menon (1998) showed that foreign firms created technological spillovers to local firms in the same industry. However, Aitken and Harrison (1999) as well as Djankov and Hoekman (2000) did not find any significant effect of FDI spillovers in Venezuela and the Czech Republic, respectively.

Other recent studies consider the importance of backward linkages in the productivity spillovers of FDI. Backward linkage spillovers occur when a firm generates positive productivity spillovers to its suppliers. Although intra-industry spillovers might not be strong, there are spillovers from multinational enterprises to their local suppliers in upstream sectors. Javorcik (2004), Girma et al. (2008) as well as Barrios et al. (2011) noted that backward linkages were the explanation of productivity spillovers from FDI to domestic firms while horizontal spillovers, i.e., spillovers from multinational enterprises to their local peers were not significant. Javorcik (2004) also compared backward FDI spillovers between export market-oriented firms and domestic market-oriented firms. In contrast to previous literature that indicated exporting activities were a channel of backward spillovers via international production networks, Javorcik (2004) found that domestic market-oriented affiliates had larger backward spillovers than the export market-oriented ones. Nonetheless, the FDI backward spillovers of domestic market-oriented affiliates are statistically insignificant. Similarly, Kohpaiboon (2009) examined FDI spillovers using Thai manufacturing data. Unlike previous studies, he found that neither backward FDI linkages nor forward FDI linkages played a role in productivity spillovers.

In addition to linkage spillovers via FDI, spillovers from exporting firms to local firms are also important. One reason why international production networks can improve productivity of local firms is that such networks allow small and medium-sized enterprises (SMEs) to participate in exporting activities with large firms or multinational enterprises as lead firms. For example, almost 2,000 Thai SMEs engage in export activities or are suppliers in international production networks of the automobiles and automotive parts industry in Thailand, according to the Thailand Automotive Institute. The participation in a production network leads to better technology and productivity. Lead firms may directly transfer knowledge and technology to the suppliers in their network. One example is the Toyota Supplier Club (TSC), which shares its manufacturing practices with the members in the club. The establishment of such clubs results in technology and knowledge transfers to Toyota’s suppliers, especially the local small and medium enterprises in the automotive parts industry, as the club provides production and management training for its members. According to Hines (1994), developing suppliers’ performance and integrating suppliers into product development process were the key success factor in Japanese final assembly firms.

Another explanation of productivity improvement from international production network comes from higher standards and requirements in terms of timely delivery and product quality, which force local SMEs to improve their technology and skills. According to Krause (1997) as well as Krause and Ellram (1997), they are part of the many strategies that lead firms can use to improve suppliers’ performance, including the creation of competition among suppliers, training programmes and suppliers’ performance assessment. All these supplier development strategies lead to higher productivity by the local firms engaging in international production networks.

The case studies mentioned above point out the importance of backward linkages in productivity spillovers of exporting activities. However, although many studies have investigated backward linkage spillovers from FDI, few empirical studies have considered backward linkages from exporting activities. For example, Javorcik (2004) compared backward spillovers of export-oriented firms with those of domestic-oriented firms. However, she only considered backward spillovers from FDI, but not from exporting activities. To fill this gap in the literature, this study investigates the existence of productivity spillovers via backward linkages, forward linkages and horizontal spillovers from exporting firms to the local firms. Forward linkage spillovers occur when a firm generates positive productivity spillovers to its buyers. Horizontal spillovers occur when a firm generates positive productivity spillovers to competitors in the same industry.

Unlike Javorcik (2004), the authors of the present study have also considered forward spillovers from exporting companies to their customers. Logically, exporting companies that have higher productivity and quality might also create a spillover effect among their customers. Therefore, it is also interesting to investigate the existence of spillovers from forward linkages. However, the authors are unaware of the existence of any studies on linkage spillovers from exporting activities.

Another important contribution by this paper is that it considers the role of export destinations in productivity spillovers. Apparently no studies have been made on how export destinations affect linkage productivity spillovers. However, if linkages do exist in technology transfers and spillovers from exporting activities, it is likely that export destinations matter. The more developed the export destinations, the higher would be the rate of technology transfers that firms would gain from exports. Exporting to highly-developed countries requires higher standards in the production process and product quality than when exporting to developing countries. Therefore, this study also investigates how export destinations affect productivity spillovers.

The study focuses on firms in Thailand as the existence of international production networks is solid in the ASEAN region according to Ando and Kimura (2003), Asian Development Bank (2007), Athukorala (2010), and Cheewatrakoolpong et al. (2010). As a result, the effect of spillovers from international production networks might be distinctive among Thai firms.

This paper is divided into four sections. Section 1 describes the estimation model. Section 2 provides description of data and some selected descriptive statistics. Section 3 details the results of the analysis while section 4 provides the conclusion.

2. Baseline estimation model

For the purpose of this study the estimation model proposed by Javorcik (2004)has been revised in order to examine productivity spillovers from exporting activities. The basic estimation model is:

$$pro_{ijt} = \alpha + \beta_1 exporter_{ijt} + \beta_2 fshare_{ijt} + \beta_3 hz_{jt} + \beta_4 bwd + \beta_5 bwm + \beta_6 fw_{jt} + \alpha_j + \alpha_t + \varepsilon_{ijt} \quad (1)$$

where the subscripts *i*, *j*, *t* index the firm, sector and time, respectively; pro_{ijt} is the productivity of firm *i* in sector *j* at time *t*; $exporter_{ijt}$ is the firm's export status; $\mathrm{exporter_{ijt}}$ is 1 for an exporting firm and zero otherwise; $\mathrm{fshare_{ijt}}$ measures the share of the firm's foreign equity to total equity; hz_{jt} is the horizontal linkages of sector *j* at time *t* from exporting activities; and $\mathrm{bwd_{jt}}$ and bwm_{jt} are backward linkages from domestic suppliers and from imports. Similarly, $\mathrm{fw_{jt}}$ is the forward linkage. The terms α_j and α_t are sector *j*'s and time fixed effects.

Because the authors only have two years' observation for each firm, the firms' fixed effects are not used. Unlike Javorcik (2004), this study follows Barrios et al. and others (2010), who differentiated backward spillovers according to input sourcing behaviour. As a result, there are two backward linkage spillovers, as mentioned above.

Horizontal, backward and forward linkages via exporting activities are adjusted from Javorcik (2004) to capture exporting activities instead of FDI, and are defined as follows – let $\mathrm{hz_{jt}}$ be the ratio of export volume of sector *j* to its output:

$$hz_{jt} = \frac{X_{jt}}{Y_{jt}} \tag{2}$$

where $\mathrm{X_{jt}}$ is the export volume of sector *j* at time *t*, $\mathrm{Y_{jt}}$ is the output of sector *j* at time *t* and $\mathrm{hz_{jt}}$ measures the export share of industry *j*. As the export share and number of exporters of the industry increase, firms in the industry become more competitive and more productive. As in Javorcik (2004), the terms $\mathrm{bwd_{jt}}$ and $\mathrm{bwm_{jt}}$ are defined as:

$$bwd_{jt} = \sum_{k \neq j} \gamma_{jkt} hz_{kt} \tag{3}$$

$$bwm_{jt} = \sum_{k \neq j} \gamma_{j\mu t} hz_{kt} \tag{4}$$

where γ_{kjt} is the proportion of sector *j* input supplied domestically by sector *k* to the total (domestic + imported) input of sector *j* at time *t* while bwd_{jt} is a proxy for the fraction of industry *j* input supplied by local exporting supplier. Similarly, $\gamma_{j\mu t}$ is the proportion of imported input of sector *j* to the total input of sector *j* at time *t* and $\mathrm{bwm_{jt}}$ is a proxy for the fraction of industry *j* input supplied by foreign firms through imports. It is expected that different sources of supply would affect productivity of firms via backward linkage spillovers.

Forward linkages are defined as:

$$fw_{jt} = \sum_{k \neq j} \gamma_{kjt} hz_{kt} \tag{5}$$

As mentioned above, the impact of export destinations on horizontal, backward and forward spillovers is considered. In revising equation (2), the horizontal linkages from exporting to developed countries ($\mathrm{hz_{djt}}$) and developing countries ($\mathrm{hz_{ljt}}$) of sector *j* at time *t*are defined as:

$$hz_{djt} = \frac{X_{djt}}{Y_{jt}} \tag{6}$$

$$hz_{ljt} = \frac{X_{ljt}}{Y_{jt}} \tag{7}$$

where X_{djt} and X_{ljt} are export volume to developed and developing countries, respectively, of sector *j* at time *t*. Note that $hz_{djt}+hz_{ljt} = hz_{jt}$. The developed countries are defined from the list of the International Monetary Fund's 35 advanced economies while the remainder comprises developing countries.

In a similar fashion, for $\theta \epsilon \{d, l\}$define

$$bwd_{\theta_{jt}} = \sum_{k \neq j} \gamma_{jkt}\, \boldsymbol{h}z_{\theta_{kt}} \tag{8}$$

$$fw_{\theta_{jt}} = \sum_{k \neq j} \gamma_{kjt}\, \boldsymbol{h}z_{\theta_{kt}} \tag{9}$$

The terms bwd_{djt} and bwd_{ljt} are proxies for the fraction of industry *j* input supplied by local firms that export to developed and developing countries, respectively. Similarly, fw_{djt} a and fw_{ljt} are proxies for the fraction of industry *j* output that are exported to developed and developing countries, respectively.

The variables in equations (5) to (9) are then incorporated into equation (1) as:

$$pro_{ijt} = \alpha + \beta_1 exporter_{ijt} + \beta_2 fshare_{jt} + \beta_3 hz_{d_{jt}} + \beta_4 \boldsymbol{h}z_{l_{jt}}$$
$$\beta_5 bwd_{d_{jt}} + \beta_6 bwd_{l_{jt}} + \beta_7 bwm_{jt} + \beta_8 fw_{d_{jt}} + \beta_9 fw_{l_{jt}} + \alpha_j + \alpha_t + \varepsilon_{ijt} \tag{10}$$

Due to the limited data available from the Stock Exchange of Thailand, returns on assets (ROA) are used as a proxy for productivity. According to Bosch-Badia (2010), returns on assets strongly correlate with both labour productivity and total factor productivity. Productivity indicators and price changes of output and input both determine the value of ROA.

3. Data description and descriptive statistics

To calculate the values of linkage variables mentioned above, data are needed from the Input-Output (IO) table. However, access to the IO table data is only available for 2004 and 2007. Firm-level panel data from the Stock Exchange of Thailand are used. The annual data of firms on ROA, export status and foreign share used in this study were obtained from financial reports of firms on the Stock Exchange of Thailand in 2004 and 2007. The annual data for the export volume of each sector, classified by destinations in 2004 and 2007,were collected from the Global Trade Analysis Project (GTAP). The coefficients for the input share of each sector (Y_{jkt}) used for calculating the backward linkages and forward linkages were drawn from Thailand's input-output matrices in GTAP.

Table 1. Number of firms in each sector

Sector	No. of firms	No. of export firms	Sector	No. of firms	No. of export firms
Vegetables	6	6	Ferrous metals	29	23
Sugar cane	2	2	Metal products	8	6
Coal	2	1	Motor vehicles and	1	1
Oil	8	7	Transport	8	7
Gas	6	6	Electronic	22	22
Minerals	7	6	Machinery	21	17
Meat products	3	3	Manufactures	7	7
Vegetable oils	6	6	Electricity	6	4
Dairy products	3	2	Gas manufacture	4	2
Processed rice	2	1	Water	2	1
Sugar	1	1	Construction	25	20
Food products	37	36	Trade	16	12
Beverages	6	5	Transport	12	5
Textiles	13	11	Water transport	3	3
Wearing apparel	11	11	Air transport	3	2
Leather products	8	7	Communication	36	25
Wood products	6	5	Financial services	3	2
Paper products	15	10	Business services	8	6
Petroleum	3	3	Recreational	34	29
Chemicals	60	50	Public	14	8
Mineral products	18	17	Dwellings	44	31
Total				**529**	**429**

Table 2. Sectors with highest and lowest ROA

Sector	ROA	hz_d	hz_l	bwm	bwd_d	bwd_l	fw_d	fw_l
Highest ROA Sectors								
Paper products	33.039	0.112	0.139	0.448	0.023	0.047	0.059	0.091
Coal	15.924	0.000	0.000	0.132	0.066	0.221	0.032	0.031
Petroleum and coal	13.181	0.076	0.072	0.786	0.003	0.005	0.032	0.177
Transport	13.005	0.000	0.328	0.049	0.082	0.103	0.045	0.055
Processed rice	11.507	0.124	0.366	0.001	0.014	0.020	0.021	0.015
Public administration	11.275	0.000	0.027	0.151	0.069	0.131	0.002	0.004
Metal products	9.983	0.305	0.145	0.596	0.037	0.058	0.056	0.044
Motor vehicles	9.126	0.172	0.214	0.522	0.079	0.075	0.007	0.034
Ferrous metals	8.993	0.126	0.168	0.432	0.012	0.018	0.129	0.089
Average	**14.004**	**0.102**	**0.162**	**0.346**	**0.043**	**0.075**	**0.043**	**0.060**
Lowest ROA Sectors								
Machinery/equipment	2.601	0.411	0.236	0.515	0.027	0.042	0.028	0.031
Chemical products	2.490	0.266	0.334	0.344	0.025	0.040	0.036	0.034
Textiles	2.371	0.165	0.173	0.306	0.039	0.056	0.108	0.030
Sugar	2.275	0.127	0.374	0.076	0.037	0.049	0.044	0.028
Wood products	1.876	0.370	0.164	0.203	0.038	0.066	0.044	0.023
Leather products	1.819	0.292	0.134	0.376	0.073	0.069	0.004	0.007
Manufactures	1.085	0.417	0.048	0.471	0.040	0.051	0.021	0.016
Construction	0.316	0.000	0.019	0.254	0.084	0.112	0.003	0.003
Dairy products	-17.74	0.029	0.139	0.196	0.060	0.084	0.017	0.043
Gas distribution	-18.98	0.000	0.002	0.051	0.027	0.054	0.033	0.037
Average	**-2.182**	**0.208**	**0.162**	**0.279**	**0.045**	**0.062**	**0.034**	**0.025**

Firms in 42 sectors are listed on the Stock Exchange of Thailand.[1] Table 1 shows the distribution of firms, with a total of 529 firms, in the data set. The 42 sectors include 38 production sectors and four service sectors. Among the 42 sectors, there are five sectors with more than 30 firms, four sectors with 20-29 firms, seven sectors with 10-19 firms and 26 sectors with less than 10 firms.

Table 2 reports the top and bottom 10 sectors with the highest and lowest ROA as well as their horizontal, forward and backward linkages. The middle and the last rows show the average of linkage variables of the sectors with the highest and lowest returns, respectively. In the two rows, there is no obvious source of differences in the sectors with the highest and lowest returns. Some negative ROAs imply negative profits in some sectors.

4. Estimation results

4.1. Basic estimation results

This section describes the estimation results. Table 3 shows the estimation results from equation (1) in the second column. In addition, because a firm's export status might affect its ability to receive spillovers as shown in Javorcik (2004), the estimates of equation (1) uses the observations from exporting and non-exporting firms as shown in columns 3 and 4, respectively.

The estimation results in column 4 show that non-exporters benefit from horizontal spillovers from exporters in the same industry. Moreover, non-exporters also gain forward spillovers from supplying materials to other exporters, and backward spillovers from imported materials. Surprisingly, no horizontal spillovers were found from the estimation. This result appears to contradict Melitz (2003), indicating that at the industry level, trade increases productivity through reallocation of firms' production. An explanation could be that Melitz's reallocation effect applies to time-series data, but the dataset in this study only spans two periods and may thus be too short to capture such an effect.

The results from table 3 suggest that exporters and non-exporters gain linkage spillovers from different sources. To test this hypothesis formally, the authors estimated equations with the interaction terms of export status and various spillover variables, as shown in table 4. All the interaction terms are not significant. The results are not consistent with those in table 3. Tables 3 and 4 together indicate that there is no robust relationship between linkage variables and firms' productivity. A potential reason for not finding robust linkage spillovers from these estimations is that all export destinations have been aggregated. It could be possible that linkage spillovers are only present with linkages via exporting to developed countries. The next section investigates whether export destinations matter for linkage spillovers.

[1] Note that because the SET and GTAP sector classification systems are not identical, in order to combine the data from two sources the sector classificationhas to be mapped between the two systems.

Table 3. Linkage spillovers and productivity – equation (1) estimation results

Variables/models	Aggregate	Exporters	Non-exporters
exporter	-0.536		
	[0.101]		
fshare	0.00174	0.0413	-0.38
	[0.978]	[0.460]	[0.103]
hz	25.41	23.93	80.92**
	[0.439]	[0.494]	[0.0126]
bwd	91.26	101.6	13.25
	[0.182]	[0.166]	[0.888]
bwm	45.88*	34.6	93.42*
	[0.0941]	[0.185]	[0.0960]
fw	24.31	-3.942	237.8**
	[0.503]	[0.919]	[0.0443]
Observations	783	649	131
R-squared	0.021	0.016	0.221
Number of sectors	42	42	26

*** p<0.01, ** p<0.05, * p<0.1.

Note: Robust standard errors clustered by sectors in parentheses.

Table 4. Linkage spillovers and productivity

Variables/models	(1)	(2)	(3)	(4)
exporter	-3.224	-2.067**	2.635	6.773
	[0.263]	[0.0496]	[0.412]	[0.140]
fshare	-0.00126	0.00284	0.00518	0.00369
	[0.983]	[0.964]	[0.934]	[0.954]
hz	15.31	24.89	25.34	23.36
	[0.557]	[0.449]	[0.439]	[0.474]
bwd	89.84	69.4	90.34	89.4
	[0.184]	[0.303]	[0.184]	[0.187]
bwm	45.22	46.09*	51.39*	44.71*
	[0.104]	[0.0908]	[0.0697]	[0.0990]
fw	25.2	-2.067**	24.88	68.33
	[0.490]	[0.0496]	[0.493]	[0.148]
exporter*hz	10.46			
	[0.366]			
exporter*bwd		25.7		
		[0.122]		
exporter*bwm			-6.79	
			[0.305]	
exporter*fw				10.46
				[0.366]
Observations	783	783	783	783
R-squared	0.022	0.022	0.023	0.022
Number of sectors	42	42	42	42

*** p<0.01, ** p<0.05, * p<0.1.

Note: Robust standard errors clustered by sectors in parentheses.

4.2. *Export destinations and linkage spillovers*

To study how exporting to developed and developing countries affects linkage spillovers differently, we estimate models with linkage variables classified into two groups: developed (d) and developing (l). In table 5, the aggregate model shows in column 2 that the two linkage variables that are most robust and significant in explaining firms' productivity are bwd_d and fw_d. The results show that when export destinations are taken into account, backward and forward spillovers from firms exporting to developed countries play an important role in productivity spillovers. However, exporting to developing countries does not produce any spillovers. Moreover, these backward and forward spillovers affect exporters and non-exporters differently. The exporters' model in column 3 of table 5 shows that exporters get only gain backward spillovers. The results indicate that a firm has a productivity gain from using materials from firms exporting to developed countries. Exporting firms in developed markets improve local producers' productivity via backward linkages only when the local producers engage in exporting activities.

However, non-exporters do not get these backward spillovers but gain forward spillovers from supplying materials to exporting firms. Non-exporting firms that have high forward linkages with exporting industries need to upgrade their productivity to meet the higher requirement from exporters serving developed markets. This finding illustrates that firms engaging in international production networks benefit from improvements in productivity even if they do not enter the export market. Indirect exporters who do not participate in export markets by themselves, but who supply their products to exporters, benefit the most from export spillovers. Moreover, this confirms the importance of international production networks as a driver of productivity improvements for participating firms.

Table 5. Export destinations and linkage spillovers: Aggregate model

Variables/models	Aggregate	Exporters	Non-exporters
exporter	-0.592*		
	[0.0937]		
fshare	0.000647	0.0405	-0.393
	[0.992]	[0.472]	[0.103]
hz_d	17.75	12.21	119.8*
	[0.558]	[0.721]	[0.0643]
hz_l	78	88.8	41.15
	[0.142]	[0.153]	[0.268]
bwd_d	186.6**	215.9**	-24.78
	[0.0443]	[0.0320]	[0.888]
bwd_l	46.23	40.63	142.6
	[0.556]	[0.656]	[0.284]
bwm	28.54	20.64	77.82*
	[0.242]	[0.458]	[0.0954]
fw_d	223.2**	154.1	555.3***
	[0.0468]	[0.252]	[0.00739]
fw_l	-35.38	-32.31	-9.321
	[0.571]	[0.661]	[0.927]
Observations	783	649	131

R-squared	0.025	0.019	0.242
Number of sectors	42	42	26

*** p<0.01, ** p<0.05, * p<0.1.
Note: Robust standard errors clustered by sectors in parentheses.

To test how different linkage channels affect the productivity of exporters and non-exporters differently, estimates using models with various interaction terms are shown in table 6 Model (2) in table 6 shows that the coefficient of "exporter*bwd_d" is positive and significant. This result confirms that exporters get more benefit from backward spillovers than do non-exporters. However, model (4) reports that the coefficient of "exporter*fwd_d" is negative and significant; non-exporters gain more spillovers from forward spillovers than do exporters. These results are robust and consistent with those in table 5.

Table 6. Export destinations and linkage spillovers

Variables/models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
exporter	-1.288	-2.893***	2.572	8.1	-2.913***	8.261
	[0.502]	[0.00252]	[0.426]	[0.119]	[0.00292]	[0.113]
fshare	-0.00045	0.00136	0.00409	0.000388	0.00199	0.000985
	[0.994]	[0.983]	[0.948]	[0.995]	[0.975]	[0.988]
hz_d	11.92	18.04	17.64	15.6	23.59	21.05
	[0.650]	[0.553]	[0.561]	[0.608]	[0.545]	[0.585]
hz_l	77.57	78.08	78.4	76.22		
	[0.139]	[0.140]	[0.140]	[0.150]		
bwd_d	186.3**	107.3	187.2**	188.5**	58.2	141.5
	[0.0441]	[0.224]	[0.0438]	[0.0443]	[0.507]	[0.117]
bwd_l	46.1	44.67	44.15	43.65		
	[0.557]	[0.572]	[0.570]	[0.576]		
Bwm	28.34	28.43	34	27.28	13.73	12.93
	[0.247]	[0.242]	[0.185]	[0.262]	[0.554]	[0.575]
fw_d	224.2**	226.0**	223.1**	329.6**	225.5**	331.5**
	[0.0449]	[0.0441]	[0.0466]	[0.0127]	[0.0135]	[0.0106]
fw_l	-35.71	-34.43	-33.92	-32.99		
	[0.568]	[0.580]	[0.591]	[0.597]		
exporter*hz_d	6.04					
	[0.728]					
exporter*bwd_d		103.5***			104.3***	
		[0.00772]			[0.00830]	
exporter*bwm			-6.773			
			[0.306]			
exporter*fw_d				-124.3*		-126.7*
				[0.0977]		[0.0932]
Observations	783	783	783	783	783	783
R-squared	0.022	0.024	0.023	0.026	0.024	0.026
Number of sector	42	42	42	42	42	42

*** p<0.01, ** p<0.05, * p<0.1.
Note: Robust standard errors clustered by sectors in parentheses.

Since the important spillovers are gained from exporting to developed markets, additional models – (5) and (6) – are employed. The significance of the coefficients of “exporter*bwd_d” and “exporter*fw_d” in models (5) and (6) confirm the previous findings that exporters gain backward spillovers while non-exporters gain forward spillovers.

5. Conclusion

International trade is regarded as an important driver of economic growth at both the country and the industry levels. However, several quantitative studies carried out, using firm-level data, have failed to confirm that engaging in exporting activities can promote firms’ productivity. Many qualitative studies regarding international production networks suggest that involvement in such networks could promote productivity of the firms via linkage spillovers. However, the empirical evidence is still limited.

This study investigates the existence of productivity spillovers from exporting activities via backward, forward and horizontal linkages from exporting firms to local firms, using data on Thai firms that were obtained from the Stock Exchange of Thailand. The results show that linkage productivity spillovers are only created when exporting to developed countries. Backward linkages are the most important spillover channel for exporting firms. On the other hand, non-exporters gain productivity through forward linkages via supplying goods to exporting firms.

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