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Export Status and Price Markups: Evidence from Chilean Plants

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Abstract

In this paper, we analyze how firms' export status affects price markups using Chilean plant-level data. We rely on the framework in Gandhi, Navarro and Rivers (2020) to estimate the industry-level markups, controlling for unobserved heterogeneity. We show that globally operating firms tend to set higher markups than firms supplying only domestic market, which supports findings in international trade literature. We also consider firms' characteristics such as foreign technical supports status and material import status and analyze how those factors affect their markups. We conclude that firms linked with foreign countries either by trade or technology adoption tends to set higher markups.

1. Introduction

Literature on international trade has found that price markups are significantly higher for exporters than non-exporters (De Loecker and Warzynski (2012) and De Loecker, Gold-berg, Khandelwal and Pavcnik (2014)). In this paper, we also address the relation between markups and export status and examine if this stylized fact also holds for our analysis.

We start with constructing a structural model following Gandhi et al. (2020), which provide estimation method on firms' markups *up to constant* with controlling for unobserved heterogeneous productivities. Following Gandhi et al. (2020), we rely on firms' First-Order Condition with respect to flexible inputs (intermediate inputs) for identification. We consider a fixed effect of firms' export status to estimate how it affects markups. We use panel Data of Chilean firms and estimate markups up to constant for the same industry in Pavcnik (2002) who estimates the production function for Chilean firms.

In order to analyze how export status affect markups, we consider the fixed effect of export

and non-export status in our estimation. As a result, we find that exporting firms charge higher markups than non-exporting firms in all the industry, which supports the stylized facts in the literature. We interpret this result as that firms improve their productivity by conducting exports, which improves their quality of goods compared with the non-exporters with raising their markups.

In our analysis, we also consider other characteristics of firms such as having foreign technical supports and importing intermediate inputs to investigate how those statuses affect markups. As a result, we find that both of foreign technical supports and material imports status raises markups as well as export status. Moreover, we find that increase in markups is higher for these two statuses than for the export status. This suggests adopting foreign advanced technology or using foreign intermediate goods improve firms' productivities more than export experience.

The rest of the paper proceeds as follows. In section 2, we provide a structural model following Gandhi et al. (2020) to show how we estimate industry-level markups, while controlling for unobserved productivity. In section 3, using Chilean plant-level data, we estimate the effect of export status on markups by allowing fixed effect into the model in section 2. We also estimate how foreign technical supports and material imports affect markups. The estimation results are provided in Section 4. Lastly, we conclude in section 5.

2. Structural Model

We construct the model following Gandhi et al. (2020) who propose identification of production function using firm's optimization problem.

There is a panel consisting of firms $j = 1, ..., J$ over periods $t = 1, ..., T$. We observe each firm's output, labor, capital, and intermediate inputs denoted by $(Y_{jt}, L_{jt}, K_{jt}, M_{jt})$ with their log values denoted as $(y_{jt}, l_{jt}, k_{jt}, m_{jt})$. Assume that each firm has a production function F_t with Hicks neutral productivity shock v_{jt} as follows:

$$Y_{jt} = F_t(L_{jt}, K_{jt}, M_{jt})\ exp(v_{jt}) \tag{1}$$

where the Hicks neutral productivity shock is decomposed as

$$v_{jt} = \omega_{jt} + \varepsilon_{jt}.$$

ω_{jt} stands for a persistent productivity shock following Markovian process, which implies that we can express:

$$\omega_{jt} = h(\omega_{jt-1}) + \eta_{jt}$$

where η_{jt} satisfies $\mathrm{E}[\eta_{jt}|\omega_{jt-1}] = 0$. ε_{jt} is the ex-post shock with $\mathrm{E}[\varepsilon_{jt}] = 0$.

For production inputs, we assume that K_{jt} and L_{jt} are determined at or prior to period $t-1$, while M_{jt} is a flexible input determined at period t.

In order to identify firm's markup, we rely on firm's optimization problem to identify the production function. M_{jt} is chosen to minimize the cost satisfying the first order condition as follows:

$$\Lambda_{jt} F_{M,t}(L_{jt}, K_{jt}, M_{jt}) \exp(\omega_{jt}) \varepsilon = \rho_t$$

where Λ_{jt} is the "—Lagrange multiplier", i.e., "—marginal cost" of firm j. Also, $\varepsilon \equiv \mathrm{E}(\exp(\varepsilon_{jt}))$ and ρ_t is the price of intermediate inputs. $F_{M,t}(\cdot,\cdot,\cdot)$ is the partial derivative of $F_t(\cdot,\cdot,\cdot)$ with respect to M_{jt}. Taking a log of both sides of FOC yields:

$$\ln \rho_t = \ln \Lambda_{jt} + \ln F_{M,t}(L_{jt}, K_{jt}, M_{jt}) + \ln \varepsilon + \omega_{jt} \tag{2}$$

Taking log of both sides of equation (1) leads to

$$\ln Y_{jt} = \ln F_t(L_{jt}, K_{jt}, M_{jt}) + \omega_{jt} + \varepsilon \tag{3}$$

Subtracting equation (3) from (2) and adding $(\ln M_{jt} - \ln P_t)$ results in

$$\underbrace{\ln \frac{\rho_t M_{jt}}{P_t Y_{jt}}}_{s_{jt}} = \underbrace{\ln \frac{\Lambda_{jt}}{P_t}}_{-\psi_{jt}} + \underbrace{\ln \frac{F_{M,t}(L_{jt}, K_{jt}, M_{jt}) M_{jt}}{F_t(L_{jt}, K_{jt}, M_{jt})}}_{\ln G_t(L_{jt}, K_{jt}, M_{jt})} + \ln \varepsilon - \varepsilon_{jt} \tag{4}$$

where s_{jt} is the log of nominal share of intermediate inputs, ψ_{jt} is the log of markup, and $G(L_{jt}, K_{jt}, M_{jt})$ is the elasticity of the production function.

Following Gandhi et al. (2020), we assume markups are common within industry by restricting the markup term ψ_{jt} as $\psi_{jt} = \psi_t$ for all j. So, the equation (4) becomes:

$$s_{jt} = -\psi_t + \ln G_t(L_{jt}, K_{jt}, M_{jt}) + \ln \varepsilon - \varepsilon_{jt} \tag{5}$$

From data, we observe s_{jt}, L_{jt}, K_{jt}, and M_{jt}. We can recover the markup *up to constant* by estimating equation (5): Regress s_{jt} on L_{jt}, K_{jt}, and M_{jt} non-parametrically, and get the constant term which $-\hat{\psi}_t + \hat{\mu}_t + \ln \hat{\varepsilon}$, the markup up to constant where $\hat{\mu}$ is the constant of $\ln \hat{G}(L_{jt}, K_{jt}, M_{jt})$.

As opposed to Gandhi et al. (2020) who assume $F_t(L_{jt}, K_{jt}, M_{jt}) = F(L_{jt}, K_{jt}, M_{jt})$, we allow production function to change over time. This is possible in our setting since our focus is estimating cross-sectional difference in markup whereas Gandhi et al. (2020) suggests to estimate the change in markups overtime.

Table 1: Summary Statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
s_{jt}	73,531	−0.742	0.518	−7.365	2.896
l_{jt}	73,531	3.712	1.035	−0.739	8.812
m_{jt}	73,531	10.73	1.663	2.492	18.49
k_{jt}	73,531	9.711	2.060	−0.477	18.43
Exporters dummy	73,531	0.0859	0.280	0	1
Domestic Suppliers dummy	73,531	0.310	0.462	0	1
Foreign Technical Supports dummy	73,531	0.0507	0.219	0	1
Material Importers dummy	73,531	0.255	0.436	0	1

3. Estimation

In previous section, we construct a structural model to estimate the markup *up to constant* following Gandhi et al. (2020). Using this model, we estimate how firm's export status and other characteristics affect the markup.

For the estimation, we use the census data of Chilean manufacturing plants provided by Chile's Instituto Nacional de EstadÍstica, where we observe firm-level outputs ($P_t Y_{jt}$), material inputs usage and prices (M_{jt} and ρ_t), and labor and capital usage (L_{jt} and K_{jt}) for several industries. The data set covers all firms from 1979 to 1996 with 10 or more employees, and includes firm-level observations on amount of exports, expenditure on foreign technology supports, and material imports. The detailed explanation on the data set and the variable construction can be found in Pavcnik (2002) and Liu (1993). Table 1 provides summary statistics for the variables used for estimation. In the estimation, we choose the same industries as Pavcnik (2002) who estimate production function for Chilean firms: food, textile, wood, paper, chemical, glass, basic metals, and machinery.

We basically estimate equation (5) with allowing fixed effect and assuming G_t (L_{jt}, K_{jt}, M_{jt}) as a polynomial of degree two in logs:

$$\begin{aligned} s_{jt} = {} & \delta_t^1 + \delta_t^0 \\ & + \ln(\gamma_{0,t} + \gamma_{l,t} l_{jt} + \gamma_{k,t} k_{jt} + \gamma_{m,t} m_{jt} + \gamma_{ll,t} l_{jt}^2 + \gamma_{kk,t} k_{jt}^2 + \gamma_{mm,t} m_{jt}^2 \\ & + \gamma_{lk,t} l_{jt} k_{jt} + \gamma_{lm,t} l_{jt} m_{jt} + \gamma_{km,t} k_{jt} m_{jt}) - \varepsilon_{jt} \end{aligned} \tag{6}$$

where δ_t^a is the fixed effect for status a and x_{jt} stands for $\ln X_{jt}$. By estimating the fixed effect of status a, we recover:

$$\hat{\delta}_t^a = -\hat{\Psi}_t^a + \hat{\mu}_t + \ln \hat{\varepsilon}$$

We assume that within industry, the production function F_t is common to all of the firms across status. Hence, we can estimate the markup of firms in each status to common constant for each year.

In the estimation, we consider the following categories in Table 2.

Table 2: Statuses to be considered

	status 1	status 0
Category 1	Exporters	Domestic suppliers
Category 2	With Foreign Technical Supports	Without Foreign Technical Supports
Category 3	Material Importers	Domestic-Material users

We estimate the effect of status 1 on markup by calculating

$$\begin{aligned}\Delta\hat{\psi}_t &\equiv -\hat{\delta}_t^1 - (-\hat{\delta}_t^0)\\ &= -(-\hat{\psi}_t^1 + \hat{\mu}_t + \ln\hat{\varepsilon}) - (-(-\hat{\psi}_t^0 + \hat{\mu}_t + \ln\hat{\varepsilon}))\\ &= \hat{\psi}_t^1 - \hat{\psi}_t^0\end{aligned} \tag{7}$$

In the estimation, we also consider the case where the markups do not vary overtime. For this case, we estimate

$$\begin{aligned}s_{jt} &= \delta^1 + \delta^0\\ &+ \ln(\gamma_{0.t} + \gamma_{l.t}\, l_{jt} + \gamma_{k.t}\, k_{jt} + \gamma_{m.t}\, m_{jt} + \gamma_{ll.t}\, l_{jt}^2 + \gamma_{kk.t}\, k_{jt}^2 + \gamma_{mm.t}\, m_{jt}^2\\ &+ \gamma_{lk.t}\, l_{jt}\, k_{jt} + \gamma_{lm.t}\, l_{jt}\, m_{jt} + \gamma_{km.t}\, k_{jt}\, m_{jt}) - \varepsilon_{jt}\end{aligned} \tag{8}$$

to recover

$$\begin{aligned}\Delta\hat{\psi} &\equiv -\hat{\delta}^1 - (\hat{\delta}^0)\\ &= -(-\hat{\psi}^1 + \hat{\mu}_t + \ln\hat{\varepsilon}) - (-(-\hat{\psi}^0 + \hat{\mu}_t + \ln\hat{\varepsilon}))\\ &= \hat{\psi}^1 - \hat{\psi}^0\end{aligned} \tag{9}$$

4. Results

4-1. Export status and markup

We first address how export status affects markups by estimating the equation (6) with considering Category 1. We drop data from 1979 to 1989 since we cannot observe export status. Table 3 and Table 4 provide $\hat{\delta}_t^1$ and $\hat{\delta}_t^0$ for each industry, respectively.

Table 3: Exporters' fixed effects（$\hat{\delta}_t^1$）

	food	textile	wood	paper	chemical	glass	metal	machine
$\hat{\delta}_{1990}^1$	−4.762	−5.426	−5.198	−5.562	−3.929	−5.521	−3.656	−5.174
	(0.145)**	(0.151)**	(0.228)**	(0.157)**	(0.064)**	(0.148)**	(0.203)**	(0.290)**
$\hat{\delta}_{1991}^1$	−4.769	−5.459	−5.220	−5.573	−3.979	−5.551	−3.591	−5.150
	(0.146)**	(0.150)**	(0.227)**	(0.157)**	(0.063)**	(0.147)**	(0.199)**	(0.290)**
$\hat{\delta}_{1992}^1$	−4.793	−5.502	−5.270	−5.561	−3.961	−5.549	−3.651	−5.201
	(0.145)**	(0.150)**	(0.225)**	(0.154)**	(0.062)**	(0.146)**	(0.198)**	(0.290)**
$\hat{\delta}_{1993}^1$	−4.780	−5.530	−5.090	−5.605	−3.966	−5.631	−3.493	−5.232
	(0.145)**	(0.150)**	(0.225)**	(0.153)**	(0.061)**	(0.146)**	(0.199)**	(0.289)**
$\hat{\delta}_{1994}^1$	−4.765	−5.493	−5.048	−5.550	−3.935	−5.692	−3.596	−5.223
	(0.146)**	(0.150)**	(0.224)**	(0.153)**	(0.060)**	(0.149)**	(0.193)**	(0.289)**
$\hat{\delta}_{1995}^1$	−4.797	−5.513	−5.030	−5.571	−3.958	−5.639	−3.534	−5.244
	(0.146)**	(0.150)**	(0.224)**	(0.153)**	(0.060)**	(0.149)**	(0.196)**	(0.289)**
$\hat{\delta}_{1996}^1$	−4.748	−5.466	−5.074	−5.494	−3.910	−5.638	−3.550	−5.192
	(0.146)**	(0.150)**	(0.225)**	(0.150)**	(0.061)**	(0.148)**	(0.189)**	(0.288)**
R^2	0.82	0.88	0.85	0.91	0.88	0.92	0.89	0.89
N	8,916	5,443	2,914	1,691	3,669	1,054	434	4,952

* $p < 0.05$; ** $p < 0.01$

According to equation (7), we recover the effect of export status on markups by using the information in Table 3 and 4. Table 5 summarizes the results.

Table 4: Non-Exporters' fixed effects（$\hat{\delta}_t^0$）

	food	textile	wood	paper	chemical	glass	metal	machine
$\hat{\delta}_{1990}^0$	−4.632	−5.415	−5.194	−5.438	−3.910	−5.453	−3.386	−5.029
	(0.144)**	(0.148)**	(0.224)**	(0.143)**	(0.058)**	(0.133)**	(0.193)**	(0.289)**
$\hat{\delta}_{1991}^0$	−4.647	−5.431	−5.175	−5.473	−3.919	−5.430	−3.363	−5.024
	(0.144)**	(0.148)**	(0.223)**	(0.144)**	(0.058)**	(0.132)**	(0.195)**	(0.288)**
$\hat{\delta}_{1992}^0$	−4.710	−5.482	−5.195	−5.536	−3.948	−5.444	−3.494	−5.067
	(0.144)**	(0.148)**	(0.224)**	(0.144)**	(0.058)**	(0.132)**	(0.191)**	(0.288)**
$\hat{\delta}_{1993}^0$	−4.757	−5.479	−5.114	−5.609	−3.934	−5.498	−3.582	−5.132
	(0.144)**	(0.148)**	(0.223)**	(0.143)**	(0.057)**	(0.132)**	(0.189)**	(0.288)**
$\hat{\delta}_{1994}^0$	−4.792	−5.470	−5.105	−5.563	−3.909	−5.518	−3.541	−5.158
	(0.144)**	(0.148)**	(0.223)**	(0.144)**	(0.057)**	(0.131)**	(0.192)**	(0.288)**
$\hat{\delta}_{1995}^0$	−4.785	−5.484	−5.058	−5.586	−3.874	−5.497	−3.619	−5.159
	(0.144)**	(0.148)**	(0.223)**	(0.144)**	(0.057)**	(0.133)**	(0.191)**	(0.288)**
$\hat{\delta}_{1996}^0$	−4.745	−5.387	−5.023	−5.571	−3.897	−5.511	−3.622	−5.119
	(0.144)**	(0.148)**	(0.223)**	(0.144)**	(0.057)**	(0.132)**	(0.192)**	(0.288)**
R^2	0.82	0.88	0.85	0.91	0.88	0.92	0.89	0.89
N	8,916	5,443	2,914	1,691	3,669	1,054	434	4,952

* $p < 0.05$; ** $p < 0.01$

From Table 5, we observe that exporting firms set higher markups than non-exporting firms in each industry. Especially glass and machine show larger difference in markups between exporters

Table 5: Effect of export status on markups

	food	textile	wood	paper	chemical	glass	metal	machine
$\Delta\hat{\psi}_{1990}$	0.13	0.011	0.004	0.124	0.019	0.068	0.27	0.145
$\Delta\hat{\psi}_{1991}$	0.122	0.028	0.045	0.1	0.06	0.121	0.228	0.126
$\Delta\hat{\psi}_{1992}$	0.083	0.02	0.075	0.025	0.013	0.105	0.157	0.134
$\Delta\hat{\psi}_{1993}$	0.023	0.051	−0.024	−0.004	0.032	0.133	−0.089	0.1
$\Delta\hat{\psi}_{1994}$	−0.027	0.023	−0.057	−0.013	0.026	0.174	0.055	0.065
$\Delta\hat{\psi}_{1995}$	0.012	0.029	−0.028	−0.015	0.084	0.142	−0.085	0.085
$\Delta\hat{\psi}_{1996}$	0.003	0.079	0.051	−0.077	0.013	0.127	−0.072	0.073
Mean	0.049	0.034	0.0094	0.02	0.035	0.124	0.066	0.104

and non-exporters whereas wood has little difference in markups.

We also try the case where markups do not vary over time by estimating equation (8). We recover the effect of export status by calculating equation (9). The results are summarized in Table 6.

Table 6: Export status and markup with common markup overtime

	food	textile	wood	paper	chemical	glass	metal	machine
$\hat{\delta}^1$	−4.830 (0.155)**	−5.449 (0.153)**	−5.046 (0.363)**	−4.896 (0.146)**	−3.955 (0.056)**	−5.575 (0.129)**	−3.444 (0.197)**	−5.194 (0.301)**
$\hat{\delta}^0$	−4.780 (0.155)**	−5.410 (0.152)**	−5.030 (0.365)**	−4.882 (0.141)**	−3.920 (0.054)**	−5.455 (0.126)**	−3.383 (0.194)**	−5.090 (0.302)**
R^2	0.81	0.87	0.85	0.91	0.88	0.92	0.89	0.89
N	8,916	5,443	2,914	1,691	3,669	1,054	434	4,952
$\Delta\hat{\psi}$	0.05	0.039	0.016	0.014	0.035	0.12	0.061	0.104

Under this specification, the results that exporters set higher markups than non-exporters sill holds. This fact is consistent with the findings in trade literature.

4-2. Foreign technical supports and markup

In this subsection, we estimate how foreign technical supports affect markups by considering Category 2. Again, we estimate equation (6) to have $\hat{\delta}_t^1$ and $\hat{\delta}_t^0$ for each industry. The results are provided in Table 7 and 8, respectively.

Using the information from Table 7 and 8, we calculate equation (7) to recover the effect of foreign-technical-support status on markups. The results are summarized in Table 9.

Table 7 shows that foreign technical supports increase markups in most of the industries. In Metal industry, foreign technical supports decreases markups in most of the years and as a results, the markups are reduced on average.

Higher markups for firms with foreign technical supports suggests that adopting advanced

Table 7: Foreign-Technical-Support fixed effects（$\hat{\delta}_t^1$）

	food	textile	wood	paper	chemical	glass	metal	machine
$\hat{\delta}^1_{1979}$	−2.979	−2.468	−2.671	−3.449	−2.170	−2.214	−1.833	−2.071
	(0.044)**	(0.124)**	(0.121)**	(0.153)**	(0.052)**	(0.080)**	(0.160)**	(0.056)**
$\hat{\delta}^1_{1980}$	−5.967	−5.072	−5.624	−6.882	−4.280	−4.717	−3.792	−4.187
	(0.091)**	(0.250)**	(0.257)**	(0.325)**	(0.105)**	(0.160)**	(0.315)**	(0.113)**
$\hat{\delta}^1_{1981}$	−6.065	−5.249	−5.663	−6.936	−4.287	−4.821	−3.756	−4.359
	(0.091)**	(0.252)**	(0.290)**	(0.340)**	(0.107)**	(0.168)**	(0.367)**	(0.116)**
$\hat{\delta}^1_{1982}$	−6.136	−5.179	−5.510	−6.799	−4.416	−4.792	−4.132	−4.177
	(0.090)**	(0.253)**	(0.294)**	(0.343)**	(0.106)**	(0.146)**	(0.347)**	(0.119)**
$\hat{\delta}^1_{1983}$	−6.081	−5.073	−5.241	−6.913	−4.324	−4.529	−3.832	−4.243
	(0.095)**	(0.253)**	(0.281)**	(0.302)**	(0.106)**	(0.162)**	(0.338)**	(0.124)**
$\hat{\delta}^1_{1984}$	−6.125	−5.059	−5.405	−6.958	−4.282	−4.654	−4.016	−4.308
	(0.091)**	(0.251)**	(0.265)**	(0.301)**	(0.105)**	(0.145)**	(0.337)**	(0.122)**
$\hat{\delta}^1_{1985}$	−6.104	−5.005	−5.442	−6.725	−4.180	−4.736	−4.085	−4.162
	(0.093)**	(0.251)**	(0.272)**	(0.296)**	(0.104)**	(0.141)**	(0.339)**	(0.120)**
$\hat{\delta}^1_{1986}$	−6.032	−5.004	−5.446	−6.811	−4.182	−4.721	−3.843	−4.232
	(0.092)**	(0.251)**	(0.255)**	(0.300)**	(0.107)**	(0.141)**	(0.337)**	(0.123)**
$\hat{\delta}^1_{1987}$	−5.990	−5.047	−5.367	−6.656	−4.135	−4.704	−3.920	−4.133
	(0.095)**	(0.252)**	(0.282)**	(0.297)**	(0.106)**	(0.151)**	(0.319)**	(0.121)**
$\hat{\delta}^1_{1988}$	−5.921	−4.977	−5.365	−6.863	−4.177	−4.596	−3.920	−4.110
	(0.094)**	(0.256)**	(0.294)**	(0.305)**	(0.106)**	(0.155)**	(0.322)**	(0.122)**
$\hat{\delta}^1_{1989}$	−5.867	−5.004	−5.790	−6.835	−4.167	−4.720	−3.689	−4.199
	(0.093)**	(0.253)**	(0.256)**	(0.296)**	(0.103)**	(0.142)**	(0.335)**	(0.119)**
$\hat{\delta}^1_{1990}$	−6.000	−5.097	−5.648	−6.854	−4.234	−4.693	−4.009	−4.157
	(0.096)**	(0.252)**	(0.252)**	(0.301)**	(0.102)**	(0.139)**	(0.320)**	(0.121)**
$\hat{\delta}^1_{1991}$	−5.918	−5.024	−5.580	−6.618	−4.182	−4.697	−3.815	−4.159
	(0.090)**	(0.251)**	(0.247)**	(0.296)**	(0.101)**	(0.136)**	(0.322)**	(0.118)**
$\hat{\delta}^1_{1992}$	−5.959	−5.126	−5.506	−6.723	−4.215	−4.686	−3.770	−4.168
	(0.093)**	(0.252)**	(0.253)**	(0.292)**	(0.100)**	(0.137)**	(0.321)**	(0.120)**
$\hat{\delta}^1_{1993}$	−5.969	−5.151	−5.351	−6.725	−4.286	−4.756	−3.850	−4.284
	(0.088)**	(0.251)**	(0.249)**	(0.291)**	(0.100)**	(0.134)**	(0.324)**	(0.114)**
$\hat{\delta}^1_{1994}$	−5.963	−5.157	−5.449	−6.712	−4.232	−4.807	−3.870	−4.342
	(0.091)**	(0.253)**	(0.249)**	(0.292)**	(0.100)**	(0.133)**	(0.330)**	(0.116)**
$\hat{\delta}^1_{1995}$	−5.993	−5.147	−5.401	−6.809	−4.264	−4.762	−3.822	−4.304
	(0.089)**	(0.250)**	(0.248)**	(0.291)**	(0.100)**	(0.127)**	(0.332)**	(0.118)**
$\hat{\delta}^1_{1996}$	−6.004	−5.099	−5.364	−6.691	−4.238	−4.756	−3.903	−4.252
	(0.088)**	(0.249)**	(0.241)**	(0.291)**	(0.098)**	(0.133)**	(0.323)**	(0.112)**
R^2	0.78	0.86	0.83	0.90	0.86	0.91	0.86	0.88
N	23,817	14,275	7,529	4,214	8,292	2,499	1,140	11,765

* $p < 0.05$; ** $p < 0.01$

technology can decrease the level of competition in the market. This would be because that firms receiving foreign technical supports monopolize the technology and produce higher quality of goods which raises markups since people become to have higher willingness to pay to get their products. If the market is perfectly competitive, foreign technology adoption by some firms decreases markup

Table 8: No-foreign-tech-support fixed effect ($\hat{\delta}_t^0$)

	food	textile	wood	paper	chemical	glass	metal	machine
$\hat{\delta}_{1979}^0$	−2.934	−2.482	−2.679	−3.386	−2.031	−2.327	−1.890	−2.012
	(0.039)**	(0.123)**	(0.112)**	(0.137)**	(0.046)**	(0.046)**	(0.149)**	(0.049)**
$\hat{\delta}_{1980}^0$	−5.908	−5.056	−5.402	−6.864	−4.124	−4.737	−3.881	−4.093
	(0.078)**	(0.245)**	(0.224)**	(0.273)**	(0.092)**	(0.093)**	(0.296)**	(0.098)**
$\hat{\delta}_{1981}^0$	−5.951	−5.097	−5.454	−6.975	−4.239	−4.798	−3.900	−4.213
	(0.078)**	(0.245)**	(0.225)**	(0.272)**	(0.092)**	(0.095)**	(0.299)**	(0.099)**
$\hat{\delta}_{1982}^0$	−5.902	−5.020	−5.375	−6.809	−4.150	−4.624	−3.850	−4.104
	(0.078)**	(0.246)**	(0.225)**	(0.273)**	(0.092)**	(0.096)**	(0.299)**	(0.098)**
$\hat{\delta}_{1983}^0$	−5.866	−4.968	−5.343	−6.711	−4.080	−4.622	−3.857	−4.041
	(0.078)**	(0.246)**	(0.225)**	(0.273)**	(0.093)**	(0.096)**	(0.301)**	(0.099)**
$\hat{\delta}_{1984}^0$	−5.876	−4.998	−5.363	−6.710	−4.120	−4.601	−3.889	−4.069
	(0.079)**	(0.246)**	(0.225)**	(0.273)**	(0.093)**	(0.096)**	(0.298)**	(0.099)**
$\hat{\delta}_{1985}^0$	−5.846	−4.957	−5.340	−6.638	−4.084	−4.536	−3.848	−3.999
	(0.079)**	(0.246)**	(0.225)**	(0.272)**	(0.094)**	(0.096)**	(0.299)**	(0.099)**
$\hat{\delta}_{1986}^0$	−5.858	−4.981	−5.376	−6.694	−4.083	−4.602	−3.822	−4.052
	(0.079)**	(0.246)**	(0.225)**	(0.271)**	(0.094)**	(0.098)**	(0.298)**	(0.099)**
$\hat{\delta}_{1987}^0$	−5.831	−4.948	−5.378	−6.584	−4.028	−4.606	−3.910	−3.994
	(0.079)**	(0.246)**	(0.225)**	(0.271)**	(0.093)**	(0.097)**	(0.297)**	(0.099)**
$\hat{\delta}_{1988}^0$	−5.817	−4.961	−5.353	−6.572	−4.030	−4.542	−3.827	−3.991
	(0.079)**	(0.246)**	(0.224)**	(0.271)**	(0.093)**	(0.098)**	(0.297)**	(0.100)**
$\hat{\delta}_{1989}^0$	−5.846	−4.971	−5.388	−6.609	−4.069	−4.558	−3.860	−4.071
	(0.079)**	(0.246)**	(0.225)**	(0.271)**	(0.094)**	(0.097)**	(0.301)**	(0.100)**
$\hat{\delta}_{1990}^0$	−5.869	−5.000	−5.432	−6.656	−4.094	−4.612	−3.847	−4.082
	(0.079)**	(0.246)**	(0.224)**	(0.272)**	(0.093)**	(0.097)**	(0.300)**	(0.099)**
$\hat{\delta}_{1991}^0$	−5.879	−5.021	−5.422	−6.699	−4.126	−4.602	−3.851	−4.079
	(0.079)**	(0.246)**	(0.224)**	(0.271)**	(0.093)**	(0.097)**	(0.299)**	(0.099)**
$\hat{\delta}_{1992}^0$	−5.939	−5.067	−5.453	−6.750	−4.136	−4.621	−3.955	−4.124
	(0.079)**	(0.246)**	(0.224)**	(0.271)**	(0.093)**	(0.096)**	(0.301)**	(0.099)**
$\hat{\delta}_{1993}^0$	−5.975	−5.072	−5.351	−6.817	−4.111	−4.665	−3.901	−4.179
	(0.079)**	(0.246)**	(0.224)**	(0.271)**	(0.093)**	(0.096)**	(0.301)**	(0.099)**
$\hat{\delta}_{1994}^0$	−5.999	−5.060	−5.331	−6.767	−4.092	−4.689	−3.919	−4.200
	(0.079)**	(0.246)**	(0.224)**	(0.271)**	(0.093)**	(0.096)**	(0.300)**	(0.099)**
$\hat{\delta}_{1995}^0$	−5.998	−5.075	−5.292	−6.785	−4.074	−4.659	−3.943	−4.205
	(0.079)**	(0.246)**	(0.224)**	(0.271)**	(0.093)**	(0.097)**	(0.300)**	(0.099)**
$\hat{\delta}_{1996}^0$	−5.960	−4.988	−5.278	−6.758	−4.062	−4.683	−3.930	−4.165
	(0.079)**	(0.246)**	(0.224)**	(0.271)**	(0.093)**	(0.097)**	(0.300)**	(0.099)**
R^2	0.78	0.86	0.83	0.90	0.86	0.91	0.86	0.88
N	23,817	14,275	7,529	4,214	8,292	2,499	1,140	11,765

* $p < 0.05$; ** $p < 0.01$

since advanced technology spillovers through market and strengthen the level of competition.

As same as previous section, we consider the case where markups do not change over time. We estimate equation (8) and recover $\Delta\hat{\psi}$ in equation (9). The results are given in Table 10.

Table 9: Effect of foreign-tech-support status on markups

	food	textile	wood	paper	chemical	glass	metal	machine
$\Delta\hat{\psi}_{1979}$	0.045	−0.014	−0.008	0.063	0.139	−0.113	−0.057	0.059
$\Delta\hat{\psi}_{1980}$	0.059	0.016	0.222	0.018	0.156	−0.02	−0.089	0.094
$\Delta\hat{\psi}_{1981}$	0.114	0.152	0.209	−0.039	0.048	0.023	−0.144	0.146
$\Delta\hat{\psi}_{1982}$	0.234	0.159	0.135	−0.01	0.266	0.168	0.282	0.073
$\Delta\hat{\psi}_{1983}$	0.215	0.105	−0.102	0.202	0.244	−0.093	−0.025	0.202
$\Delta\hat{\psi}_{1984}$	0.249	0.061	0.042	0.248	0.162	0.053	0.127	0.239
$\Delta\hat{\psi}_{1985}$	0.258	0.048	0.102	0.087	0.096	0.2	0.237	0.163
$\Delta\hat{\psi}_{1986}$	0.174	0.023	0.07	0.117	0.099	0.119	0.021	0.18
$\Delta\hat{\psi}_{1987}$	0.159	0.099	−0.011	0.072	0.107	0.098	0.01	0.139
$\Delta\hat{\psi}_{1988}$	0.104	0.016	0.012	0.291	0.147	0.054	0.093	0.119
$\Delta\hat{\psi}_{1989}$	0.021	0.033	0.402	0.226	0.098	0.162	−0.171	0.128
$\Delta\hat{\psi}_{1990}$	0.131	0.097	0.216	0.198	0.14	0.081	0.162	0.075
$\Delta\hat{\psi}_{1991}$	0.039	0.003	0.158	−0.081	0.056	0.095	−0.036	0.08
$\Delta\hat{\psi}_{1992}$	0.02	0.059	0.053	−0.027	0.079	0.065	−0.185	0.044
$\Delta\hat{\psi}_{1993}$	−0.006	0.079	0	−0.092	0.175	0.091	−0.051	0.105
$\Delta\hat{\psi}_{1994}$	−0.036	0.097	0.118	−0.055	0.14	0.118	−0.049	0.142
$\Delta\hat{\psi}_{1995}$	−0.005	0.072	0.109	0.024	0.19	0.103	−0.121	0.099
$\Delta\hat{\psi}_{1996}$	0.044	0.111	0.086	−0.067	0.176	0.073	−0.027	0.087
Mean	0.101	0.067	0.100	0.065	0.139	0.070	-0.0012	0.120

Table 10 shows that foreign technical supports raises markup for all industries but the Metal industry. Comparing the results from this subsection with the previous subsection, we find that foreign technical supports raise markups more than export status except for Glass and Metal industries. One possible explanation of this is that direct technical supports improves productivities more than export experience.

Table 10: Foreign-tech-support status and markup with common markup overtime

	food	textile	wood	paper	chemical	glass	metal	machine
$\hat{\delta}^1$	−5.969	−5.325	−5.485	−6.103	−4.429	−4.637	−3.812	−4.166
	(0.075)**	(0.258)**	(0.231)**	(0.216)**	(0.097)**	(0.094)**	(0.284)**	(0.095)**
$\hat{\delta}^0$	−5.867	−5.265	−5.388	−6.074	−4.281	−4.568	−3.824	−4.052
	(0.074)**	(0.260)**	(0.227)**	(0.208)**	(0.097)**	(0.090)**	(0.283)**	(0.096)**
R^2	0.77	0.85	0.83	0.89	0.86	0.90	0.86	0.87
N	23,817	14,275	7,529	4,214	8,292	2,499	1,140	11,765
$\Delta\hat{\psi}$	0.102	0.06	0.097	0.029	0.148	0.069	−0.012	0.114

* $p < 0.05$; ** $p < 0.01$

4-3. Material import status and markup

Lastly, in this subsection, we conduct the same exercise as in previous two subsections to estimate how material imports affect markups. We estimate equation (6) with considering Category 3 to obtain $\hat{\delta}_t^1$ and $\hat{\delta}_t^0$ for each industry. The results are shown in Table 11 and 12, respectively.

Table 11: Material Import Status fixed effect ($\hat{\delta}_t^1$)

	food	textile	wood	paper	chemical	glass	metal	machine
$\hat{\delta}_{1979}^1$	−3.018	−2.690	−2.789	−3.422	−2.244	−2.375	−1.936	−2.336
	(0.044)**	(0.098)**	(0.128)**	(0.115)**	(0.059)**	(0.056)**	(0.147)**	(0.059)**
$\hat{\delta}_{1980}^1$	−6.069	−5.480	−5.685	−6.947	−4.512	−4.759	−3.889	−4.726
	(0.088)**	(0.196)**	(0.256)**	(0.231)**	(0.119)**	(0.115)**	(0.293)**	(0.118)**
$\hat{\delta}_{1981}^1$	−6.145	−5.526	−5.729	−7.010	−4.608	−4.885	−3.902	−4.815
	(0.088)**	(0.196)**	(0.256)**	(0.232)**	(0.119)**	(0.115)**	(0.295)**	(0.118)**
$\hat{\delta}_{1982}^1$	−6.145	−5.493	−5.717	−6.903	−4.604	−4.819	−3.997	−4.832
	(0.089)**	(0.196)**	(0.257)**	(0.233)**	(0.119)**	(0.119)**	(0.297)**	(0.118)**
$\hat{\delta}_{1983}^1$	−6.085	−5.431	−5.648	−6.831	−4.503	−4.763	−3.964	−4.740
	(0.089)**	(0.196)**	(0.258)**	(0.232)**	(0.120)**	(0.117)**	(0.300)**	(0.119)**
$\hat{\delta}_{1984}^1$	−6.140	−5.474	−5.659	−6.881	−4.544	−4.790	−4.002	−4.793
	(0.089)**	(0.196)**	(0.257)**	(0.231)**	(0.120)**	(0.118)**	(0.298)**	(0.119)**
$\hat{\delta}_{1985}^1$	−6.109	−5.425	−5.605	−6.740	−4.492	−4.772	−3.987	−4.704
	(0.088)**	(0.196)**	(0.256)**	(0.232)**	(0.120)**	(0.117)**	(0.297)**	(0.119)**
$\hat{\delta}_{1986}^1$	−6.072	−5.403	−5.620	−6.765	−4.457	−4.825	−3.840	−4.704
	(0.088)**	(0.196)**	(0.258)**	(0.231)**	(0.120)**	(0.117)**	(0.297)**	(0.119)**
$\hat{\delta}_{1987}^1$	−6.082	−5.382	−5.544	−6.708	−4.401	−4.880	−4.034	−4.630
	(0.089)**	(0.196)**	(0.257)**	(0.230)**	(0.120)**	(0.117)**	(0.297)**	(0.119)**
$\hat{\delta}_{1988}^1$	−6.077	−5.398	−5.496	−6.730	−4.418	−4.646	−3.981	−4.614
	(0.088)**	(0.196)**	(0.260)**	(0.230)**	(0.120)**	(0.119)**	(0.297)**	(0.119)**
$\hat{\delta}_{1989}^1$	−6.057	−5.389	−5.717	−6.742	−4.441	−4.634	−3.961	−4.713
	(0.088)**	(0.196)**	(0.257)**	(0.232)**	(0.120)**	(0.119)**	(0.300)**	(0.119)**
$\hat{\delta}_{1990}^1$	−6.020	−5.448	−5.635	−6.821	−4.484	−4.693	−4.000	−4.695
	(0.089)**	(0.196)**	(0.261)**	(0.232)**	(0.120)**	(0.118)**	(0.299)**	(0.119)**
$\hat{\delta}_{1991}^1$	−6.037	−5.450	−5.619	−6.777	−4.508	−4.690	−3.993	−4.686
	(0.089)**	(0.196)**	(0.260)**	(0.232)**	(0.120)**	(0.117)**	(0.301)**	(0.119)**
$\hat{\delta}_{1992}^1$	−6.049	−5.497	−5.578	−6.804	−4.502	−4.655	−4.011	−4.707
	(0.088)**	(0.196)**	(0.259)**	(0.232)**	(0.120)**	(0.114)**	(0.303)**	(0.118)**
$\hat{\delta}_{1993}^1$	−6.109	−5.502	−5.469	−6.853	−4.486	−4.741	−3.896	−4.783
	(0.088)**	(0.196)**	(0.259)**	(0.231)**	(0.120)**	(0.112)**	(0.302)**	(0.118)**
$\hat{\delta}_{1994}^1$	−6.104	−5.501	−5.537	−6.831	−4.459	−4.827	−3.942	−4.791
	(0.087)**	(0.195)**	(0.258)**	(0.232)**	(0.119)**	(0.113)**	(0.301)**	(0.118)**
$\hat{\delta}_{1995}^1$	−6.090	−5.519	−5.472	−6.840	−4.453	−4.777	−3.912	−4.785
	(0.088)**	(0.196)**	(0.260)**	(0.232)**	(0.119)**	(0.115)**	(0.308)**	(0.118)**
$\hat{\delta}_{1996}^1$	−6.080	−5.451	−5.515	−6.762	−4.423	−4.737	−3.865	−4.774
	(0.087)**	(0.196)**	(0.258)**	(0.232)**	(0.119)**	(0.113)**	(0.305)**	(0.117)**
R^2	0.78	0.86	0.84	0.90	0.86	0.91	0.86	0.88
N	23,817	14,275	7,529	4,214	8,292	2,499	1,140	11,765

* $p < 0.05$; ** $p < 0.01$

Table 12: Material Non-import Status fixed effect ($\hat{\delta}_t^0$)

	food	textile	wood	paper	chemical	glass	metal	machine
$\hat{\delta}^0_{1979}$	−2.965	−2.631	−2.716	−3.389	−2.164	−2.322	−1.916	−2.238
	(0.042)**	(0.098)**	(0.125)**	(0.115)**	(0.059)**	(0.050)**	(0.149)**	(0.058)**
$\hat{\delta}^0_{1980}$	−5.972	−5.355	−5.477	−6.866	−4.413	−4.773	−4.006	−4.558
	(0.085)**	(0.195)**	(0.250)**	(0.229)**	(0.118)**	(0.099)**	(0.299)**	(0.116)**
$\hat{\delta}^0_{1981}$	−6.012	−5.399	−5.525	−6.990	−4.513	−4.817	−4.043	−4.697
	(0.085)**	(0.195)**	(0.250)**	(0.228)**	(0.119)**	(0.101)**	(0.303)**	(0.116)**
$\hat{\delta}^0_{1982}$	−5.964	−5.307	−5.438	−6.805	−4.383	−4.624	−3.886	−4.521
	(0.085)**	(0.196)**	(0.250)**	(0.229)**	(0.118)**	(0.103)**	(0.302)**	(0.116)**
$\hat{\delta}^0_{1983}$	−5.925	−5.253	−5.404	−6.706	−4.348	−4.598	−3.904	−4.477
	(0.085)**	(0.196)**	(0.250)**	(0.230)**	(0.119)**	(0.103)**	(0.302)**	(0.116)**
$\hat{\delta}^0_{1984}$	−5.932	−5.276	−5.425	−6.693	−4.359	−4.582	−3.949	−4.502
	(0.085)**	(0.196)**	(0.250)**	(0.230)**	(0.119)**	(0.103)**	(0.300)**	(0.116)**
$\hat{\delta}^0_{1985}$	−5.901	−5.235	−5.408	−6.636	−4.323	−4.520	−3.877	−4.433
	(0.085)**	(0.196)**	(0.250)**	(0.229)**	(0.120)**	(0.103)**	(0.305)**	(0.116)**
$\hat{\delta}^0_{1986}$	−5.920	−5.283	−5.451	−6.707	−4.378	−4.568	−3.976	−4.517
	(0.085)**	(0.196)**	(0.250)**	(0.227)**	(0.120)**	(0.105)**	(0.301)**	(0.117)**
$\hat{\delta}^0_{1987}$	−5.888	−5.254	−5.462	−6.572	−4.327	−4.546	−3.944	−4.464
	(0.085)**	(0.196)**	(0.250)**	(0.227)**	(0.120)**	(0.104)**	(0.297)**	(0.117)**
$\hat{\delta}^0_{1988}$	−5.868	−5.266	−5.444	−6.567	−4.320	−4.559	−3.867	−4.473
	(0.085)**	(0.196)**	(0.250)**	(0.227)**	(0.120)**	(0.105)**	(0.296)**	(0.117)**
$\hat{\delta}^0_{1989}$	−5.904	−5.291	−5.465	−6.618	−4.393	−4.604	−3.899	−4.561
	(0.085)**	(0.196)**	(0.250)**	(0.227)**	(0.120)**	(0.103)**	(0.300)**	(0.117)**
$\hat{\delta}^0_{1990}$	−5.941	−5.312	−5.528	−6.656	−4.409	−4.645	−3.902	−4.575
	(0.085)**	(0.196)**	(0.250)**	(0.228)**	(0.119)**	(0.104)**	(0.300)**	(0.117)**
$\hat{\delta}^0_{1991}$	−5.949	−5.334	−5.517	−6.705	−4.432	−4.636	−3.880	−4.574
	(0.085)**	(0.196)**	(0.250)**	(0.227)**	(0.119)**	(0.103)**	(0.298)**	(0.117)**
$\hat{\delta}^0_{1992}$	−6.014	−5.380	−5.551	−6.766	−4.461	−4.671	−3.996	−4.623
	(0.085)**	(0.196)**	(0.250)**	(0.227)**	(0.119)**	(0.103)**	(0.299)**	(0.117)**
$\hat{\delta}^0_{1993}$	−6.044	−5.383	−5.447	−6.835	−4.445	−4.701	−4.029	−4.675
	(0.085)**	(0.196)**	(0.250)**	(0.227)**	(0.118)**	(0.104)**	(0.299)**	(0.117)**
$\hat{\delta}^0_{1994}$	−6.072	−5.362	−5.420	−6.779	−4.417	−4.711	−4.037	−4.699
	(0.085)**	(0.196)**	(0.250)**	(0.227)**	(0.118)**	(0.103)**	(0.300)**	(0.117)**
$\hat{\delta}^0_{1995}$	−6.077	−5.377	−5.388	−6.806	−4.405	−4.691	−4.048	−4.714
	(0.085)**	(0.196)**	(0.250)**	(0.227)**	(0.118)**	(0.104)**	(0.298)**	(0.117)**
$\hat{\delta}^0_{1996}$	−6.035	−5.280	−5.364	−6.791	−4.415	−4.731	−4.088	−4.659
	(0.086)**	(0.196)**	(0.250)**	(0.227)**	(0.118)**	(0.104)**	(0.298)**	(0.117)**
R^2	0.78	0.86	0.84	0.90	0.86	0.91	0.86	0.88
N	23,817	14,275	7,529	4,214	8,292	2,499	1,140	11,765

* $p < 0.05$; ** $p < 0.01$

Using the fixed effects from Table 11 and 12, we calculate equation (7) to recover the effect of material import status on markups. The results are summarized in Table 13.

Table 13 shows that firms importing their material of production set higher markups than those who use only domestically produced intermediate goods in most of the industries except for

the metal industry. We can interpret this fact as foreign material improves the quality of product, which increases the markups. In this sense, material imports have the same effect of productivity improvement by foreign technical supports.

Table 13: Effect of material imports status on markups

	food	textile	wood	paper	chemical	glass	metal	machine
$\Delta\hat{\psi}_{1979}$	0.053	0.059	0.073	0.033	0.08	0.053	0.02	0.098
$\Delta\hat{\psi}_{1980}$	0.097	0.125	0.208	0.081	0.099	−0.014	−0.117	0.168
$\Delta\hat{\psi}_{1981}$	0.133	0.127	0.204	0.02	0.095	0.068	−0.141	0.118
$\Delta\hat{\psi}_{1982}$	0.181	0.186	0.279	0.098	0.221	0.195	0.111	0.311
$\Delta\hat{\psi}_{1983}$	0.16	0.178	0.244	0.125	0.155	0.165	0.06	0.263
$\Delta\hat{\psi}_{1984}$	0.208	0.198	0.234	0.188	0.185	0.208	0.053	0.291
$\Delta\hat{\psi}_{1985}$	0.208	0.19	0.197	0.104	0.169	0.252	0.11	0.271
$\Delta\hat{\psi}_{1986}$	0.152	0.12	0.169	0.058	0.079	0.257	−0.136	0.187
$\Delta\hat{\psi}_{1987}$	0.194	0.128	0.082	0.136	0.074	0.334	0.09	0.166
$\Delta\hat{\psi}_{1988}$	0.209	0.132	0.052	0.163	0.098	0.087	0.114	0.141
$\Delta\hat{\psi}_{1989}$	0.153	0.098	0.252	0.124	0.048	0.03	0.062	0.152
$\Delta\hat{\psi}_{1990}$	0.079	0.136	0.107	0.165	0.075	0.048	0.098	0.12
$\Delta\hat{\psi}_{1991}$	0.088	0.116	0.102	0.072	0.076	0.054	0.113	0.112
$\Delta\hat{\psi}_{1992}$	0.035	0.117	0.027	0.038	0.041	−0.016	0.015	0.084
$\Delta\hat{\psi}_{1993}$	0.065	0.119	0.022	0.018	0.041	0.04	−0.133	0.108
$\Delta\hat{\psi}_{1994}$	0.032	0.139	0.117	0.052	0.042	0.116	−0.095	0.092
$\Delta\hat{\psi}_{1995}$	0.013	0.142	0.084	0.034	0.048	0.086	−0.136	0.071
$\Delta\hat{\psi}_{1996}$	0.045	0.171	0.151	−0.029	0.008	0.006	−0.223	0.115
Mean	0.116	0.137	0.144	0.082	0.090	0.109	−0.0075	0.159

Lastly, again, we consider the case of common markups overtime. We estimate equation (8) and recover $\Delta\hat{\psi}$ in equation (9). The results are given in Table 14.

Table 14 shows that the result of higher markups for foreign material users still holds for this

Table 14: Material import status and markup with common markup overtime

	food	textile	wood	paper	chemical	glass	metal	machine
$\hat{\delta}^1$	−5.929	−5.434	−6.009	−6.734	−4.523	−4.697	−3.839	−4.676
	(0.078)**	(0.205)**	(0.283)**	(0.199)**	(0.077)**	(0.096)**	(0.288)**	(0.104)**
$\hat{\delta}^0$	−5.813	−5.297	−5.856	−6.652	−4.433	−4.595	−3.855	−4.528
	(0.078)**	(0.206)**	(0.281)**	(0.198)**	(0.075)**	(0.093)**	(0.290)**	(0.104)**
R^2	0.77	0.86	0.83	0.89	0.86	0.91	0.86	0.88
N	23,817	14,275	7,529	4,214	8,292	2,499	1,140	11,765
$\Delta\hat{\psi}$	0.116	0.137	0.153	0.082	0.09	0.102	−0.016	0.148

* $p < 0.05$; ** $p < 0.01$

setting. Comparing the effect export status on markups, we conclude that foreign material usage raises markups more than export status form most of the industries expect for Glass and Metal industries. This means that material imports are more effective in improving in productivity than final goods exports. Also, compared with the effect of foreign-technical-support status on markups, material imports raise markup more than adopting foreign technology except for the chemical and metal industries. This result suggests that foreign material usage is more effective in improving productivity than having technical supports from foreign countries.

5. Conclusion

In this paper, we analyze how firms' export status and other characteristics affect markups. We show that exporting firms set higher markups than non-exporting firms, which is the consistent result with the finding from previous international trade studies such as De Loecker and Warzynski (2012) and De Loecker et al. (2014). We also find that firms having foreign technical supports or importing foreign materials have higher markups than those who do not have those statuses. Hence we can conclude that firms who are linked with abroad by any channel charges higher markups.

Our analysis has an implication of the effect of opening trade and productivity improvement on competition. Although we have empirical stylized fact that export status raises markups, some of the theoretical works show that opening trade has pro-competitive effect. Our paper answers if material imports and foreign technology adoption have either procompetitive effect or counter-competitive effect (i.e., rising markups), which is not addressed by previous studies. According to the results in this paper, foreign technology usage and foreign material usage has even more stronger counter-competitive effect than export status. One possible explanation for this would be followings. Foreign material usage and foreign technology adoption improves firms' productivity more than experiencing export, but this improvement only happens among those firms and does not spillover to other firms since the market is imperfectly competitive. As a result, only those who rely on foreign material or technology produce higher quality of goods which raises markups for those products and the degree of increase in markups is higher for those two statuses than export status since it improves firms' productivity more.

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