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Does Home (Output) Import Tariff Reduction Increase Home Exports? Evidence from Korean Manufacturing Plant–Product Data

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Abstract: *This study examines the effects of domestic output import tariff reduction on domestic plant export dynamics and clarifies the underlying mechanism, using rich plant–product data from the Republic of Korea for 1991–2002. We find that home import liberalisation increases domestic plants' export market participation (extensive margins), particularly for industry where markup growth is more negative during tariff reductions. However, we do not find evidence that cutting import tariffs significantly affects incumbent home exporters' export volume (intensive margins). This study unveils a new mechanism – 'escape competition' to foreign markets – by showing that reducing import tariffs leads domestic firms under heightened industry competition to look for an opportunity in foreign markets via export inauguration.*

Keywords: Plant-product level data; output tariff; Lerner symmetry; extensive margin; intensive margin; product scope

JEL Classification: F15; F23

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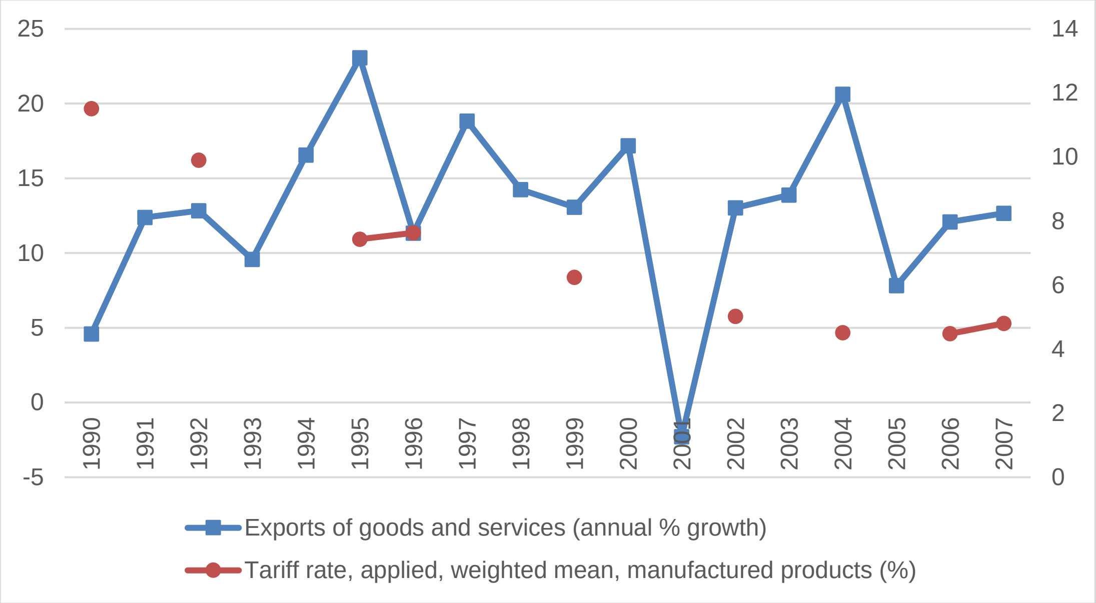
1. Introduction

This study aims to examine the effects of cutting import tariffs on domestic plants' exports and clarify the underlying mechanism, using rich plant–product data from the Republic of Korea (henceforth, Korea) for 1991–2002. Trade liberalisation has been a prevalent trend in the world economy – countries have encouraged their firms to enter foreign markets (via exports) and have opened their import markets to foreign counterparts. This symmetric liberalisation is not mandatory, but required to a certain extent for the resolution of trade disputes. In this regard, the promotion of exports needs to be discussed along with the liberalisation of import markets. Korea drew much attention as one of the prominent emerging economies in the 1990s because of its rapid export and economic growth. As the Korean economy (a small open economy) relies significantly on exports, it has been aggressively liberalising the domestic market to foreign countries simultaneously.

Figure 1 depicts the changes in the average tariff rate with aggregate export growth for Korea during 1990–2007. Since the early 1990s, the average tariff rate for manufacturing products had decreased continuously. At the same time, Korea experienced positive export growth during the period except for 2001, implying that Korean exports had a clear increasing trend during that time though its growth rate was volatile. In sum, we observe that Korea continued to liberalise its domestic market to foreign countries while pursuing foreign market expansion via exports. Although this graph does not provide any causality on the two variables, it triggers an important question on the micro linkage between import tariffs and export growth, particularly in relation to firm-, plant-, or product-level export dynamics.

Figure 1: Tariff Rates and Export Growth in the Republic of Korea



Source: WDI, World Bank.

A strand of previous studies focused on the direct determinants of exports, such as the exchange rate and foreign market size (foreign gross domestic product), from the macro-perspective. Other literature using microdata started to discuss which firms' characteristics matter for exports and offer new insights into the determinants of exports by examining the firm-level decision of export entry and continuation. However, these studies did not link the facilitation of home imports through tariff cuts with home firms' export dynamics. Home import tariff reduction and foreign firms' exports (home imports) are evidently linked. In addition, cutting tariffs on home firms' intermediate input imports can influence the exports of home firms that use the imported inputs. However, how the reduction in output tariffs in the home market affects the home firms' *exports* is theoretically ambiguous. Note that while Lerner symmetry points to the macro-level import–export linkage using the terms of trade, few studies examine the related micro-mechanism. Thus, it is worthwhile investigating this output import tariff–export linkage using firm- or plant-level data empirically.

The key questions of this study are as follows.

- Does cutting import tariffs at home increase home exports? What are the micro-dynamics of plant exports in response to the import tariff reduction beyond Lerner symmetry?

- Which of the following mechanisms is most consistent with the evidence – scale economies or the escape competition effect?

To draw out answers to the above questions, we address the following additional questions.

- Can we find evidence that is consistent with what the escape competition effect scenario would predict?
- Do the domestic sales decrease most for plants that are most vulnerable to increased import competition, such as small and less productive plants?
- Is there evidence that these plants increase research and development (R&D) efforts to break into export markets?

To the best of our knowledge, this is the first study to examine the effect of domestic tariff changes in output imports on domestic plant 'export' dynamics. While previous works looked at the effect of trade liberalisation on domestic firms' outcomes, such as productivity and product scope, this study investigates the effect of trade liberalisation on domestic firms' operating decisions – whether to start exporting and whether to increase or decrease exports. In addition, we examine how domestic import tariff cuts affect the export decisions of domestic plants. Another novel feature of this study is that by using product-level information, we identify plant-level tariff changes. Our research will provide an idea of how import and export linkage is shaped on the micro-level, and improve the understanding of plant-level export dynamics in response to import liberalisation.

Using rich Korean plant–product data for 1991–2002, we find that domestic import liberalisation helps domestic firms start to export more (extensive margins), particularly for industry where markup growth is more negative during tariff reductions. We also find that this positive tariff cut effect is more pronounced for small plants. However, we do not find evidence that cutting import tariffs significantly affects incumbent exporters' export volume (intensive margins). The results of this study unveil a new mechanism – escape competition – whereby domestic firms under heightened industrial competition, driven by import tariff reductions, may look for a new opportunity in the foreign market (by expanding to foreign markets via exports).

2. Theoretical Background and Contribution

2.1. Theoretical Discussion

At least the following three arguments provide predictions on the effect of cutting import tariffs on exports. First, the Lerner symmetry argument from Lerner (1936) addresses the linkage between import tariffs and export promotion. Lerner symmetry establishes the equivalence between import tariffs and export taxes, indicating that import tariffs and export taxes are substitutes. A simple idea of this theorem is that while the tariff increases the price of importing goods, the export tax decreases the price of exporting goods, so in either case the terms of trade change in the same direction. Under a trade balance condition, a tariff (tax) reducing imports (exports) also lowers exports (imports). Thus, under Lerner symmetry, a reduction in import tariffs is expected to increase exports.[1] Irwin (2007) found that the 30% average tariff on manufacturing imports resulted in an effective tax on exporters of 11% in the United States in the nineteenth century.

Since this Lerner symmetry focuses on changes in the terms of trade, the import tariff reduction would change the incumbent exporters' export volume (export intensity), but not new exporters' entry decisions. Note that if the impact of cutting import tariffs is large and permanent, we may face subsequent consequences on firm dynamics.

Second, cutting import tariffs may affect the scale of domestic firms' production. If economies of scale exist at the firm level, domestic firms would lose this scale benefit when the import tariff is reduced and competition is intensified. Thus, the resulting increase in firms' average and marginal costs may decrease exports. However, it is possible that firms would be actively engaged in exporting to maintain the benefit of economies of scale.

Third, cutting import tariffs may affect firm export dynamics through changes in the intensity of competition in the domestic market. Aghion et al. (2001) showed that more intense product market competition gives greater incentives for some firms

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[1] Subsequent studies support the validity of Lerner symmetry with respect to different settings and assumptions. Amongst others, Costinot and Werning (2017) provide a number of generalisations and qualifications. However, few previous studies examine the Lerner symmetry argument empirically.

to innovate (the escape-competition effect) because it increases the incremental benefit from engaging in innovation. If firms need to increase the quality or reduce the cost of products to survive or break into new markets, the reduction in import tariffs may increase export participation at least for some firms that are most vulnerable to the increased import competition, such as small, less productive firms. Another possibility is that firms under harsh domestic competition resulting from trade liberalisation would look for a new and greater foreign market (physically escaping the domestic market with unleashed competition towards a new foreign market).

2.2. Relations to the Literature

Previous theoretical studies examined the effects of reducing tariffs (both final goods and intermediate inputs) on the productivity of domestic firms. A reduction in output tariffs can generate productivity gains by inducing tougher import competition, whereas cheaper imported inputs resulting from the reduction in input tariffs can raise productivity via learning, variety, and quality effects. One strand focused on the effect of lower output tariffs on productivity. Pavcnik (2002) showed that industries with high import competition in Chile enjoyed higher productivity gains than non-traded goods industries because of liberalised trade. Trefler (2004) showed that labour productivity increased in the industries that experienced the largest tariff cuts in United States–Canada trade. Other studies on output tariffs and productivity include Tybout, de Melo, and Corbo (1991); Levinsohn (1993); Harrison (1994); Tybout and Westbrook (1995); Krishna and Mitra (1998); and Head and Ries (1999).

The other strand of studies – such as Schor (2004); Amiti and Konings (2007); and Topalova and Khandelwal (2011) – looks at the effect of intermediate input imports or input tariff reductions on productivity in Brazil, Indonesia, and India, respectively.[2] They suggest that in comparison to the competition effect of trade, the access to cheaper intermediates has a larger impact on firm productivity. In sum, these studies focus on the effect of tariff reductions on domestic firm productivity

[2] The following studies examine the effect of imported inputs on productivity: Feenstra, Markusen, and Zeile (1992); Halpern, Koren, and Szeidl (2015); and Kasahara and Rodrigue (2008).

through various channels but are silent on the subsequent consequences on domestic firms' export dynamics.

While many previous studies have paid attention to the relationship between a reduction in output import tariffs, the entry of foreign firms, and the aggregate productivity of domestic firms, no study examines the effect of the output import tariff reduction on firm export dynamics using plant- or plant-product level data. Since we do not have a full understanding of firms' export dynamics (particularly the new entry of plants and products into export markets) along with output import tariff changes or its underlying mechanism, this study attempts to fill this gap.

Furthermore, few studies investigate multi-product firms' export dynamics in response to the import competition driven by the tariff changes. In addition, we examine which channels between scale effects and escape competition effects matter for the extensive and intensive margins of exporting in response to the import tariff reduction. Analysing these issues may help illuminate the role of industrial policy (protectionism) plays in the export growth as well as in the export diversification. Another potential contribution of this study is to clarify how plant and product export market entries are related to the plant and/or industry level tariff changes by identifying plant level tariff changes.

3. Data and Methodology

3.1. Data

We use a plant–product data set on Korean manufacturing industries covering 1991–2002. The data are unpublished plant-level data from Statistics Korea's Annual Report on Mining and Manufacturing Survey. Statistics Korea performed a complete enumeration survey of all plants in Korea and compiled the data at the plant level. We chose this time span, 1991–2002 for two important reasons. First, the data since 2002 are not fully accessible because Statistics Korea does not release all the information on the mining and manufacturing survey.[3] Second, since we are interested in import liberalisation and its impact on plant export dynamics, the 1990s is the best period of experiment to use full variations of import tariff changes

[3] The precise export value is not fully revealed but reported as the discrete value in specific ranges. R&D information is not reported either.

(Figure 1). Notice that since 2000, import tariffs have remained quite constant. The data cover all plants with five or more employees across 461 manufacturing industries with 5-digit Korean Standard Industrial Classification (KSIC) codes. Also note that about 70% of plants are single plant firms, so most of the data also use firm-level information. Production structures and export status are available for each year.[4]

Yearly import tariff data come from the Korea Customs Service at the 10-digit level with the Harmonized System (HS) code system. They provide data on the value of applied tariffs and imports for each HS category, and the output tariff can be directly calculated by dividing the value of applied tariffs by the value of imports. We construct plant-level tariff changes – these tariff data with the HS code system have been converted to Korea's 141 input–output industry codes to calculate the weighted average of industry-level output tariffs for each plant (see Hahn and Choi (2016) for more detailed information).

To measure the degree of (industry) competition during the reduction in import tariffs, this study introduces (3-digit) industry-level markup growth. We employ the De Loecker and Warzynski (2012) method which estimates firm-level markups, then we compute the industry average markup growth. A brief introduction to the De Loecker and Warzynski (2012) method is in the appendix. A change in domestic shipments is used as a proxy for domestic scale growth.

Before moving towards our empirical analysis, we provide summary statistics of the main variables, annualised tariff change (%), with industry markup growth and domestic shipments growth in Table 1. Overall, output tariffs show negative growth, which is consistent with a trend of trade liberalisation in Korea, except for 1994–1995, 1996–1997, and 1997–1998. During the Asian financial crisis (1997–1998), while domestic shipment growth is negative, industry markup growth is positive, implying that industry competition is lowered during that period. Another interesting observation is that the (average) industry markup plummeted by –10.5% from 2000 to 2001 after the crisis.

[4] For a detailed description of the data set, see Choi and Pyun (2017) and Hahn and Choi (2016), which use the same plant–product level data set.

Table 1: Annual Changes in Import Tariff, Industry Markup, and Domestic Sales

Year (t-1)	Obs.	Tariff changes (t-1, t)		Industry markup growth (t-1, t)		Domestic sales growth (t-1, t)	
		Mean (%)	STD	Mean (%)	STD	Mean (%)	STD
1991	28,778	-1.146	3.191	-1.129	9.216	0.130	0.660
1992	30,033	-1.401	2.371	4.128	9.903	0.194	0.694
1993	33,276	-0.829	2.251	2.848	8.471	0.207	0.660
1994	33,919	0.708	7.969	2.023	9.431	0.205	0.680
1995	35,836	-0.312	8.391	2.465	9.042	0.158	0.697
1996	31,840	0.068	1.709	-1.746	9.074	0.069	0.649
1997	31,173	0.122	2.207	8.125	10.041	-0.064	0.718
1998	32,802	-0.320	2.760	-2.408	12.059	0.210	0.729
1999	39,338	-0.226	1.862	0.145	10.259	0.174	0.723
2000	44,972	-0.157	1.640	-10.542	9.919	0.127	0.694
2001	58,143	-0.174	1.630	--	--	0.124	0.673

Obs. = observations, STD = standard deviation.
Notes: Firm level markups are constructed up to 2001. The information on industry markup growth from 2001 to 2002 is missing.
Source: Authors' calculation based on Statistics Korea's Annual Report on Mining and Manufacturing Survey.

3.2. Methodology

This study analyses the effect of plant-level tariff reduction on Korean manufacturing plant-level exporting and its underlying mechanism. To consider the effect of the output import tariff reduction on domestic plants' exports through domestic import competition or scale growth, we limit our sample to plants that are already operating in the domestic market (domestic sales are greater than zero). Using this domestic plant sample, we examine their extensive margins of export (new entry to export market) or intensive margins of export (increase in export volume). We focus on a nonlinear relationship between two margins of export and tariff changes (across plants and industries) by introducing the interaction terms. To study the heterogeneous effects of tariffs on plants' exporting, we estimate the following panel empirical models:

1) Extensive margin

$$EXP_{ijt,t-1} = \alpha_1 \cdot Tariff\ change_{ijt,t-1} + \alpha_2 \cdot Tariff\ change_{ijt,t-1} \times Scale\ or\ competition\ changes_{ijt,t-1} + X_{ij,t-1} \cdot \gamma + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt,t-1}$$

2) Intensive margin

$$EXP\_volume\_growth_{ijt,t-1} = \beta_1 \cdot Tariff\ change_{ijt,t-1} + \beta_2 \cdot Tariff\ change_{ijt,t-1} \times Scale\ or\ competition\ changes_{ij,t-1} + X_{ijt,t-1} \cdot \gamma + \beta_i + \beta_j + \beta_t + e_{ijt,t-1}$$

where *j* indicates industry, *i* denotes plant level, and *t* is the time descriptor. $EXP_{ijt,t-1}$ is a binary indicator which shows whether plant *i* enters the export market between *t-1* and *t*. $Tariff\ change_{ijt,t-1}$ is the plant-level tariff changes between *t-1* and *t* in Korea. To understand the channels through which the reduction in domestic output import tariffs affect domestic plant export dynamics, this study proposes two possible mechanisms: competition vs scale. Reducing import tariffs may decrease the domestic sales of domestic firms, implying that import liberalisation negatively influences the domestic firms' market shares. We employ plants' domestic sales growth during tariff reduction as a proxy for the scale growth of domestic incumbent firms. Negative (positive) industry markup growth during the tariff reduction implies that industry competition becomes more (less) intensified. We interact these two variables, $industry\ markup\ growth_{ijt,t-1}$ and $scale\ growth_{ijt,t-1}$ with $Tariff\ change_{ijt,t-1}$ to check whether scale or competition or both channels are working.

X_{ijt-1} is a vector of other control variables that affect plant exporting and product scope: plant standardised productivity for every year ($STFP_{ijt-1} = \ln TFP_{ijt-1} - \overline{\ln TFP_{jt-1}}$), plant size (employment), plant age, multi-product firm dummy, innovator dummy (R&D dummy), capital intensity, skill intensity, and the Herfindahl-Hirschman Index (HHI). The innovator dummy is whether plant *i* is engaged in R&D investment at *t*. The capital intensity variable is constructed by dividing the plant capital by total employment. Skill intensity is a ratio of the number of skilled workers (white-collar worker) to total workers. To make our analysis more consistent, we adjust individual variables consistent with the form of our dependent variables (i.e. in the linear regression using a log-dependent variable, we put all controls except for the dummy variable by taking a log). We include plant fixed effects, (2-digit) industry fixed effects, and year fixed effects for the robustness of the results.

4. Results

4.1. Main Results

Table 2 shows the results for extensive margins. The dependent variable is a binary indicator for whether domestic plant *i* starts exporting between *t-1* and *t*. In column (1), the coefficient on tariff changes is negative, which implies that the output import tariff cut that domestic plants are facing would lead to an increase in the likelihood that those plants start exporting. More interestingly, the estimated coefficient on the interaction term of tariff change and industry markup growth is significant and positive. Combining the coefficients of tariff change and its interaction term with industry markup growth, we find that the positive effect of the domestic output import tariff cut on domestic plants' export inauguration is greater for plants in the industry with greater negative markup growth. This suggests that during a reduction in output import tariffs, domestic firms that face heightened competition (a decrease in industry markup) try to escape this competitive environment and search for new opportunities in foreign markets via exports.

Table 2: Extensive Margins

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Dependent variable	**New export participation between t-1 and t (binary variable)**				
	FE LPM	**FE logit**	**RE logit**	**Small plants <100**	**Large plants >100**
Tariff change (t-1,t)	-0.0062	-0.2138	-0.1588	-0.0067	0.0933
	(0.006)	(0.478)	(0.313)	(0.006)	(0.095)
Tariff change (t-1,t) ×	0.2231*	6.4179**	6.5089***	0.2384**	0.9578
Ind. markup growth (t-1,t)	(0.121)	(2.781)	(2.079)	(0.119)	(1.263)
Tariff change (t-1,t) ×	0.0078	0.5576	-0.1079	0.0087	-0.3376*
Scale growth (t-1,t)	(0.008)	(0.618)	(0.391)	(0.007)	(0.195)
Ind. markup growth	-0.0101	-0.0873	-0.3162***	-0.0080	-0.0618
	(0.007)	(0.127)	(0.092)	(0.007)	(0.078)
Scale growth	-0.0272***	-0.4980***	-0.6316***	-0.0260***	-0.0780***

	(0.001)	(0.020)	(0.015)	(0.001)	(0.011)
STFP (t-1)	-0.0130***	-0.2260***	-0.0100	-0.0123***	-0.0221
	(0.002)	(0.051)	(0.030)	(0.002)	(0.023)
ln(employment) (t-1)	0.0247***	0.4311***	1.0524***	0.0210***	0.0293
	(0.002)	(0.038)	(0.016)	(0.002)	(0.022)
Innovator (t-1)	0.0101***	0.1066***	0.3357***	0.0079***	0.0165
	(0.003)	(0.041)	(0.031)	(0.003)	(0.014)
Multi-product (t-1)	0.0006	0.0448	-0.1307***	0.0005	-0.0108
	(0.002)	(0.038)	(0.025)	(0.002)	(0.015)
ln(age) (t-1)	0.0037***	0.1396***	-0.1020***	0.0028**	0.0222*
	(0.001)	(0.027)	(0.013)	(0.001)	(0.013)
Capital intensity (t-1)	0.0000***	0.0002	0.0013***	0.0000***	0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Skill intensity (t-1)	-0.0000	-0.0002	0.0078***	0.0000	-0.0003
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Plant FE	Yes	Yes	Yes	Yes	Yes
Industry (2-digit) FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	278,054	43,268	278,054	269,339	8,715
Adj R-squared	0.347			0.342	0.403
Number of plants	87,994	9,818	87,994	86,275	3,178

FE = fixed effects, Ind. = industry, LPM = linear probability model, RE = random effects, STFP = standardized TFP, TFP = total factor productivity.
Notes: Clustered robust standard errors at the plant level are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.
Source: Authors' calculation.

We use alternative estimation methods such as the fixed effect logit and random effect logit models in columns (2) and (3). The results are consistent with those in column (1). In columns (4) and (5), we divide our full sample into samples of small plants whose employment is less than 100 and medium-sized and large plant samples. The results show that this positive effect of import tariff reduction is only observed amongst small plants in column (4). In column (5) of the results with large plants, industry markup growth does not identify the effect of the import tariff cut on export entry. However, the interaction term of tariff change and scale growth is significantly negative and the coefficient on tariff change turns out to be positive but insignificant. This implies that the effect of the import tariff cut on new export entry is detected for medium-sized and large plants through the domestic scale growth. Here, given that they have negative (positive) scale growth, the import tariff cut affects large plants to increase (decrease) the likelihood of export inauguration.

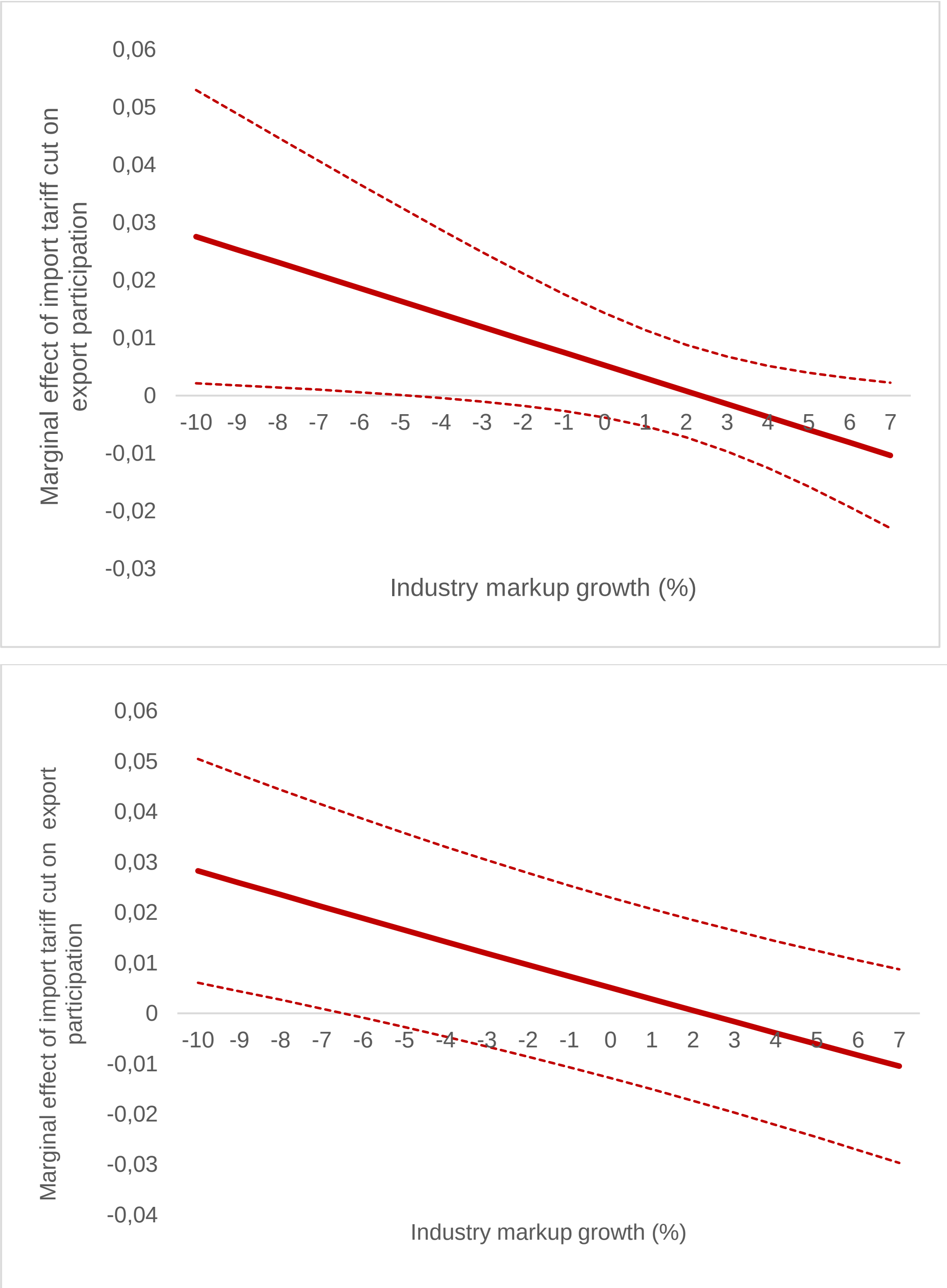
The main result of the positive tariff cut effect on export inauguration in the industry, with negative markup growth, is likely to be driven by the results with small plants. Note that about 94% of total observations are those of small plants. This sub-sample result may also strengthen the escape competition channel as the small plants increase their export inauguration in response to heightened domestic industry competition driven by import tariff cuts, while large plants (presumably with a large domestic market share) determine whether to start new exports according to changes in their domestic sales, not markups. Small plants can be innovative but vulnerable to domestic competition. Thus, small domestic plants in particular would have more incentives to diversify their market in response to external shocks (tariff cuts on their domestic output).

Figure 2 evaluates the marginal effect of domestic output import tariff cuts on the probability of domestic plants' export entry with respect to industry markup growth using the results in both columns (1) and (3) of Table 2. We compute the marginal effect at various levels of industry markup growth, ranging from –10% to 7%. Figure 2 clearly shows that a significantly positive effect of domestic output import tariff cuts on domestic plants' export participation in foreign markets is greater when industry markup growth is more negative.

Figure 2: Import Tariff Cut Effect on Export Market Participation

Column (2) of Table 2

Column (4) of Table 2



Source: Authors' calculation.

Table 3 shows the results for intensive margins. The dependent variable is annualised changes in export volume between *t-1* and *t*. We do not find any evidence that domestic output import tariff cuts significantly affect incumbent exporters' export growth in the foreign market via either channel. This suggests that changes in tariffs on exporters' domestic output do not have significant effects on their incumbent exports. To understand these insignificant results more deeply, we implement sub-sample regression according to firm size and export–sales ratio for incumbent exporters. Here, we compute an individual plant’s average export–sales ratio for the sample period and separate the full sample into two sub-samples based on the median export–sales ratio (=0.125).

We first look at the differences in export volume growth between small and large exporters, but do not find any significant difference in the intensive margin driven by import tariff cuts between small and large plants. Note that amongst exporters, 79% of total observations belong to small plants. However, when we separate our sample using the export–sales ratio, we find that plants with smaller export–sales (less than the 0.125) respond to import tariff cuts through scale channels rather than competition channels. We also evaluate the marginal effect of the tariff changes according to domestic sales growth. The plants that face higher positive (negative) domestic sales growth are likely to increase (decrease) export growth in response to import tariff cuts. Thus, we show that the domestic sales growth and export growth are complements in response to the reduction in domestic output import tariffs

Table 3: Intensive Margins

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Dependent variable	**Export volume growth between t-1 and t**				
		Small plants <100	**Large plants >100**	**Low export to sales**	**High export to sales**
Tariff change (t-1,t)	0.219	0.648	-0.485	0.946*	-0.367
	(0.369)	(0.466)	(0.496)	(0.564)	(0.286)
Tariff change (t-1,t) ×	0.290	1.636	-1.782	4.841	-0.717
Ind. markup gr. (t-1,t)	(1.636)	(2.007)	(2.682)	(3.626)	(1.586)
Tariff change (t-1,t) ×	-0.311	-0.614	-0.087	-1.766**	0.523
Scale growth (t-1,t)	(0.760)	(0.955)	(0.617)	(0.854)	(0.351)
Ind. markup growth	0.066	0.070	0.127	0.268	0.011
	(0.067)	(0.086)	(0.110)	(0.177)	(0.067)
Scale growth	-0.263***	-0.256***	-0.305***	-0.025	-0.278***
	(0.013)	(0.014)	(0.026)	(0.052)	(0.013)
STFP (t-1)	-0.712***	-0.842***	-0.535***	-0.361***	-0.787***

	(0.035)	(0.046)	(0.063)	(0.078)	(0.039)
ln(employment) (t-1)	-0.342***	-0.344***	-0.217***	-0.272***	-0.340***
	(0.026)	(0.033)	(0.049)	(0.058)	(0.029)
Innovator (t-1)	-0.036**	-0.027	-0.053**	-0.026	-0.041**
	(0.017)	(0.023)	(0.026)	(0.036)	(0.018)
Multi-product (t-1)	-0.042**	-0.068***	0.019	-0.021	-0.046**
	(0.019)	(0.025)	(0.033)	(0.044)	(0.021)
ln(age) (t-1)	-0.113***	-0.119***	-0.106***	-0.085***	-0.118***
	(0.016)	(0.020)	(0.028)	(0.033)	(0.018)
ln(Capital intensity) (t-1)	-0.096***	-0.096***	-0.079***	-0.084***	-0.094***
	(0.013)	(0.016)	(0.021)	(0.027)	(0.014)
ln(Skill intensity) (t-1)	0.002	-0.001	-0.004	0.049	-0.013
	(0.017)	(0.022)	(0.029)	(0.041)	(0.018)
Plant FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	45,941	31,454	14,487	14,911	31,030
R-squared	0.334	0.408	0.262	0.352	0.326
Number of plants	14,614	12,148	3,523	5,782	8,832

FE = fixed effects, Ind. = industry, LPM = linear probability model, RE = random effects, STFP = standardized TFP, TFP = total factor productivity.
Notes: Clustered robust standard errors at the plant level are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.
Source: Authors' calculation.

4.2. Robustness

To support our main findings, we check the robustness of our results. First, this study emphasises that changes in *output* import tariffs affect industry competition, and thereby domestic firms' decisions about beginning to export. However, changes in *input* tariffs directly influence firms' export decisions through changes in cost and efficiency. For instance, input tariff reductions would help domestic firms become more competitive by enhancing cost efficiency as well as increasing production, so domestic firms attaining higher cost efficiency would start entering the export market. In sum, while input import tariff cuts are likely to have a positive effect on domestic firms' participation in export markets, the channel through which the input tariff cuts affect firms' export decisions is different from that of output tariff cuts. Thus, it is expected that the escape competition channel would not be revealed when introducing input import tariff changes.

We compare the effect of output import tariffs and that of input import tariffs on plant export entry. Columns (1)–(3) of Table 4 show the results with output tariff changes and columns (4)–(6) show those with input tariff changes. The results with output tariff changes are consistent with our main results in Table 2. However, the results with input tariff changes show that both scale and competition mechanisms do not work – the estimated coefficient on the interaction terms of industry input tariff changes and industry markup growth turn out to be insignificant as expected.

Table 4: Output Tariff vs Input Tariff

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Dependent variable	**Export participation between t-1 and t (binary variable)**					
	5-digit industry output tariff			**5-digit industry input tariff**		
	FE LPM	**FE logit**	**RE logit**	**FE LPM**	**FE logit**	**RE logit**
Tariff change (t-1,t)	-0.0124**	-0.5609	-0.3794	-0.0160	-0.0382	-0.6612
	(0.006)	(0.461)	(0.306)	(0.044)	(1.575)	(1.291)
Tariff change (t-1,t) × Ind. markup growth(t-1,t)	0.2576**	5.1878**	6.1457***	-0.0726	-0.3273	-1.8037
	(0.123)	(2.411)	(1.810)	(0.374)	(6.950)	(5.681)
Tariff change (t-1,t) × Scale growth (t-1,t)	0.0014	-0.5062	-0.5926*	-0.0226	-0.1922	-2.5291
	(0.008)	(0.658)	(0.344)	(0.094)	(2.160)	(1.714)
Ind. markup growth	-0.0144**	-0.2096**	-0.4489***	-0.0156***	-0.2499**	-0.4855***
	(0.006)	(0.103)	(0.077)	(0.006)	(0.104)	(0.079)
Scale growth	-0.0277***	-0.5042***	-0.6398***	-0.0277***	-0.5019***	-0.6427***
	(0.001)	(0.019)	(0.014)	(0.001)	(0.019)	(0.015)
STFP (t-1)	-0.0131***	-0.2044***	-0.0411	-0.0131***	-0.2027***	-0.0405
	(0.002)	(0.047)	(0.028)	(0.002)	(0.047)	(0.028)
ln(employment) (t-1)	0.0250***	0.4341***	1.0596***	0.0250***	0.4343***	1.0591***
	(0.002)	(0.036)	(0.015)	(0.002)	(0.036)	(0.015)
Innovator (t-1)	0.0093***	0.0819**	0.3238***	0.0093***	0.0806**	0.3236***
	(0.003)	(0.038)	(0.029)	(0.003)	(0.038)	(0.029)
Multi-product (t-1)	0.0006	0.0449	-0.1071***	0.0006	0.0439	-0.1066***
	(0.002)	(0.035)	(0.024)	(0.002)	(0.035)	(0.024)
ln(age) (t-1)	0.0036***	0.1270***	-	0.0036***	0.1266***	-

			0.1072***			0.1074***
	(0.001)	(0.025)	(0.013)	(0.001)	(0.025)	(0.013)
Capital intensity (t-1)	0.0000***	0.0002	0.0010***	0.0000***	0.0002	0.0010***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Skill intensity (t-1)	0.0000	0.0004	0.0079***	0.0000	0.0004	0.0080***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Plant FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry (2-digit) FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	310,065	49,313	310,065	310,065	49,313	310,065
R-squared	0.017			0.017		
Number of pid	95,220	10,990	95,220	95,220	10,990	95,220

FE = fixed effects, Ind. = industry, LPM = linear probability model, RE = random effects, STFP = standardized TFP, TFP = total factor productivity.
Notes: Clustered robust standard errors at the plant level are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.
Source: Authors' calculation.

Second, we use alternative measures for industry competition and test the effect of tariff changes on extensive margins. Our baseline industry markup measure is constructed at the KSIC 3-digit level. Columns (1)–(2) of Table 5 introduce markup measures using more detailed industry classifications while column (3) employs a plant-level markup. The results in columns (1) and (2) support our main findings, and our results are not sensitive to the industry classification at which industry markup is constructed. However, the results with the plant-level markup lose statistical significance, particularly in the competition channel. This finding could be understood in that individual firms' markups would not contain the information of rival firms and not precisely capture the degree of competition in the industry (the extent to which a firm has market power compared with other firms in the industry). Columns (4)–(6) include alternative measures for industry competition amongst domestic firms. A shortcoming of this HHI measure (compared with industry markup) is that it does not capture the influence of foreign firms operating in the industry. We introduce the HHI calculated as $\sum_{k \in j} s_{kt}^2$, where s_{kt} is the domestic market share of firm *k* in the 3-, 4-, or 5-digit industry *j* at time *t*. The results in columns (4) and (5) are consistent with our main findings, whereas the results with 5-digit HHI in column (6) show insignificant results.

Table 5: Robustness Check – Different Markup Measures and HHI Measures

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	**Export participation between t-1 and t (binary variable)**					
	RE logit					
Measure for competition	**4-digit markup**	**5-digit markup**	**Firm level markup**	**3-digit HHI**	**4-digit HHI**	**5-digit HHI**
Tariff change (t-1,t)	-0.0808	-0.0875	-0.1902	-0.8017***	-0.5018	0.0478
	(0.255)	(0.261)	(0.312)	(0.294)	(0.317)	(0.286)
Tariff change (t-1,t) × Competition change (t-1,t)	5.1796***	3.1703**	0.0069	39.6751***	11.7227*	-0.6836
	(1.973)	(1.502)	(0.009)	(9.416)	(6.322)	(3.206)
Tariff change (t-1,t) ×	-0.3163	-0.5104	-0.7118	-0.3129	-0.3139	-0.2950
Scale growth (t-1,t)	(0.620)	(0.662)	(0.473)	(0.361)	(0.376)	(0.390)
Competition change	-0.2301**	-0.1578*	0.0028***	-0.7401*	-0.0817	0.7704***
	(0.092)	(0.083)	(0.000)	(0.394)	(0.219)	(0.108)
Scale growth	-0.6325***	-0.6346***	-0.9162***	-0.6380***	-0.6380***	-0.6390***
	(0.021)	(0.021)	(0.026)	(0.017)	(0.017)	(0.017)
STFP (t-1)	-0.0086	-0.0080	0.0399	0.0136	0.0136	0.0134
	(0.033)	(0.033)	(0.040)	(0.028)	(0.028)	(0.028)
ln(employment) (t-1)	1.0522***	1.0527***	1.0521***	1.0596***	1.0587***	1.0549***
	(0.016)	(0.016)	(0.020)	(0.014)	(0.014)	(0.014)
Innovator (t-1)	0.3350***	0.3369***	0.3757***	0.3412***	0.3408***	0.3371***
	(0.031)	(0.031)	(0.038)	(0.027)	(0.027)	(0.027)
Multi-product (t-1)	-0.1306***	-0.1302***	-0.1536***	-0.0901***	-0.0904***	-0.0928***
	(0.025)	(0.025)	(0.031)	(0.022)	(0.022)	(0.022)
ln(age) (t-1)	-0.1019***	-0.1030***	-0.0458**	-0.0979***	-0.0973***	-0.0962***

	(0.014)	(0.014)	(0.018)	(0.012)	(0.012)	(0.012)
Capital intensity (t-1)	0.0013***	0.0013***	0.0010***	0.0010***	0.0010***	0.0010***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Skill intensity (t-1)	0.0078***	0.0078***	0.0062***	0.0094***	0.0094***	0.0094***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Plant FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry (2-digit) FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	278,048	277,971	190,697	398,685	398,685	398,685
Number of pid	87,992	87,983	62,373	125,972	125,972	125,972

FE = fixed effects, HHI = Herfindahl-Hirschman Index, Ind. = industry, LPM = linear probability model, RE = random effects, STFP = standardized TFP, TFP = total factor productivity.
Notes: Clustered robust standard errors at the plant level are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.
Source: Authors' calculation.

While we focus on the effect of domestic import competition on domestic firms' export participation using the argument on escape competition, previous studies such as Aghion et al. (2001) theorised the effect of competition on innovation but not on exports. They find a nonlinear relationship between competition and firms' innovation, and coin the term of escape competition, whereby higher competition leads to firms' innovation activity, particularly for neck and neck firms to escape from competition with rival firms. Hence, Table 6 includes R&D growth (innovation input) as the dependent variable to check this original escape-competition effect, instead of export market participation and export volume growth. We do not find significant evidence on the escape-competition towards innovation, whereas our main results imply that there is escape competition towards another market (export inauguration).[5]

[5] This might be because we exploit annual variations of R&D and tariff changes, but not their longer-term variations.

Table 6: Competition on Innovation

	(1)	(2)	(3)	(4)	(5)
Dependent variable	**R&D growth between t-1 and t**				
				Small plants <100	**Large plants >100**
	Domestic firms (Never exporters)	**Domestic firms with no exports**	**Domestic and exporters**	**Domestic firms with no exports**	**Domestic firms with no exports**
Tariff change	-0.322	0.743	-1.229	0.478	1.965
	(0.562)	(0.708)	(0.929)	(0.783)	(1.525)
Tariff change ×	-2.684	-0.061	-3.967	1.107	-19.009*
Ind. markup growth	(3.076)	(4.445)	(4.404)	(4.506)	(11.486)
Tariff change ×	0.746	-1.011	2.172	-2.766	-0.651
Scale growth	(0.964)	(1.612)	(1.432)	(1.948)	(1.831)
Ind. markup growth	-0.031	0.177	-0.173	0.159	0.068
	(0.116)	(0.204)	(0.160)	(0.221)	(0.680)
Scale growth	0.065***	0.159***	0.041	0.203***	-0.100
	(0.020)	(0.046)	(0.026)	(0.050)	(0.139)
STFP (t-1)	-0.013	0.029	0.014	0.078	-0.128
	(0.053)	(0.088)	(0.081)	(0.102)	(0.236)
ln(employment) (t-1)	-0.204***	-0.092	-0.291***	-0.123	0.169
	(0.038)	(0.073)	(0.057)	(0.086)	(0.214)
Multi-product (t-1)	-0.005	0.014	0.005	0.049	-0.018
	(0.035)	(0.064)	(0.047)	(0.072)	(0.160)
ln(age) (t-1)	-0.042	-0.007	-0.050	-0.021	0.143
	(0.029)	(0.053)	(0.036)	(0.059)	(0.134)
ln(Capital intensity) (t-1)	-0.093***	-0.082*	-0.098***	-0.074	0.002
	(0.025)	(0.046)	(0.035)	(0.052)	(0.131)
ln(Skill intensity) (t-1)	-0.005	-0.010	-0.022	0.000	-0.037
	(0.032)	(0.057)	(0.045)	(0.067)	(0.127)
Plant FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	20,555	9,369	11,186	7,550	1,819
R-squared	0.058	0.054	0.069	0.058	0.077
# of plants	8,725	5,521	4,574	4,714	959

FE = fixed effects, Ind. = industry, LPM = linear probability model, R&D = research and development, RE = random effects, STFP = standardized TFP, TFP = total factor productivity.
Notes: Clustered robust standard errors at the plant level are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.
Source: Authors' calculation.

5. Conclusion

This study examined the effects of cutting domestic output import tariffs on domestic plants export dynamics and clarified the underlying mechanism, using rich Korean plant–product data for 1991–2002. We found that import trade liberalisation (output import tariff cuts) increases domestic plants' new entry into the export market (extensive margins), particularly for industries that face more fierce competition during the tariff reduction. Interestingly, this finding is only observed with output tariff cuts, but not input tariff cuts. In addition, we find that cutting domestic output import tariffs does not affect incumbent exporters' export volume significantly (intensive margins). This study unveils a new mechanism – escape competition – by showing that reducing output import tariffs leads domestic firms facing heightened industry competition (a decrease in industry markup) to look for new opportunities in foreign markets.

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Appendix: Estimation of Firm-Level Markup (De Loecker and Warzynski, 2012)

Consider the cost minimisation problem for firm *i* at time *t* with value-added production technology, $Q_{it} = f(L_{it}, K_{it}, \omega_{it})$, where L_{it} denotes labour, which is the only variable input, K_{it} is capital, and ω_{it} denotes firm-level efficiency. Assume that $Q_{it}(\cdot)$ is continuous and twice differentiable for each of its arguments. Let w_{it} and r_{it} be firm-specific input prices for labour and capital, respectively. Then, the first-order condition for cost minimisation indicates that

$$\frac{\partial Q_{it}(\cdot)}{\partial L_{it}} = \frac{1}{\lambda_{it}} w_{it} \tag{A1}$$

where λ_{it} measures the marginal cost of production. By multiplying both sides of equation (A1) by the labour share to output L_{it}/Q_{it} and rearranging it, we obtain

$$\frac{\partial Q_{it}(\cdot)}{\partial L_{it}} \frac{L_{it}}{Q_{it}(\cdot)} = \frac{1}{\lambda_{it}} \frac{w_{it} L_{it}}{Q_{it}} \tag{A2}$$

The markup, μ_{it} , is simply defined as $\mu_{it} \equiv \frac{P_{it}}{\lambda_{it}}$, where P_{it} denotes the output price for firm *i* at time *t*. Then, we can rearrange equation (A2) as follows:

$$\mu_{it} = \frac{\partial Q_{it}}{\partial L_{it}} \frac{L_{it}}{Q_{it}} / \frac{w_{it} L_{it}}{P_{it} Q_{it}} = \frac{\theta_{it}^{L}}{\alpha_{it}^{L}} \tag{A3}$$

where θ_{it}^{L} denotes the output elasticity of labour input and α_{it}^{L} is the share of expenditure on labour input in total sales ($P_{it}Q_{it}$). The latter can be obtained directly from the data and, thus, θ_{it}^{L} only needs to be estimated to obtain the markup measure, μ_{it} for firm *i* at time *t*.

To estimate the output elasticity, De Loecker and Warzynski (2012) introduce a detailed procedure of production function estimation. In addition, they consider production functions with a scalar Hicks-neutral productivity term and common technology parameters across the set of producers. According to these two conditions, they express the production function as follows:

$$Q_{it} = f(L_{it}, K_{it}; \beta_L) \exp(\omega_{it}) \tag{A4}$$

where a set of time-invariant coefficients β_L govern the transformation of labour to units of output, combined with the firm's productivity, ω_{it}. De Loecker and Warzynski (2012) argue that the main advantage of assuming production technologies of (A4) is its reliance on the proxy methods suggested by Ackerberg, Caves, and Frazer (2006) to obtain consistent estimates of β_L. Hence, by estimating the log version of equation (A1), they recover the output elasticity of labour, $\theta_{it}^{L} = \frac{\partial \ln Q(\cdot)}{\partial \ln L_{it}}$. Refer to De Loecker and Warzynski (2012) for details of the estimation procedure of the production function parameters.

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