

Exporting and Investment under Credit Constraints¹

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¹The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Canada.

Motivation

- Market size matters for innovation and hence for productivity
 - improved access to foreign markets will encourage firms to export and invest in raising productivity.

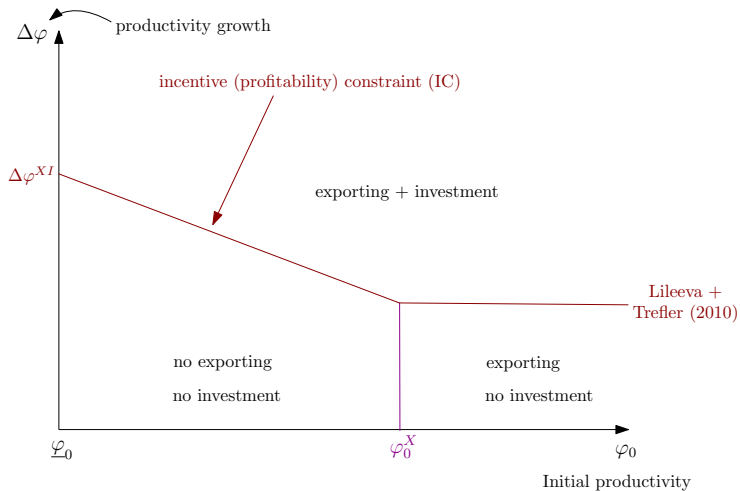
Motivation

- Market size matters for innovation and hence for productivity
 - improved access to foreign markets will encourage firms to export and invest in raising productivity.
- Credit constraints may prevent firms from:
 - investing in productivity enhancing technology
 - exporting

What we do

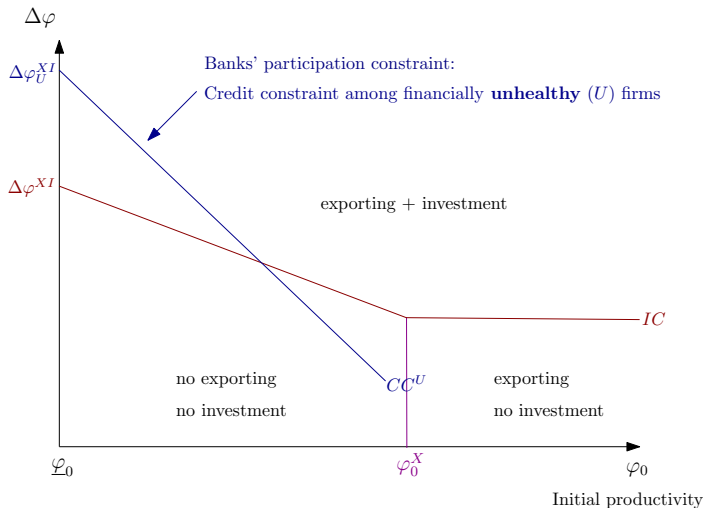
- Build framework to motivate firms' export and investment decisions
 - ⇒ heterogeneous returns on exporting based on firm's initial financial condition
- Use empirical framework (MTE) to identify credit constrained exporters
 - Productivity gains to exporting with endogenous selection
 - Share of financially constrained firms
 - Aggregate productivity changes from removing constraints
- Contribution
 - Current empirical literature does not account for unobserved selection
 - Less parametric restrictions relative to structural models

Theoretical framework: Lileeva and Trefler (2010)

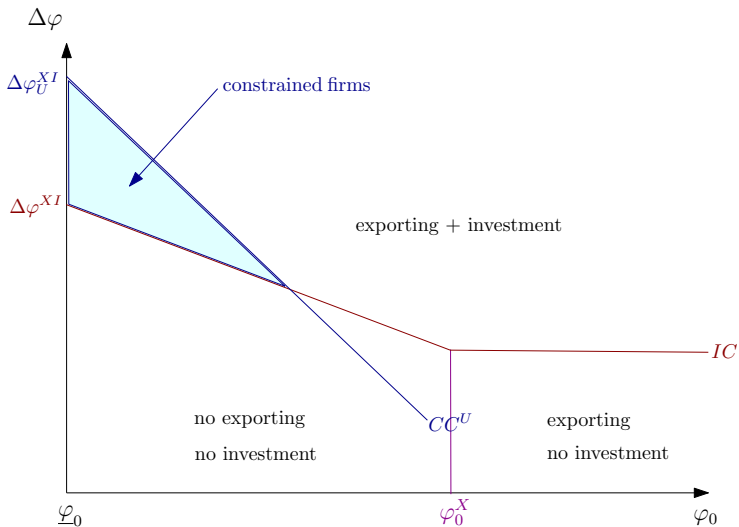


Adding Credit Constraints à la Manova (2013)

Productivity growth

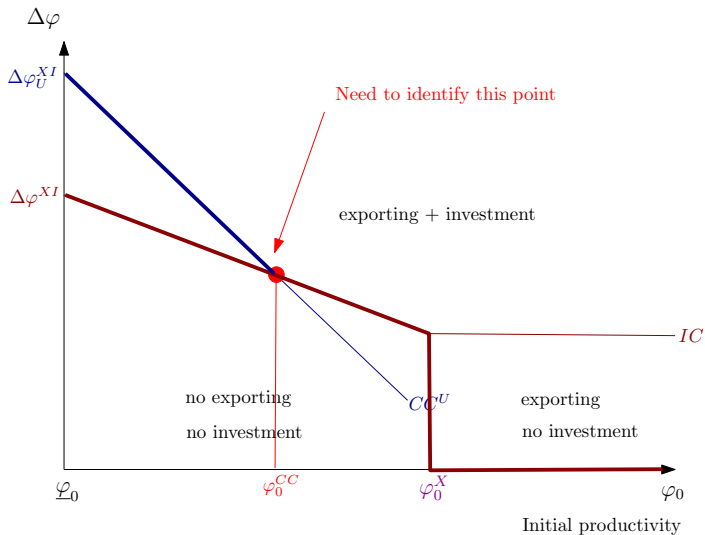


Adding Credit Constraints à la Manova (2013)



Identification: Intuition

Productivity growth



Going to empirics

Our solution: **Marginal Treatment Framework**

- Exploit heterogeneous returns from exporting after trade shock
- Firms less likely to export but choose to export have:
 - higher productivity return
 - increase their leverage
 - invest more

→ **Positive selection suggestive of heterogeneous returns**

Estimate counterfactual returns to identify credit constraints

- policy-relevant treatment effects (Zhou and Xie 2019)

Data - T2ASM

Merged Plant (ASM) to Firm (T2)

- Corporate tax-records (T2) linked with the Annual Survey of Manufactures (ASM)
- Time period: 2000-2010

Given AMS

- Manufacturing Only
- Unit of observation → Plant

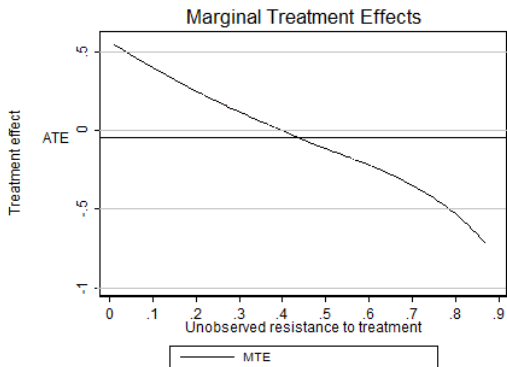
Firm-level variables are common to all plants of the firm.

- Remark: out of 10367 plants in our data, 134 belong to multi-plant firms.

Estimation approach

- 2-stage model with selection on unobservables
- 1st stage: selection equation
 - Probit model to estimate probability to export
 - **Instrument:** changes in US tariffs with Rest Of World (ROW) [▶ More...](#)
- 2nd stage: return equation (TFP growth)
 - Estimate returns for new exporters (treated) and non-exporters (untreated)
 - Include 1st order polynomial of propensity scores
- Plant level controls:
 - initial debt/asset ratio (initial financial distress)
 - initial Total Factor Productivity (TFP)
 - initial sales, age, age²

Estimated Treatment Effects



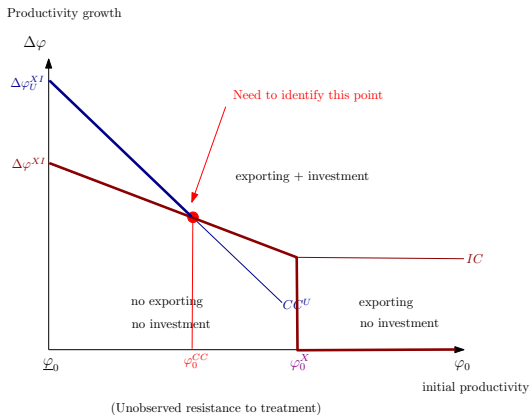
	$\Delta \log(\text{TFP})$ (1)
ATT	0.358 (0.074)
ATE	-0.047 (0.120)
ATUT	-0.210 (0.175)
LATE	0.212 (0.057)
Obs. het.	(0.000)
Ess. het	(0.000)
Obs.	10,367

Notes: (Bootstrapped Std. Errors)

- Firms who are more likely to choose to export increase productivity by more.
- [▶ More...](#)

Summary so far

Marginal returns



- Firms that have lowest resistance to treatment:

- highest productivity growth
- increase leverage the most
- invest the most

⇒ still unclear whether credit constraints bind.

Identifying Credit Constraints

Policy: Financial reform

- Improve firms' access to credit → no firm is in financial distress
- ⇒ compute counterfactual Policy Relevant Treatment Effect (PRTE)

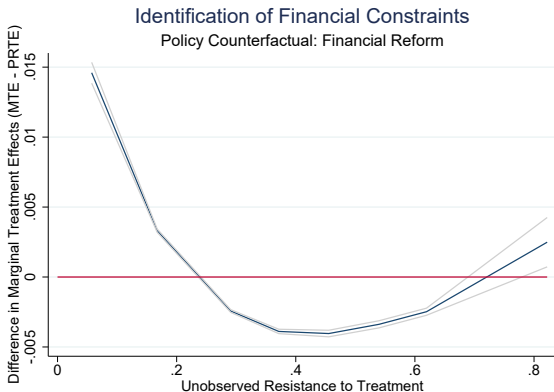
Identification:

- A firm is financially constrained if $MTE > PRTE$

Assumptions

- A1: policy works only through Δ financial conditions.
- A2: policy only affects some firms but not all

Marginal treatment effect before (MTE) after (PRTE) financial reform



- Results suggest that up to 48% of current producers being credit constrained from export markets.

Policy Relevant Treatment Effects

- 1 Financial reform: no firm is financially distressed
- 2 Trade reform: export market size \uparrow (US tariff with ROW \uparrow 10%)
- 3 Simultaneous trade & financial reform

Policy	Counterfactual Productivity Growth	
	Weighted	Unweighted
Financial Reform	1.04 pct. pts.	0.97 pct. pts.
Trade Reform	0.84 pct. pts.	0.81 pct. pts.
Joint Reform	1.71 pct. pts.	1.57 pct. pts.

Baseline productivity growth: 0.82 percentage points over 2000-2010.

Conclusions

Are (Canadian) manufacturers credit constrained from export markets?

- For approx. 48% of Canadian firms credit constraints are binding.
- Identification based on selection on gains
 - Positive selection of exporting: productivity growth, leverage and investment

By how much do financial constraints limit gains from exporting (10 years)?

- Productivity increase for firms induced to exporting: 15.2%
- Financial reform would increase aggregate productivity: 1.04%

Policy complementarity between trade & financial reform?

- Trade and financial reform are substitutes wrt to aggregate productivity growth.

Thanks/Merci

Are firms credit constrained? Some existing answers...

- Reduced-form evidence
 - Greenaway et al. (2007), Manova (2008), Berman and Hericourt (2010), Bellone (2010), Ahn (2011), Amiti and Weinstein (2011), Feenstra et al. (2014), Antras and Foley (2015), Manova et al (2015), Manova and Zhang (2011), Muuls (2015), Paravisini et al. (2015)...
 - Requires observing a shifter to credit access that does not affect profitability
- Structural evidence
 - Hennessy and Whited (2005), Miao (2005), Rossi-Hansberg and Wright (2007), Buero et al. (2011), Kaboski and Townsend (2011), Arellano et al. (2012), Buero et al. (2013), Caggese and Cunat (2013), Bond et al. (2015), Kohn et al. (2016), Brooks and DAVIS (2020), Leibovici (2020)...
 - Typically relies on a parametric, unobserved, and indirectly identified credit constraint.

Summary statistics for controls

	Non-exporters		New Exporters		Difference t-stat
	Mean	Std. dev.	Mean	Std. dev.	
Init. leverage ratio	0.726	0.489	0.669	0.383	5.575
Init. labor productivity	0.778	1.081	0.876	1.257	-3.874
Init. total factor productivity	11.56	0.573	11.74	0.572	-14.13
log(age)	2.836	0.214	2.846	0.215	-2.233
log(age) squared	8.087	1.194	8.148	1.200	-2.293
Initial size (\$ Mill.)	1.719	1.458	2.803	1.290	-34.229
Industry av. initial leverage ratio	0.864	0.109	0.847	0.111	6.996
Initial financial distress	0.338	0.252	0.302	0.227	6.585
Number of observations	7660		2707		

Remark: financial distress = | initial leverage ratio - av. initial leverage ratio|

- Exporters are larger and more productivity
 - Lower debt to asset ratio

Summary statistics for dependent variables

	Non-exporters		New Exporters		Difference t-stat
	Mean	Std. dev.	Mean	Std. dev.	
Δ labor productivity	0.157	0.895	0.221	0.809	-3.258
Δ total factor productivity	0.019	0.073	0.022	0.092	-1.407
Δ leverage ratio	-0.214	1.108	-0.187	0.830	-1.270
Δ short-term leverage	-0.224	0.967	-0.202	0.894	-0.923
Δ tangible assets	0.556	1.103	0.742	1.155	7.445
Δ tangible over total assets	0.274	0.989	0.212	0.968	2.801
Δ US tariff with ROW	-0.423	0.913	-0.201	0.747	-1.650
Number of observations	7660		2707		

- Exporters have higher productivity and investment growth

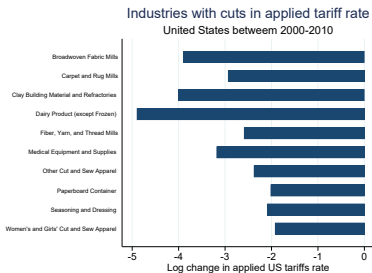
First stage: Probit

Dependent variable:	Export status in 2010			
Initial financial distress	-0.325 (0.056)	-0.368 (0.058)	-0.302 (0.060)	-0.374 (0.063)
Initial total factor productivity	0.289 (0.023)	0.401 (0.025)	0.424 (0.025)	0.395 (0.038)
Initial net size		0.327 (0.011)	0.363 (0.013)	0.381 (0.133)
Average initial leverage ratio			-0.175 (0.133)	1.194 (0.169)
log(age)			-2.575 (2.223)	-2.599 (2.293)
log(age) squared			0.351 (0.399)	0.376 (0.411)
Change in U.S. tariffs 2000–2010	0.559 (0.159)	0.639 (0.159)	0.639 (0.166)	1.362 (0.389)
Control variables	none	size	all	all
Industry fixed effects	no	no	no	yes
LR chi(2)	237.94	1124.72	1203.11	1833.03
Pseudo R2	0.020	0.094	0.101	0.154
Number of observations	10,367	10,367	10,367	10,367
Marginal effect at the mean				
Change in U.S. tariffs 2000–2010	0.180 (0.051)	0.198 (0.051)	0.196 (0.051)	0.407 (0.116)

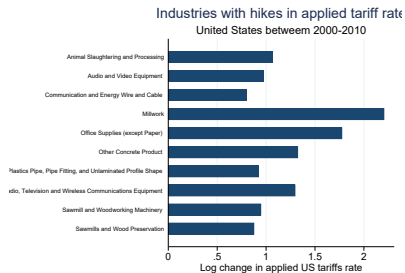
Instrument: US applied tariff changes with Rest of the World

- Main 5-digit NAICS industries with applied tariff changes

(a) Tariff increasing industries



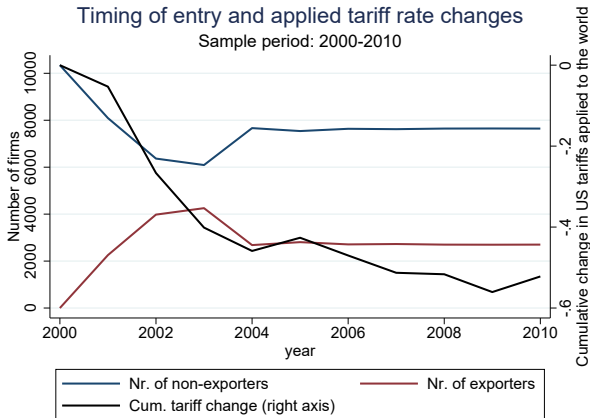
(b) Tariff decreasing industries



- Tariff increases: 54 sectors
- Tariff decreases: 105 sectors

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Timing of entry and tariff changes

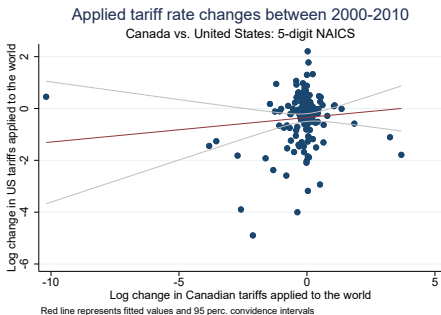


- Entry and tariff changes at the beginning of sample period.

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Identification concerns

- Changes in US tariffs can be correlated with changes in Canadian tariffs



- Result: no significant correlation at 5-digit NAICS industry-level
- Changes in US tariffs can be correlated with initial industry characteristics
 - No correlation between changes in US tariffs and industry averages of financial distress and productivity.

Correlation between change in tariffs and initial variables

Dependent variable:	Change in US tariffs 2000-2010			
Initial size	0.0043 (0.0039)			-0.0012 (0.0013)
Initial financial distress		-0.0028 (0.0053)		0.0006 (0.0036)
Initial total factor productivity			0.0292 (0.0230)	0.0306 (0.0236)
R2	0.0005	0.0001	0.0343	0.0346
Number of Observations	10,367	10,367	10,367	10,367

- No evidence of correlation with industry trends [▶ Back](#)

US imports from Canada and tariff changes vis a vis Rest of the World

Dependent variable:	Change log (US imports from Canada) (2010 - 2000)			
	(1)	(2)	(3)	(4)
Change log(US tariff with Rest of the World) (2010 - 2000)	0.208*** (0.060)	0.120* (0.069)	0.165*** (0.057)	0.157** (0.069)
log(initial labour productivity)		0.154** (0.072)		0.051 (0.077)
log(initial size)		0.151** (0.059)		0.153*** (0.057)
Change log(import from China)			-2.141*** (0.419)	-1.851*** (0.554)
Number of observations	162	142	159	139
R2	0.070	0.131	0.203	0.198

- US tariff increases with ROW increase import from Canada

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Bilateral US imports and tariff changes

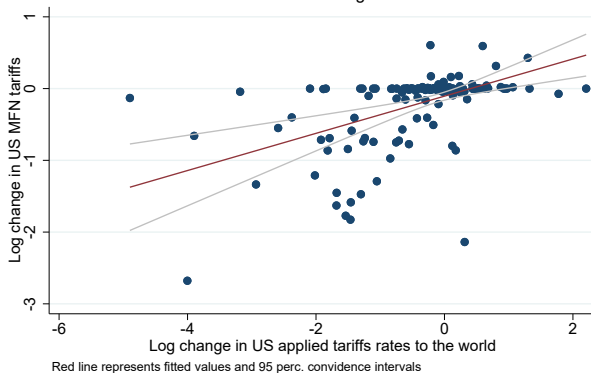
Dependent variable:	Change log (bilateral imports) (2010 - 2000)	
	(1)	(2)
Change log(bilateral tariff) between 2010 - 2000	-6.177*** (1.262)	-4.145** (1.758)
Country fixed effects	no	yes
Industry fixed effects	no	yes
Name	8,301	8,301
Adjusted R2	0.012	0.271

- Estimated trade elasticities (-6.2 and -4.2) are consistent with estimates from the literature. [▶ Back](#)

Additional evidence on IV

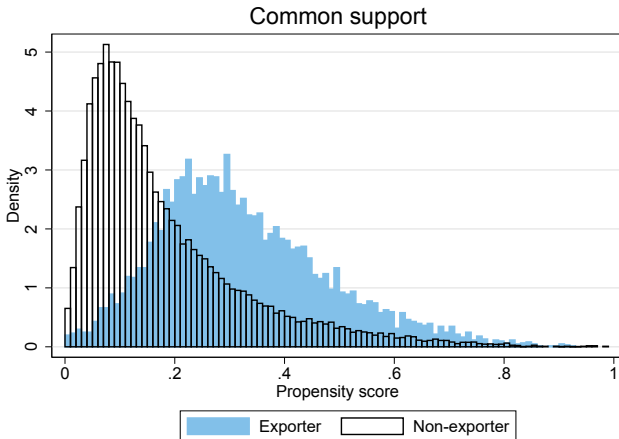
Applied and MFN tariff rate changes between 2000-2010

United States: 5-digit NAICS



- Applied tariff changes reflect MFN tariff changes. [▶ Back](#)

Difference between exporters and non-exporters



- Firms with a higher predicted probability of exporting are more likely to be exporters.

Second stage: Returns

Dependent variable:	Log-change in total factor productivity			
Non-exporters				
Initial financial distress	0.014 (0.047)	0.054 (0.011)	0.044 (0.010)	0.032 (0.008)
Initial total factor productivity	-0.002 (0.052)	-0.054 (0.011)	-0.042 (0.010)	-0.016 (0.008)
Difference: exporters vs. non-exporters				
Initial financial distress	-0.014 (0.233)	-0.094 (0.042)	-0.058 (0.039)	-0.037 (0.028)
Initial total factor productivity	0.112 (0.211)	0.128 (0.041)	0.072 (0.035)	0.075 (0.021)
Marginal effects				
ATT	0.296 (0.187)	0.465 (0.087)	0.358 (0.074)	0.133 (0.051)
ATE	0.068 (0.685)	-0.177 (0.128)	-0.047 (0.120)	0.019 (0.090)
ATUT	-0.004 (0.949)	-0.440 (0.194)	-0.210 (0.175)	-0.020 (0.124)
LATE	0.360 (0.232)	0.226 (0.051)	0.212 (0.057)	0.142 (0.050)
Observable heterogeneity (p-value)	(0.627)	(0.000)	(0.000)	(0.000)
Essential heterogeneity (p-value)	(0.430)	(0.000)	(0.000)	(0.000)
Control variables	none	size	all	all
Industry fixed-effects	no	no	no	yes
Number of observations	10,367	10,367	10,367	10,367

Constrained versus unconstrained plants

	Unconstrained		Constrained		Difference t-stat
	Mean	Std. dev.	Mean	Std. dev.	
Initial leverage ratio	0.64	0.36	0.78	0.54	-15.75
Initial labour productivity	0.91	1.33	0.69	0.85	9.80
Initial total factor productivity	11.75	0.61	11.46	0.50	26.84
log(age)	2.85	0.21	2.82	0.21	5.71
log(age) squared	8.17	1.19	8.03	1.19	5.80
Initial size	3.09	1.12	0.85	0.82	115.33
Initial size (net)	0.58	0.87	-1.16	1.14	87.58
Average initial leverage ratio	0.84	0.11	0.88	0.11	-17.48
Initial financial distress	0.30	0.22	0.35	0.27	-9.75
P(export)	0.37	0.12	0.14	0.05	124.82
P(export) financial reform	0.41	0.12	0.17	0.06	129.01
P(export) trade reform	0.40	0.12	0.16	0.06	125.43
P(export) joint reform	0.40	0.12	0.17	0.06	125.83
Number of observations	5310		5057		

- Constrained plants have higher initial leverage, lower productivity and are smaller and more likely to be financially distressed.