

Impact of China on Korea's Manufacturing Plants: The Role of Intermediate Goods Trade

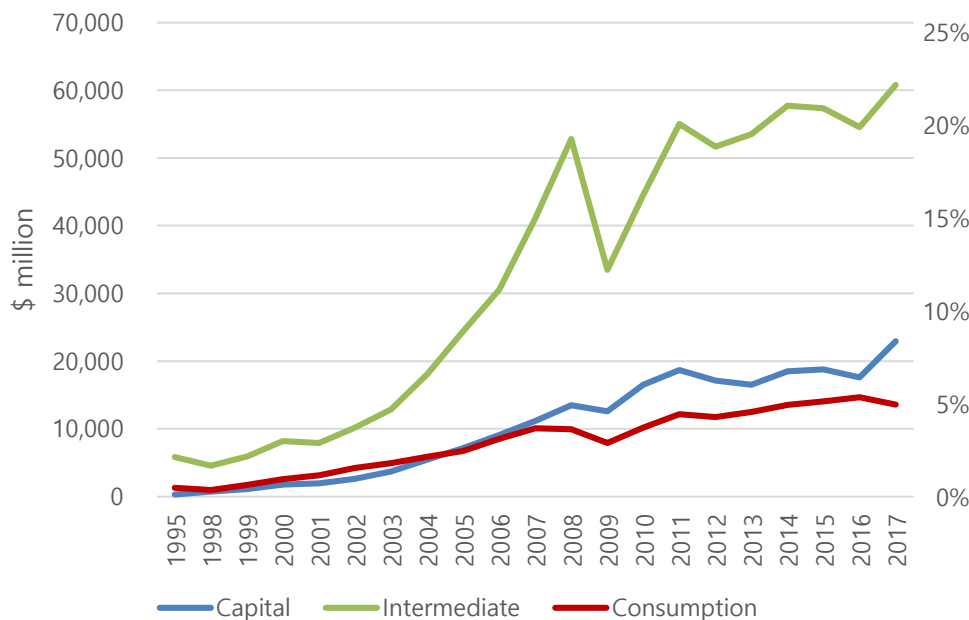
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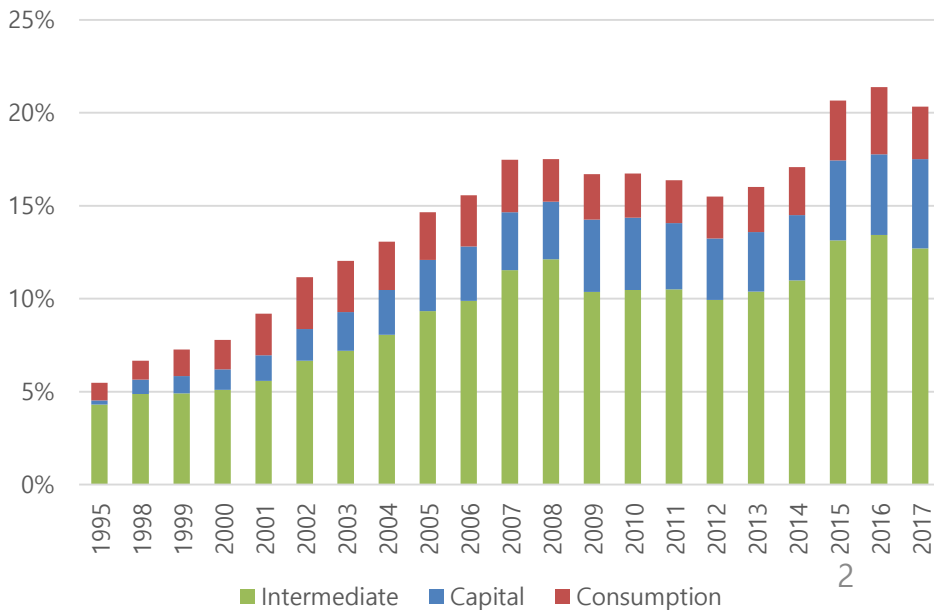
Motivation: Key Facts about South Korea's Trade with China

- The import share of China in Korea increased from 5.5% in 1995 to 20.5% in 2017
- A distinctive departure from the patterns of other developed countries' trade with China is that intermediate goods make up a significantly large portion of Korea's imports from China.

Korea Import from China



Import Share of China

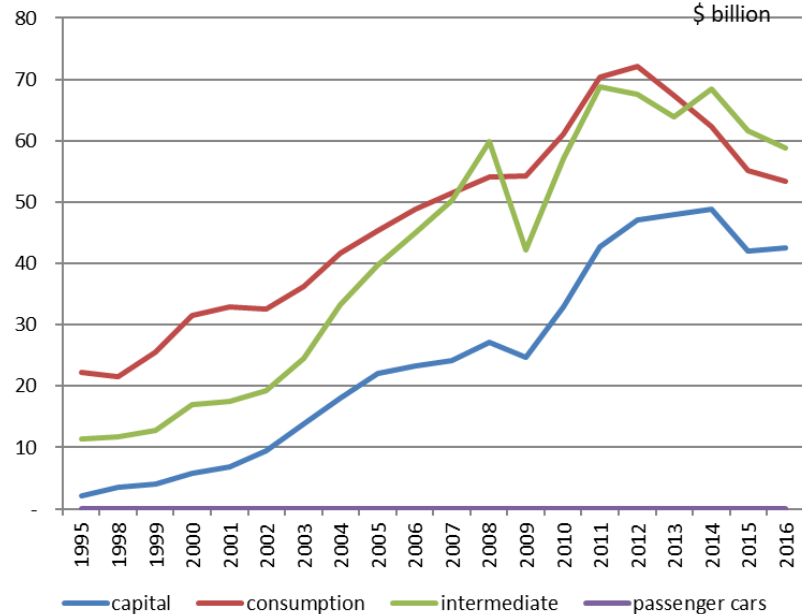


Motivation: Key Facts about South Korea's Trade with China

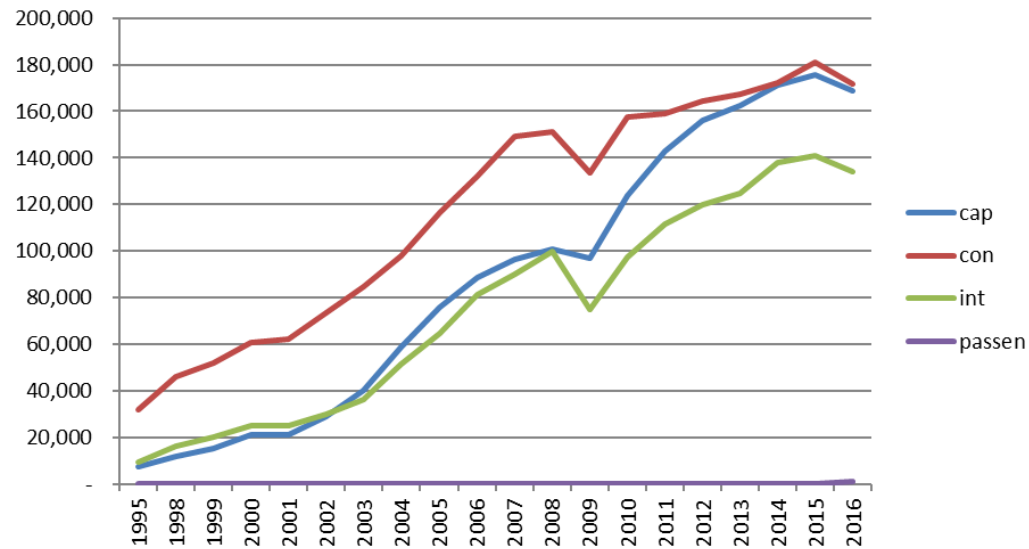
- For example, consumer goods make up more than 35% of total imports in Japan and in the US, while it is only about 10% in Korea.

Japan Import from China

Unit :
\$ billion



USA Import from China



This paper

- ❑ This paper investigates the impact of Chinese imports on Korean manufacturing plants and industries.
 - What is the impact of 'output' import penetration on productivity, markups, employment, and plant survival rates?
 - How does the effect differ for 'input' import penetration?
 - How does the Chinese imports affect the Korea's industry level productivity and employment (reallocation Vs. within-firm performance)?

This paper

- ❑ This paper is motivated by the literature which studies the impact of rising Chinese import competition on the firms, industries and labor markets.
 - Autor, Dorn, Hanson (2013), Acemoglu, Autor, Dorn, Hanson (2016), and Pierce and Schott (2016) show that rising Chinese imports cause a significant decline in the US manufacturing employment.
 - Autor, Dorn, Hanson (2017) show that rising China import competition stifle innovation, documenting its negative impact on patent production within trade-exposed firms
 - In addition, Bernard, Jensen, and Schott (2006) find that plant survival and employment growth are negatively associated with industry exposure to low-wage country imports.

This paper

- We find that, in South Korea,
 1. 'output' import penetration rate from China increase TFP but not markups and 'input' rate from China does not raise TFP but raise markups.
 2. 'input' import penetration rate from China is important factor that reduces employment growth but increases plant's survival rate

Literature & Contributions

- ❑ A large literature on the effects of trade openness on firm performances, productivity, markups, employment, growth, etc.
 - Pro-competitive effects
 - Access to inputs at a cheaper prices
 - Innovations
 - Learning-by-doing
 - Access to better inputs and new input varieties
 - Quality upgrading
 - Reduction of X-inefficiencies and management practices.

Literature & Contributions

- ❑ A large literature on the effects of trade openness on firm performances, productivity, employment, markups, growth, etc.
 - 1) Developed countries' exposure to low-wage countries:
 - In contrast to the findings in the US (e.g., Bernard et al., 2016; Autor et al., 2017), Bloom et al. (2013) show Chinese import competition led to increased innovation within firms, and reallocated employment between firms towards more technologically advanced firms, in European countries.
 - Balsvik et al. (2015) show that import competition from China have negative employment effects in Norway.
 - Using Belgian manufacturing firm-level data, Mion and Zhu (2013) Industry-level import competition from China reduces firm employment growth and induce skill upgrading in low-tech manufacturing industries.

Literature & Contributions

- ❑ A large literature on the effects of trade openness on firm performances, productivity, employment, markups, growth, etc.

2) Developing countries' exposure to China:

- Amiti and Konings (2007) show, using **Indonesian manufacturing data**, Lower output tariffs can increase productivity by inducing tougher import competition, whereas cheaper imported inputs can raise productivity via learning, variety, and quality effects.
- On the other hand, Mexico experienced a negative and significant impact on employment and plant growth (Utar and Ruiz, 2013)

Using the India's rapid trade liberalization episodes,

- Topalova and Khandelwal (2011) show that pro-competitive forces, (resulting from lower tariffs on final goods) as well as access to better inputs (due to lower input tariffs) both appear to have increased firm-level productivity.
- De Loecker et al. (2016) show that the price declines are small relative to the declines in marginal costs, which fall predominantly because of the input tariff liberalization. The reason for this incomplete cost pass-through to prices is that firms offset their reductions in marginal costs by raising markups.

Literature & Contributions

- ❑ A large literature on the effects of trade openness on firm performances, productivity, employment, markups, growth, etc.
 - 2) Developing countries' exposure to China:
 - Medina (2015) shows that China's entry into the WTO in 2001 led Peruvian garment industries to **upgrade its quality**, which led to a substantial growth in exports.

Literature & Contributions

- Large literature on “the effects of trade on firm productivity”
- On the background:
Trade liberalization => Firm efficiency
- Many studies use trade liberalization episodes to study the productivity gains either from within-firm improvements (productive efficiency gains) or from reallocation towards into large, more productive firms(allocative efficiency gains).
- The productivity in those studies usually captures profitability which depends on physical efficiency as well as prices and costs(markups).
- Understanding whether opening up markets induce increase in physical efficiency or increase in markups can offer insights on the source of the gains from trade.

Literature & Contributions

- Opening up markets through changes in trade policy (i.e. tariff reduction) can
 1. increase import competition and make domestic firms lower price and markups or make domestic firms to increase their physical efficiency
 2. Lower marginal costs for domestic firms from using cheaper intermediate goods or from increased physical efficiency.
=> raise markups when this cost saving is not perfectly passed through to prices.
- This paper considers the fast growth in Chinese import penetration in Korea as a trade liberalization episode and studies the effects on both productivity and markups of manufacturing plants in Korea.

How I measure the impact of China

- Import penetration rate of China in each industry represents the industry's exposure to international trade with China

I utilize the difference in the level of import competition from China across Korean manufacturing industries (ISIC 4-digit) to identify the impact of China's trade integration.

- The source of the growth
 - ✓ Distinguish import penetration rate of China for final goods and intermediate goods
 - ✓ Construct input import penetration rate using I/O tables.
 - ✓ One measures the import competition from China and the other measures the availability of Chinese goods as an imported inputs

Data

- Longitudinal plant-level data from 1995 to 2013 in the Mining and Manufacturing Survey, Statistics Korea
 - censored census
 - establishments with at least 10 employees in manufacturing industries
 - unbalanced panel of 52,391 plants (1995) => 64,332 (2013)

In 2012, compared to the manufacturing industry, data represent

Number of plants	Employees	Gross output
17%	72%	87%

Source: 1) Gross output: Input-Output table from the Bank of Korea
 2) Number of plants and employees: Bank of Korea

Data: Import penetration from China

- Import penetration rate from China in industry s

$$CPEN_{st}^O \equiv \left(\frac{IM_{st}^C}{IM_{st} + Q_{st} - EX_{st}} \right)$$

IM_{st}^C : imports from China

IM_{st} : imports from all countries

Q_{st} : domestic gross output

EX_{st} : exports

- Input import penetration rate from China

$$CPEN_{st}^I \equiv \sum_n a_{nt} CPEN_{nt}^O$$

a_{nt} : input share of industry n in industry s

Source: 1) Trade data: UN comtrade Database

2) Gross production data: Mining and Manufacturing Survey, Statistics Korea

3) Input/Output table: Bank of Korea

Data: Import Penetration from China

Industry	1992	1997	2002	2007	2012
Food and Beverages	1.1	1.7	2.1	3.1	2.2
Textiles	9.5	13.0	11.3	21.7	16.3
Apparel	9.5	7.1	12.8	18.9	13.3
Leather	1.4	11.7	10.2	26.7	24.7
Wood	1.6	4.5	5.9	4.9	4.6
Petroleum	0.1	0.5	1.3	1.2	0.4
Chemicals	1.0	1.7	1.9	4.8	4.4
Rubber and Plastic	0.1	0.5	0.8	2.5	2.6
Non-metallic Mineral	2.3	1.2	3.1	6.4	7.6
Basic Metal	1.3	4.6	2.3	10.2	6.4
Fabricated Metal	0.5	0.9	1.7	4.4	5.7
Machinery and Equipment	0.2	0.5	1.1	3.7	4.5
Office, Accounting and Computing Machinery	9.1	2.5	9.1	635.2	157.1
Electrical Machinery	0.5	2.7	4.9	8.4	7.6
Radio, Television and Communication Equipment	0.4	2.1	3.3	3.0	2.8
Motor Vehicles	0.0	0.0	0.1	0.8	1.1
Other Transport Equipment	0.0	0.5	1.0	1.5	3.4
Furniture and Miscellaneous	2.2	5.4	7.1	13.2	10.8
Manufacturing Total	0.9	2.1	3.7	5.7	6.2

Estimation

Estimation of Productivity

$$q_{it} = \alpha_{sl}l_{it} + \alpha_{sk}k_{it} + \alpha_{sm}m_{it} + \omega_{it} + \varepsilon_{it}$$

ω_{it} : persistent productivity term,

ε_{it} : transitory shock including measurement error

- Estimate α_{sl} , α_{sk} and α_{sm} , the elasticity parameters of labor, capital, and intermediate inputs for each of two-digit industries
- Adopt the generalized method of moments(GMM) estimator, methodology used in De Loecker and Warzynski (2012), to control for endogeneity problem and to calculate TFP and markups

Estimation

Estimation of Productivity

$$q_{it} = \alpha_{sl}l_{it} + \alpha_{sk}k_{it} + \alpha_{sm}m_{it} + \omega_{it} + \varepsilon_{it}$$

- Plants' intermediate inputs were used as a proxy for unobserved (to researcher) shock to productivity
- Proxy for productivity is obtained by inverting demand for material input
 - $m_{it} = m(l_{it}, k_{it}, \omega_{it}, CPEN_{st-1}^O, CPEN_{st-1}^I)$
- Included input and output import penetration rate from China explicitly since they can affect optimal input choice

Estimation

- As in Brandt et al.(2017), growth of productivity is estimating

$$\Delta TFPR_{it} = \Delta \omega_{it} + \Delta \varepsilon_{it} + (\Delta p_{it}^Q - \Delta \bar{p}_t^Q) - \alpha_m (\Delta p_{it}^M - \Delta \bar{p}_t^M)$$

- Define markup as the difference in price to marginal cost

$$\mu_{it} = \left(\frac{p^Q}{MC} \right)_{it} = \frac{\alpha_m}{S_{it}^M}$$

- Final equation is derived from cost minimization conditions for variable inputs and is the ratio of an input's output elasticity to its input share in revenue where

$$S_{it}^M = \frac{\exp(m_{it}^n)}{\exp(r_{it} - \hat{\varepsilon}_{it})}$$

Empirical Methods

Plant level OLS regression model on $\Delta Y_{it:t+3}$, the growth of productivity, markup and employment of plant i

$$\begin{aligned} \Delta Y_{it:t+3} &= c + Z'_{it}\alpha + \beta_0 CPEN^O_{st-1} + \beta_1 CPEN^I_{st-1} + \beta_2 OPEN^O_{st-1} + \beta_3 EX_{st-1} + X'_{it}\gamma \\ &+ \delta_t + \delta_s + \delta_i + \epsilon_{it} \end{aligned}$$

Z'_{it} : (plant characteristics) age, (lagged log values of) TFP, employment, capital intensity

EX_{st} : (industry characteristics) export share

X'_{it} : cross terms of plants' TFP and capital intensity with input and output import penetration rate from China.

δ_t : time fixed effects

δ_s : industry fixed effects

δ_i : plant fixed effects

Empirical Results

Results on the productivity growth

	(1)	(2)	(3)	(4)
$\ln(\text{employment}_{it-1})$	0.008**(0.003)	0.008**(0.003)	0.008**(0.003)	0.008**(0.003)
$\ln(\text{capital intensity}_{it-1})$	0.002(0.003)	0.002(0.003)	-0.017**(0.008)	-0.034**(0.014)
$\ln(\text{TFP}_{it-1})$	-0.151*** (0.007)	-0.151*** (0.007)	-0.139*** (0.013)	-0.133*** (0.022)
$\ln(\text{CPEN}_{st-1}^O)$	0.007*** (0.001)	0.007*** (0.002)	0.005*** (0.002)	0.006*** (0.002)
X $\ln(\text{TFP}_{it-1})$			0.003(0.003)	0.002(0.003)
X $\ln(\text{capital intensity}_{it-1})$			-0.005*** (0.002)	-0.003(0.002)
$\ln(\text{CPEN}_{st-1}^I)$		-0.001(0.003)	-0.001(0.003)	-0.006(0.004)
X $\ln(\text{TFP}_{it-1})$				0.003(0.008)
X $\ln(\text{capital intensity}_{it-1})$				-0.007(0.005)
$\ln(\text{OPEN}_{st-1}^O)$	-0.005** (0.003)	-0.005** (0.003)	-0.005** (0.003)	-0.005** (0.003)
$\ln(\text{export share}_{st-1})$	0.000(0.002)	0.000(0.002)	-0.001(0.002)	-0.001(0.002)
Plant, Industry, Year fixed effects	Yes	Yes	Yes	Yes
N	203,864	203,485	203,485	203,485
Within R²	0.017	0.017	0.017	0.017

Empirical Results

Results on the markup growth

	(1)	(2)	(3)	(4)
$\ln(\text{employment}_{it-1})$	-0.017***(0.004)	-0.018***(0.004)	-0.016***(0.004)	-0.017***(0.004)
$\ln(\text{capital intensity}_{it-1})$	0.065***(0.005)	0.066***(0.005)	0.068***(0.012)	0.099***(0.023)
$\ln(\text{TFP}_{it-1})$	-0.098***(0.011)	-0.099***(0.011)	-0.150***(0.021)	-0.210***(0.036)
$\ln(\text{CPEN}_{st-1}^O)$	0.003**(0.002)	0.002(0.002)	0.000(0.002)	-0.001(0.002)
X $\ln(\text{TFP}_{it-1})$			-0.013***(0.004)	-0.004(0.004)
X $\ln(\text{capital intensity}_{it-1})$			0.001(0.002)	-0.003(0.003)
$\ln(\text{CPEN}_{st-1}^I)$		0.010**(0.005)	0.010**(0.005)	0.014**(0.006)
X $\ln(\text{TFP}_{it-1})$				-0.028***(0.010)
X $\ln(\text{capital intensity}_{it-1})$				0.014**(0.007)
$\ln(\text{OPEN}_{st-1}^O)$	-0.009***(0.003)	-0.009***(0.003)	-0.009***(0.003)	-0.010***(0.003)
$\ln(\text{export share}_{st-1})$	0.000(0.003)	0.000(0.003)	0.001(0.003)	0.001(0.003)
Plant, Industry, Year fixed effects	Yes	Yes	Yes	Yes
N	181,319	181,279	181,279	181,279
Within R²	0.011	0.011	0.011	0.012

Empirical Results

Results on the growth of productivity and markup

	Productivity		Markup	
	1995~2002	2003~2013	1995~2002	2003~2013
$\ln(\text{employment}_{it-1})$	0.010*(0.006)	-0.005(0.006)	0.007(0.007)	-0.013*(0.007)
$\ln(\text{capital intensity}_{it-1})$	0.013(0.029)	-0.031(0.02)	0.128*** (0.046)	0.099*** (0.034)
$\ln(TFP_{it-1})$	-0.04(0.042)	0.011(0.036)	-0.161** (0.066)	-0.143** (0.059)
$\ln(CPEN_{st-1}^O)$	0.006*(0.003)	0.007** (0.004)	0.001(0.003)	-0.006(0.004)
X $\ln(TFP_{it-1})$	0.004(0.005)	0.000(0.006)	-0.004(0.006)	0.007(0.009)
X $\ln(\text{capital intensity}_{it-1})$	-0.002(0.003)	0.000(0.004)	0.001(0.004)	-0.004(0.005)
$\ln(CPEN_{st-1}^I)$	0.003(0.007)	-0.007(0.007)	0.01(0.009)	0.036*** (0.01)
X $\ln(TFP_{it-1})$	0.006(0.014)	0.028** (0.013)	-0.022(0.018)	-0.043** (0.018)
X $\ln(\text{capital intensity}_{it-1})$	0.002(0.009)	-0.012(0.008)	0.016(0.012)	0.028** (0.012)
$\ln(OPEN_{st-1}^O)$	-0.007(0.005)	-0.005(0.005)	-0.009* (0.005)	0.005(0.006)
$\ln(\text{export share}_{st-1})$	0.009* (0.005)	0.001(0.004)	-0.001(0.005)	-0.010* (0.005)
Plant, Industry, Year fixed effects	Yes	Yes	Yes	Yes
N	87,923	100,859	84,981	82,046
Within R²	0.006	0.009	0.012	0.003₃

Empirical Results

Results on the employment growth

	(1)	(2)	(3)	(4)
$\ln(\text{employment}_{it-1})$	-0.360***(0.005)	-0.360***(0.005)	-0.359***(0.005)	-0.359***(0.005)
$\ln(\text{capital intensity}_{it-1})$	0.002(0.003)	0.002(0.003)	0.024***(0.007)	0.038***(0.013)
$\ln(\text{TFP}_{it-1})$	-0.027***(0.006)	-0.027***(0.006)	-0.056***(0.011)	-0.071***(0.017)
$\ln(\text{CPEN}_{st-1}^O)$	0.001(0.002)	0.002(0.002)	0.004*(0.002)	0.003(0.002)
X $\ln(\text{TFP}_{it-1})$			-0.008***(0.002)	-0.005*(0.003)
X $\ln(\text{capital intensity}_{it-1})$			0.006***(0.002)	0.004*(0.002)
$\ln(\text{CPEN}_{st-1}^I)$		-0.010**(0.004)	-0.010**(0.004)	-0.007(0.005)
X $\ln(\text{TFP}_{it-1})$				-0.007(0.006)
X $\ln(\text{capital intensity}_{it-1})$				0.007(0.005)
$\ln(\text{OPEN}_{st-1}^O)$	-0.013***(0.003)	-0.013***(0.003)	-0.013***(0.003)	-0.013***(0.003)
$\ln(\text{export share}_{st-1})$	0.014***(0.003)	0.014***(0.003)	0.015***(0.003)	0.015***(0.003)
Plant, Industry, Year fixed effects	Yes	Yes	Yes	Yes
N	208,095	207,707	207,707	207,707
Within R²	0.089	0.089	0.089	0.089

Empirical Results

Results on the exit dummy

	(1)	(2)	(3)	(4)
$\ln(\text{employment}_{it-1})$	-0.056***(0.002)	-0.056***(0.002)	-0.056***(0.002)	-0.056***(0.002)
$\ln(\text{capital intensity}_{it-1})$	-0.002(0.002)	-0.003(0.002)	-0.030***(0.004)	-0.055***(0.007)
$\ln(\text{TFP}_{it-1})$	-0.014***(0.003)	-0.014***(0.003)	0.008(0.005)	0.01(0.009)
$\ln(\text{CPEN}_{st-1}^O)$	-0.000(0.001)	0.000(0.001)	-0.003**(0.001)	-0.001(0.001)
X $\ln(\text{TFP}_{it-1})$			0.006***(0.001)	0.006***(0.002)
X $\ln(\text{capital intensity}_{it-1})$			-0.008***(0.001)	-0.004***(0.001)
$\ln(\text{CPEN}_{st-1}^I)$		-0.005**(0.002)	-0.005**(0.002)	-0.013***(0.003)
X $\ln(\text{TFP}_{it-1})$				0.001(0.003)
X $\ln(\text{capital intensity}_{it-1})$				-0.012***(0.003)
$\ln(\text{OPEN}_{st-1}^O)$	0.011***(0.002)	0.011***(0.002)	0.011***(0.002)	0.011***(0.002)
$\ln(\text{export share}_{st-1})$	-0.016***(0.001)	-0.016***(0.001)	-0.017***(0.001)	-0.017***(0.001)
Plant, Industry, Year fixed effects	Yes	Yes	Yes	Yes
N	382,727	382,147	382,147	382,147
Within R^2	0.476	0.476	0.477	0.477

Conclusion

- Integration of China into Korea's market has increased fast over last two decades, especially in intermediate goods.
- This paper studies the effects of imports from China separately from other countries on markups, productivity, and employment growth of manufacturing plants in Korea.
- Distinguish the effects of import competition in output markets (seller) and input markets (buyer)

Conclusion

- We find that
 1. 'output' import penetration rate from China increase TFP but not markups and 'input' rate from China does not raise TFP but raise markups.

Pro-competitive effects on productivity => gains from trade

Lower input costs => benefit goes to Korean plants

2. 'input' import penetration rate from China is important factor that reduces employment growth but increases plant's survival rate

Further studies

- Study the effect of Chinese imports on the industry level productivity and employment (reallocation Vs. within-firm performance)
- potential endogeneity issue (reverse causality, policies affecting both import competition and productivity)
 - ✓ Instrumental variable estimation

