

Dancing with dragons:
Chinese import penetration and the performances
of manufacturing firms in South Africa

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Summary

Research questions

- ▶ What is the impact of Chinese import competition on SA-based mfg firms' performances (2010-17)?
- ▶ Are firms investing in capabilities development more resilient?

Main findings

- ▶ Rising Chinese import exposure - direct one but also in downstream segments of the DVC - has:
 - ▶ ↓ employment growth and sales growth of surviving firms
 - ▶ ↑ the probability of shutdown for firms not investing in capabilities development.
- ▶ Such effects are only partially mitigated by firms' investments in capabilities development.

Background and motivation

China's global expansion

- ▶ Concerns on potential negative effects of rising Chinese import competition on industrial development in LMICs
 - ▶ *Lall and Alaladejo, (2004); Lall and Weiss, (2005); Andreoni (2019)*

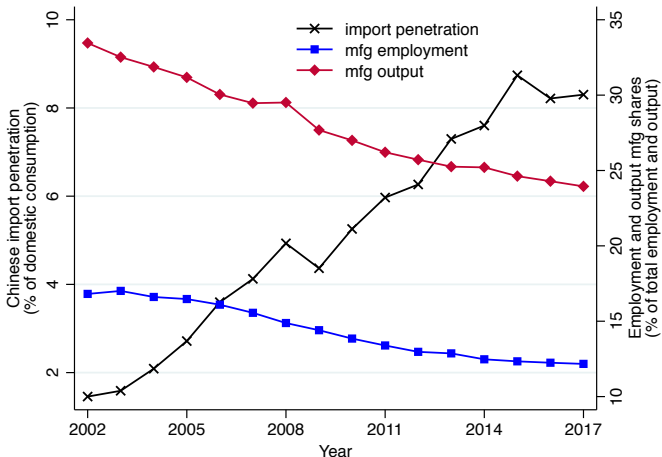
South African context

- ▶ Lack of dynamism of the mfg sector and deindustrialisation trends
 - ▶ *Rodrik (2008), Tregenna (2016), Andreoni and Tregenna (2018)*
- ▶ Increasing competitive pressure from imports, especially from China
 - ▶ *Edwards (2005), Jenkins (2008)*
- ▶ Since 2009 China is the 1st commercial partner of SA but unbalanced trade structure
 - ▶ *Edwards and Jenkins (2015)*

Gap

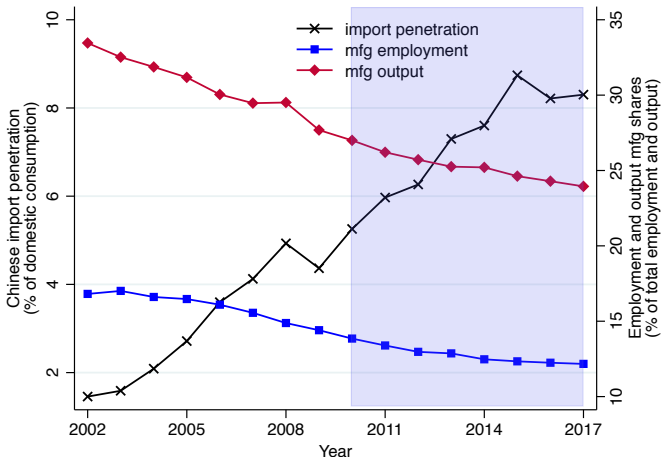
- ▶ Few studies at the firm-level in developing countries (especially SSA)

Figure 1: Chinese import penetration in mfg (*left scale*), share of mfg employment (output) in tot employment (output) (*right scale*), 2002-2017.¹



¹Own elaborations based on UNComtrade and SAS.

Figure 2: Chinese import penetration (left scale), and deindustrialisation dynamics (right scale) as in figure 1, sample period of interest highlighted (2010-2017).²



²Company Income Tax (CIT) data are only available for the 2008-2017 period.

Related literature(s)

1. Impact of Chinese imports on manufacturing firms

- ▶ Evidence mainly on advanced countries (*Bernard et al., 2006; Mion and Zhu, 2013*), only few empirical studies on LMICs (*Alvarez and Claro, 2009; Iacovone et al., 2013*)
- ▶ Findings: decreasing survival rates, employment and output growth

2. Building resilience to import competition

- ▶ H-O model with heterogeneous firms (*Bernard et al., 2006*)
 - ▶ Capital- and skill-intensive firms are more likely to survive and grow
- ▶ Capability theories of the firm (*Dosi, 1990; Lall, 1999*)
 - ▶ firms' reaction to competition depends on their internal capabilities
- ▶ Some evidence that US-based firms with larger R&D stock downsize less in response to Chinese imports (*Hombert and Matray, 2018*)

3. Shocks' diffusion through domestic input-output linkages

- ▶ Indirect effects of Chinese import competition arising from IO linkages (*Acemoglu et al., 2016*)

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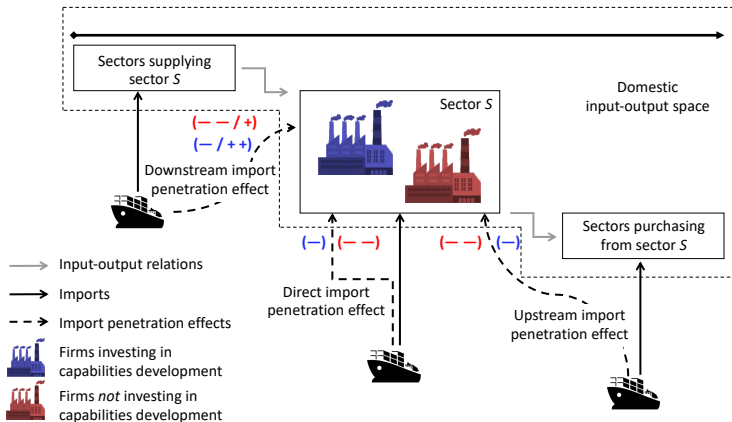
- ▶ Indirect effects of Chinese import competition arising from IO linkages (*Acemoglu et al., 2016*)

Research hypotheses

1. Increasing import competition from China will result in a reduction of employment growth and ...
2. ... sales growth for firms whose output *directly* compete with such imports.
3. It will also increase the probability for firms to exit the market.
4. Firms committing resources in capabilities development activities might be better equipped in responding to such competition.
5. Chinese import penetration might affect firms expansionary dynamics *indirectly*:
 - ▶ import penetration affecting a firm's downstream clients (*upstream effect*) might have a negative impact on the same firm:
 - ▶ reduction in the demand of its clients for inputs;
 - ▶ increase of competition from imports affecting a firm's upstream suppliers (*downstream effects*) might have ambiguous implications for the firm itself:
 - ▶ downward pressure on inputs' prices;
 - ▶ disruption of existing long-term supply agreements for specialised inputs.

Conceptual framework

Figure 3: The impact(s) of Chinese import penetration on SA-based mfg firms.³



³Authors' elaboration.

Data

Administrative firm-level data

- ▶ SARS-NT database:⁴
 - ▶ Company Income Tax (*CIT*) data from registered firms
 - ▶ *IRP5* employee income tax certificates merged into the *CIT* data using *PAYE* reference numbers
- ▶ Coverage:
 - ▶ $s = 1, 2, \dots, 42$ 3-digit mfg sectors
 - ▶ $i = 16,000+$ mfg firms per year
 - ▶ $t = 8$ years, from 2010 to 2017

Data on sector-level trade, production, IO tables

- ▶ UN Comtrade database
- ▶ Statistics South Africa
- ▶ Quantec

⁴All monetary values converted to constant Rand of 2012.

Variables

Sector-level (*direct* and *indirect*) import penetration:

$$pen_{s,t}^{chn} = \frac{M_{s,t}^{chn}}{M_{s,t} + Y_{s,t} - X_{s,t}} \quad (1)$$

$$pen_{s,t}^{chn,up} = \sum_k w_{k,s,2008}^{up} \times PEN_{k,t}^{chn} \quad (2)$$

- ▶ $M_{s,t}^{chn}$: sectoral imports from China
- ▶ $M_{s,t}$, $Y_{s,t}$, $X_{s,t}$: sectoral SA imports, output and exports
- ▶ $w_{k,s,2008}^{up}$: $\frac{\mu_{k,s,2008}^{up}}{\sum_{k'} \mu_{k',s,2008}^{up}}$, where $\mu_{k,s,2008}^{up}$ is the output of s purchased by k
- ▶ $PEN_{s,t}^{chn,down}$ as in 2 after reversing s and k in the numerator of $w_{k,s,2008}^{up}$

Firm-level capabilities

- ▶ $INVST_{i,t}$: investment intensity in capital equipment (*process innovation*)
- ▶ $INNOV_{i,t}$: expenditure intensity in innovation⁵ (*product innovation*)
- ▶ $TRAIN_{i,t}$: expenditure intensity in training (*skill development*)

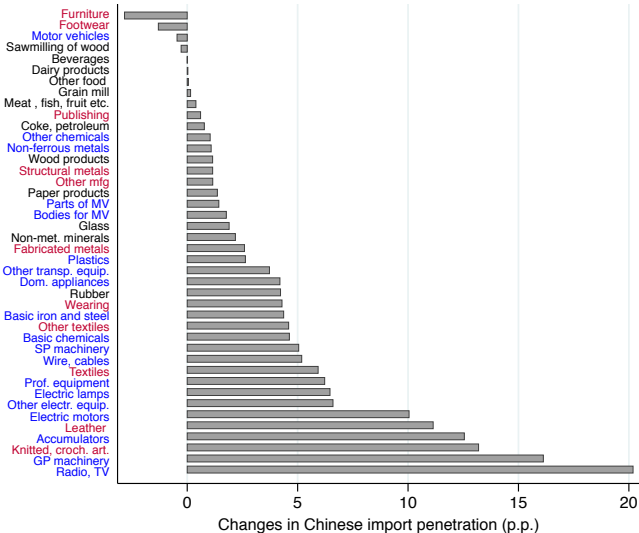
⁵Spending in R&D and/or royalties.

Empirical strategy

$$Outcome_{i,t,t+1} = f(V_{i,t}, PEN_{s,t}^{chn}, X_{i,s,t}) \quad (3)$$

- ▶ $Outcome_{i,t}$: a battery of dependent variables
 - ▶ $\Delta \log(\text{Employment})_{i,t+1}$, $\Delta \log(\text{Sales})_{i,t+1}$, $Death_{i,t+1}$,
- ▶ $V_{i,t}$: a set of year t firm characteristics
 - ▶ $V_{i,t}$: size, age, investment intensity in capital equipment, innovation and training
- ▶ $PEN_{s,t}^{chn}$: import penetration from China, direct and indirect
 - ▶ China's imports in other LMICs used as IV for SA imports
 - IV identification strategy
 - First-stage regression
 - Threats to the IV strategy
- ▶ $X_{i,s,t}$: a set of interactions between $PEN_{s,t}^{chn}$ and:
 - ▶ firm-level investments in capabilities development:
 - ▶ investments in capital equipment
 - ▶ expenditures in innovation
 - ▶ expenditures in training

Figure 4: Changes in CIP (2010-2017) by sector: RB, LT, MHT.⁶



⁶Own elaborations based on UNComtrade and SAS.

Table 1: Direct import penetration analysis.

Dependent variable	$\Delta \log(\text{Employment})_{i,t+1}$		$\Delta \log(\text{Sales})_{i,t+1}$		$\text{Death}_{i,t+1}$	
Specification	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	IV	IV	IV	IV	IV	IV
$PEN_{s,t}^{chn}$	-1.333*** (0.401)	-1.489*** (0.401)	-1.367*** (0.415)	-1.404*** (0.415)	0.240 (0.180)	0.370** (0.180)
× $INVST_{i,t}$		0.230*** (0.023)		0.232*** (0.022)		-0.255*** (0.012)
× $INNOV_{i,t}$		0.134** (0.055)		0.122** (0.059)		-0.037* (0.020)
× $TRAIN_{i,t}$		0.149*** (0.034)		0.055 (0.038)		-0.204*** (0.015)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	90,530	90,530	86,289	86,289	134,395	134,395
R-squared	0.3157	0.3162	0.2196	0.2198	0.0735	0.0753
Number of firms	12,959	12,959	12,919	12,919	23,170	23,170

1. Specifications 1 to 4 refer to the subset of surviving firms.
 2. A linear probability model is used in specifications 5 and 6.
 3. SE in parentheses are clustered at both industry and firm level.
- * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

OLS estimates

Table 2: Indirect import penetration analysis. $\Delta \log(\text{Employment})_{i,t+1}$.

Specification	(1)	(2)	(3)
A. 1st order indirect import exposure variables			
$PEN_{s,t}^{chn}$	-1.235*** (0.369)	-1.325*** (0.412)	-1.237*** (0.371)
$PEN_{s,t}^{chn,up}$	-2.885*** (0.843)		-3.013*** (0.840)
$PEN_{s,t}^{chn,down}$		-0.091 (0.759)	-0.652 (0.746)
B. Full (higher order) indirect import exposure variables			
$PEN_{s,t}^{chn}$	-1.304*** (0.368)	-1.340*** (0.414)	-1.311*** (0.371)
$PEN_{s,t}^{chn,up}$	-2.487*** (0.695)		-2.582*** (0.697)
$PEN_{s,t}^{chn,down}$		-0.074 (0.656)	-0.622 (0.640)
Firm controls	Yes	Yes	Yes
Constant	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	90,530	90,530	90,530
Number of firms	12,959	12,959	12,959

1. All specifications report IV estimates.

2. SE in parentheses are clustered at industry and firm level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Combined (direct + indirect) import penetration analysis.

Dependent variable	$\Delta \log(\text{Employment})_{i,t+1}$		$\Delta \log(\text{Sales})_{i,t+1}$		$\text{Death}_{i,t+1}$	
Specification	(1)	(2)	(3)	(4)	(5)	(6)
A. 1st order indirect import exposure variables						
$PEN_{s,t}^{chn} + PEN_{s,t}^{chn,up}$	-1.245*** (0.373)	-1.369*** (0.358)	-1.053*** (0.368)	-1.079*** (0.369)	0.174 (0.160)	0.307** (0.153)
× $INVST_{i,t}$		0.208*** (0.020)		0.045** (0.022)		-0.222*** (0.010)
× $INNOV_{i,t}$		0.127*** (0.048)		0.108** (0.051)		-0.032** (0.017)
× $TRAIN_{i,t}$		0.123*** (0.030)		0.042 (0.032)		-0.176*** (0.013)
B. Full (higher order) indirect import exposure variables						
$PEN_{s,t}^{chn} + PEN_{s,t}^{chn,up}$	-1.322*** (0.373)	-1.440*** (0.357)	-1.023*** (0.383)	-1.047*** (0.383)	0.169 (0.165)	0.296** (0.163)
× $INVST_{i,t}$		0.202*** (0.019)		0.044** (0.021)		-0.214*** (0.010)
× $INNOV_{i,t}$		0.128*** (0.046)		0.105** (0.049)		-0.031** (0.017)
× $TRAIN_{i,t}$		0.117*** (0.028)		0.040 (0.031)		-0.169*** (0.012)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Main findings

- ▶ Chinese import penetration (CIP) in SA increased over 2010-2017, especially in advanced mfg sectors;
- ▶ direct CIP decreases mfg firms' employment and sales growth;
- ▶ the negative impact of CIP propagates upstream along the DVC;
- ▶ the increase of CIP in the inputs market is never significant:
 - ▶ *hyp*: positive impact of cheaper foreign inputs offset by disruption of existing long-term supply relations for specialised domestic inputs
- ▶ firms investing in capabilities are more resilient to CIP and decrease their risk of shutting down
- ▶ however, these firms mitigate such impact only to a limited extent:
 - ▶ only a very small % of firms is involved in significant and continuous investments;
- ▶ the rise in CIP over 2010-2017 can be blamed (*only*) for a:
 - ▶ 4.28% loss in mfg-wide firm employment growth;
 - ▶ 4.39% loss in mfg-wide firm sales growth;
 - ▶ 1% increase of the shutdown probability for firms not investing capabilities development.

Conclusion

Policy implications

- ▶ Due to the dramatic upgrading of Chinese companies in GVCs, even SA firms operating in advanced sectors are (and will be) increasingly exposed to competition; **China's DVA in GVCs**
- ▶ reactive investments in capabilities development can reduce the negative impacts of such competition;
- ▶ investments in capabilities will have a positive impact only if they are significant, sustained, distributed across firms;
- ▶ localisation policies have to take into account the impact of Chinese imports along the entire supply chains;
- ▶ negative effects of CIP are linked with long-term structural problems of SA economy: concerted industrial policies are needed.

Ways forward

- ▶ Case studies needed to open the black box of mechanisms through which firms investing in capabilities can mitigate impact of CIP;
- ▶ current research project on SA supply chain for *mining equipment*.

Thanks for your attention
comments are welcome

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IV identification strategy

Concern

- ▶ Imports from China may be influenced by both South Africa import demand shocks and Chinese export supply shocks

Solution

- ▶ Instrument for South African imports using other LMICs' imports (excluding South Africa) from China,

$$PEN_{s,t}^{lmic,chn} = \frac{M_{s,t}^{lmic,chn}}{M_{s,t}^{lmic,tot}} \quad (4)$$

Rationale

- ▶ China's export growth has been driven by factors internal to China
- ▶ Common component of Chinese import growth across other LMICs plausibly captures this positive shock to Chinese export supply

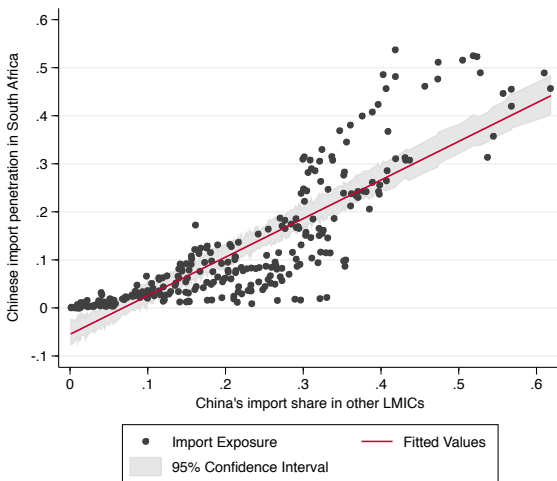
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Table 4: IV first-stage regression. Dependent: $PEN_{i,t}^{chn}$

$PEN_{s,t}^{mic,chn}$	0.803*** (0.033)
Constant	Yes
Year dummies	Yes
Observations	294
R-squared	0.7262
F-statistics	85.81
Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$	

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Figure 5: First-stage regression, 2010-2016



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Threats to the IV identification strategy

Correlation of demand across LMICs:

- ▶ e.g., electronics, textiles
- ▶ results generally holds when excluding such sectors
- ▶ e.g., impact of $\text{pen}_{s,t}^{chn}$ on $\Delta \log(E)_{i,t+1}$ slightly higher when excluding consumer electronics

South African productivity shocks drive imports from China also in other LMICs:

- ▶ Chinese exports driven by productivity growth and policy reforms
- ▶ from 2010 and 2017 China accounted for over 70% of the growth in manufacturing value added in LMICs

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Excluding consumer electronics

Table 5: Import competition analysis. $\Delta \log(E)_{i,t+1}$

Specification	(1)	(2)
Estimation method	IV	IV
$PEN_{s,t}^{chn}$	-1.489*** (0.401)	-1.748*** (0.516)
$\times (d)INVST_{i,t}$	0.230*** (0.023)	0.243*** (0.026)
$\times (d)INNOV_{i,t}$	0.134** (0.055)	0.144** (0.061)
$\times (d)TRAIN_{i,t}$	0.149*** (0.034)	0.171*** (0.040)
Firm fixed effects	Yes	Yes
Year dummies	Yes	Yes
Observations	90,530	88,986
R-squared	0.3162	0.3130
Number of firms	12,959	12,738

1. All estimates refer to the subset of surviving firms.
 2. All specifications control age, size, INVST, INNOV, TRAIN.
 3. (1) reports estimates with 358, 364, 365, 372 (2) excludes them.
 4. SE in parentheses, clustered at the industry-firm level.
- * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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Table 6: Direct import penetration analysis. OLS estimates.

Dependent variable	$\Delta \log(E)_{i,t+1}$	$\Delta \log(\text{Sales})_{i,t+1}$	$\text{Death}_{i,t+1}$
Specification	(1)	(2)	(3)
Estimation method	OLS	OLS	OLS
$PEN_{s,t}^{chn}$	-0.738*** (0.237)	-0.912*** (0.237)	0.275** (0.102)
× $INVST_{i,t}$	0.341*** (0.051)	0.172*** (0.061)	-0.152*** (0.033)
× $INNOV_{i,t}$	0.166** (0.158)	0.151** (0.139)	-0.033* (0.018)
× $TRAIN_{i,t}$	0.084*** (0.026)	0.099 (0.036)	-0.126*** (0.012)
Firm controls	Yes	Yes	Yes
Constant	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	90,530	86,289	134,395
R-squared	0.3214	0.2242	0.0773
Number of firms	12,959	12,919	23,170

1. Specifications 1 and 2 refer to the subset of surviving firms.

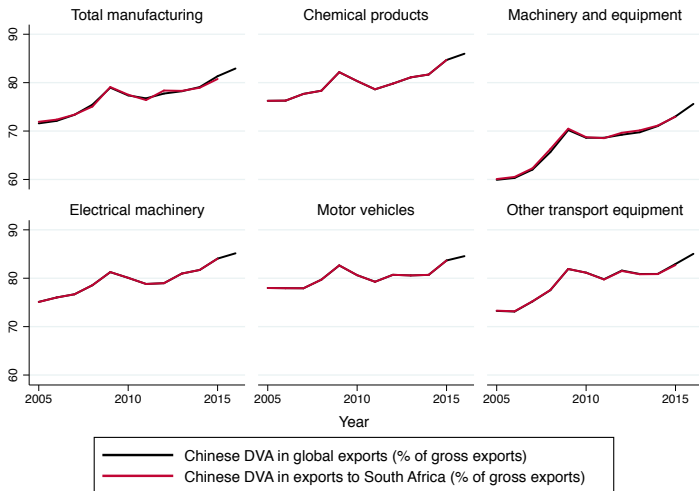
2. A linear probability model is used in specifications 3.

3. SE in parentheses are clustered at both industry and firm level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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Figure 6: Chinese DVA content of exports by mfg sector, 2005-2016.⁷



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⁷Own elaborations based on OECD-TiVA.