

Exporting and Worker Training

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Introduction

- A growing body of literature suggests that exporting has significant effects on firms' use of skills, material inputs and technologies
 - Evidence on firm heterogeneity and exporting (Greenaway and Kneller, 2007)
 - Evidence of effects on employment of skilled labor and wages (Greenaway, Hine and Wright, 1999, Greenaway and Nelson, 2001, Verhoogen, 2008, Greenaway, Falvey and Silva, 2010, and Brambilla, Lederman, and Porto, 2012)
 - Evidence of effects on prices of material inputs (Bastos, Silva and Verhoogen, 2015)
 - Evidence of effects on technology investments (Bustos, 2011; Lileeva and Trefler, 2010)
- Important, not yet fully resolved questions:
 - Does exporting affect worker training within firms?
 - If so, does training within exporters translate into higher wages?

Introduction (cont.)

- Possible theoretical explanations:
 - “Skill-bias globalization” (Matsuyama, 2007): exporting activities (including marketing, distribution and exporting services) are skill intensive, requiring skills such as expertise in international business, languages, foreign technologies and knowledge of foreign markets
 - “Quality story” (Verhoogen, 2008; Kugler and Verhoogen, 2012): exporting induces quality upgrading which is a skill intensive activity
- This paper:
 - Focuses on the link between firms’ export status and worker training, thereby emphasizing a new impact of exporting -- skill upgrading of the firm’s existing workforce
 - Tests the hypothesis in a rich combination of administrative records for Brazil, matching customs trade data, a worker-firm census, and training records at the trainee level for the main provider

Introduction (cont.)

- Strategy in this paper:
 - Look at firm-level effects of exporting on share of workers trained
 - Use information on switchers and real-exchange-rate movements as instrument for the timing of exporting (linked to Greenaway, Kneller and Zhang, 2012)
 - Look at returns to training (worker-level effects), using matched worker-firm information on wages, jobs and firm characteristics within exporting firms
- Punchlines:
 - Exporting increases workers technical training;
 - Technical training within exporters has positive returns to *upgraded* workers;

Data

- Three main datasets:

- (1) Workers training (SENAI/CNI) administrative records of training provision “Systema S/SENAI” for 2009-2012.**

- Administrative records on trainee/worker-level training collected by the biggest training provider in manufacturing (provides 80% of all training, is financed by tax to firms)(Confederation of Industry’s training arm for manufacturing SENAI). Data covers around 270 thousand trainees per year.
 - Trainee/worker-level information on training received as well as demographic characteristics, occupation before starting the course, course modality, enrolment date, completion date, course duration, identifier of the firm he/she works for and form of financing.

- (2) Customs data**

- Firm-level international trade transactions collected by SECEX/MDIC (essentially the universe of exports).
 - Information on firm-level export status in each year 2009-2012 and the industry share exported to each country in the base year (2008). No information on how much the firm exported, in total and per destination.

Data (cont.)

- Three main datasets (cont.):

- (3) **“Registro Annual de Informacoes Sociais” (RAIS), The Brazilian longitudinal worker-firm data fro 2009-2012**

- Social security records, collected by the Brazilian Ministry of Employment and Labor.
 - Data built upon compulsory survey of all firms and their registered workers. Covers all workers and firms in formal private and public sector, a total of around 230 thousand firms and over 7.5 million workers each year in the manufacturing sector.
 - Provides comprehensive information on
 - worker’s demographic characteristics (age, gender, schooling, race),
 - job characteristics (occupation, wage, hours worked), plant tenure, hiring and termination dates, along with employing firm ID codes.
 - firm-level characteristics (number of employees, geographical location, date of creation, and industry code).

- Baseline estimates are for panel composed of around 230,000 firms/year observations

Main stylized facts about exporting firms are confirmed in Brazil

	Non-exporters	Exporters	All
Share of workers that received training	1.40%	4.10%	1.50%
	[0.063]	[0.068]	[0.064]
Employment (ln)	1.889	4.161	1.998
	[1.232]	[1.711]	[1.349]
Hourly Wage (ln)	1.724	2.253	1.75
	[0.371]	[0.494]	[0.395]
Schooling less than High School	51.50%	38.90%	50.90%
	[0.360]	[0.271]	[0.357]
Schooling High School	43.70%	45.10%	43.80%
	[0.352]	[0.236]	[0.348]
Schooling more than High School	4.69%	15.80%	5.20%
	[0.129]	[0.178]	[0.134]
Share of production workers	35.20%	36.70%	35.30%
	[0.348]	[0.255]	[0.344]
Share of managers and professionals (skill 1)	4.00%	6.90%	4.20%
	[0.135]	[0.117]	[0.135]
Technicians and associate professionals (skill 2)	3.50%	10.10%	3.80%
	[0.123]	[0.126]	[0.124]
Clerks, service workers and machine operators (skill 3)	81.40%	66.80%	80.70%
	[0.280]	[0.249]	[0.280]
Elementary occupations (skill 4)	11.10%	16.20%	11.30%
	[0.229]	[0.214]	[0.229]
<i>N</i>	891,461	61,984	953,445

Notes: Standard errors of means in brackets. Exporter means having exported in any of the years in the 2008-2012 period. Wages are in 2010 Brazilian Reais per hour in log, employment in log of number of workers, employment share in total workers of each firm.

There is a diverse set of workers trainings

- Two types of TVET in Brazil:
 - Technical education of courses TEC: Generally considered pre-employment technical education, Offers upward permeability within the education system
 - [our focus] Vocational training (FIC): Not tied to formal education, aimed at creation or improving workers' qualifications
- “Sistema S” is a vocational training institution managed by industry consortia (manuf., commerce, rural, ag., transport and cooperatives)
- Other vocational training providers in the manufacturing sector, but SENAI (“Serviço Nacional de Aprendizagem Industrial”) is a key player
 - 5th largest training provider in the World.
 - Financed by tax charged to firms equal to 1% of their wage bill.

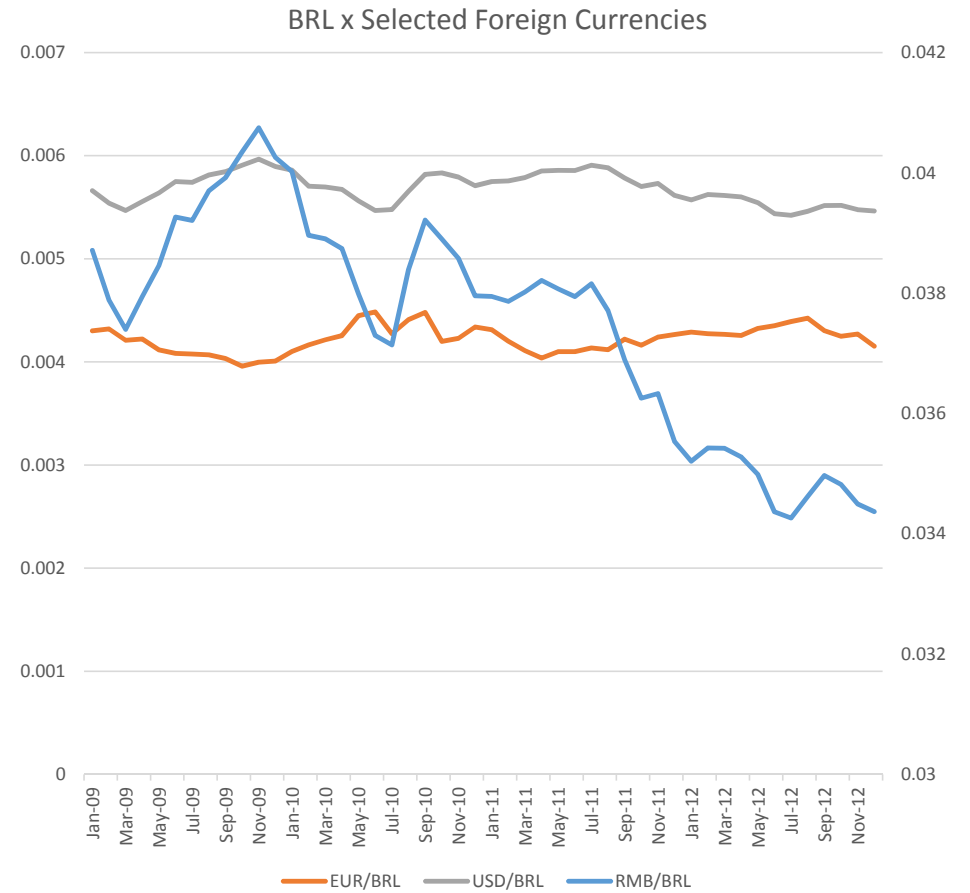
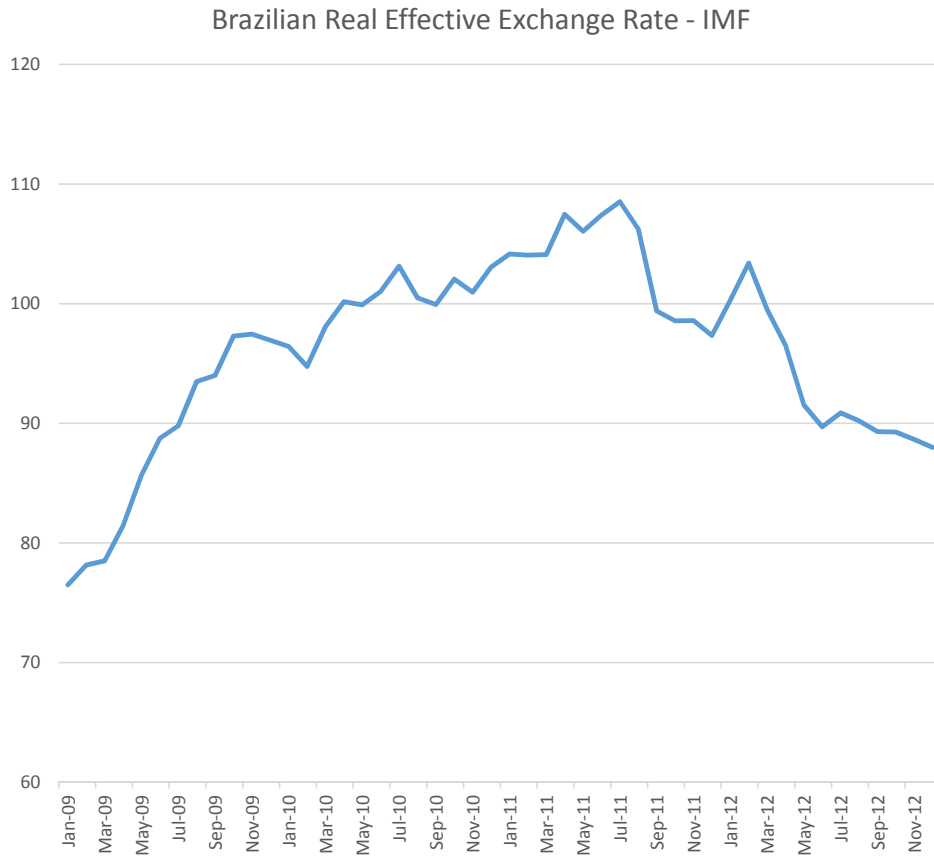
	Technical upgrading	Apprenticeship	Habilitation	Initiation
Avg trainee age	31.97 [10.52]	18.25 [2.43]	24.55 [7.57]	26.26 [10.36]
Avg course duration (in hrs)	40.41 [44.97]	809.58 [501.7]	1109.34 [508.45]	164.7 [372.33]
Share of trainees working	68% [0.46]	27% [0.44]	55% [0.5]	46% [0.5]
Average tenure of trainees (months)	54.87 [70.56]	11.33 [14.88]	37.40 [46.29]	33.01 [46.63]
Number of trainees in manufacturing firms				
2009	75,099	5,331	6,840	33,334
2010	166,694	7,660	9,358	49,237
2011	179,555	8,079	16,738	60,902
2012	164,784	7,550	11,568	50,279
Age restriction (Y/N)	N	Y	Y	N
Education restriction (Y/N)	N	Y	N	N

Exporting firms have higher share of trainees

	Non-exporters	Exporters	All
Share of workers that received training by course modality			
Technical upgrading	0.57%	2.06%	0.64%
Initiation, Habilitation, Apprenticeship , Qualification	0.93%	2.23%	0.99%
Share of workers that received training by occupation group			
Share of managers and professionals (skill 1)	0.60%	1.12%	0.67%
Technicians and associate professionals (skill 2)	1.73%	3.10%	1.97%
Clerks, service workers and machine operators (skill 3)	0.58%	2.26%	0.66%
Elementary occupations (skill 4)	0.50%	1.76%	0.62%

Notes: Exporter means having exported in any of the years in the 2008-2012 period. Wages are in 2010 Brazilian Reais per hour in log.

2009-2012 was a period of high external volatility, which provides a nice setting for identification



Empirical Approach

- Estimate the effect of the exporting on workers training:

$$s_{jt} = \beta EXP_{jt} + \mathbf{X}_{it}\alpha + a_j + b_t + \epsilon_{jt} \quad (1)$$

- Firm j , time t
- s_{jt} is the firm-level average share of trained workers in year t ;
- EXP_{jt} is the firm export status in year t ;
- X_{it} are other time varying firm characteristics,
- a_j is a firm fixed effect;
- b_t is a year effect
- ϵ_{jt} is a conditional-mean-zero error term. Standard errors are clustered at the firm-level.

Empirical Approach (cont.)

- Look at “Switchers”
- Instrument $z_{i,t}$ for industry level destination exchange rate.
For export destination j , industry i and year t , we compute the real weighted exchange rate level defined as

$$z_{i,t} = \sum_j ER_{j,t} w_{i,j}$$

- $w_{i,j}$ is the sum of industry i exports to destination j over total industry i exports in 2008, a year before our analysis starts.
- $ER_{j,t}$ is the real exchange rate in Brazilian Reais by LCU in year t .

Assuming industry-level export destinations are correlated across years, increases in $ER_{j,t}$ imply an increase in external demand for that industry's exports

Empirical Approach (cont.)

- Estimate the returns to training in exporting firms.

$$w_{ijt} = \beta T_{it} + \mathbf{X}_{it}\alpha + \mathbf{Z}_{jt}\delta + a_i + b_j + c_t + \epsilon_{ijt} \quad (2)$$

- worker i , firm j , year t
- w_{ijt} is the log of the hourly real wage,
- T_{it} is the variable of interest which is equal to 1 if the person did the training and 0 otherwise;
- \mathbf{X} is the vector of time varying worker characteristics,
- \mathbf{Z} is the vector of firm characteristics (including firm size, sector, location)
- a_i as a worker fixed effect,
- b_j is a firm fixed effect,
- c_t is a year effect,
- ϵ is a conditional-mean-zero error term.

Results: Export status and changes in the share of workers trained, all firms

	1	2	3	4
A: Dependent Variable - Share of workers receiving technical upgrading				
Export	0.0128*** (0.000303)	0.00503*** (0.000326)	0.00135** (0.000675)	0.00119* (0.000651)
ln(firm size)		0.00121*** (5.73e-05)		0.000533*** (0.000205)
B: Dependent Variable - Share of workers receiving training in other modalities				
Export	0.0106*** (0.000283)	0.00236*** (0.000344)	-0.000240 (0.000800)	-0.000421 (0.000779)
ln(firm size)		0.000888*** (7.11e-05)		0.000307 (0.000251)
Firm Fixed Effects	No	No	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
State Effects	No	Yes	No	Yes
Firm Controls	No	Yes	No	Yes
Observations	953,445	953,445	953,445	953,445

Notes: Robust standard errors clustered by firm in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Firms controls are average age of workers; average tenure; male to female workers ratio; share of workers with less than high school completed, share of workers with exactly high school completed and share of workers with more than high school completed; average log wage; share of white workers; share of workers by occupational groups (managers and professionals (skill 1), Technicians and associate professionals (skill 2), Clerks, service workers and machine operators (skill 3), Elementary occupations (skill 4)) and CNAE 2-digit sector dummies.

Results (cont.): Export status and changes in the share of workers trained, switchers only

	1	2	3	4
A: Dependent Variable - Share of workers receiving technical upgrading				
Export	0.00162*** (0.000536)	0.00114** (0.000487)	0.00148** (0.000637)	0.00127** (0.000571)
ln(firm size)		0.00237*** (0.000429)		0.00128 (0.00150)
B: Dependent Variable - Share of workers receiving training in other modalities				
Export	-0.000155 (0.000611)	-0.000700 (0.000575)	-0.000373 (0.000755)	-0.000931 (0.000723)
ln(firm size)		0.000566 (0.000440)		0.00208 (0.00139)
Firm Fixed Effects	No	No	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
State Effects	No	Yes	No	Yes
Firm Controls	No	Yes	No	Yes
Observations	29,347	29,347	29,347	29,347

Notes: Robust standard errors clustered by firm in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Firms controls are average age of workers; average tenure; male to female workers ratio; share of workers with less than high school completed, share of workers with exactly high school completed and share of workers with more than high school completed; average log wage; share of white workers; share of workers by occupational groups (managers and professionals (skill 1), Technicians and associate professionals (skill 2), Clerks, service workers and machine operators (skill 3), Elementary occupations (skill 4)) and CNAE 2-digit sector dummies.

Results: Export status and changes in the share of workers trained, switchers, instrument

	1	2
First Stage		
A: Dependent Variable - Export Status		
Log real exchange rate	0.00441***	0.00438***
	(0.00131)	(0.00131)
F-Stat	11.31	11.17
Second Stage		
A: Dependent Variable - Share of workers receiving technical upgrading		
Export	0.0558*	0.0585**
	(0.0285)	(0.0292)
B: Dependent Variable - Share of workers receiving training in other modalities		
Export	18.50	18.84
	(19.46)	(19.60)
Firm Fixed Effects	Yes	Yes
Year effects	Yes	Yes
Firm Controls	No	Yes
Observations	29,347	29,347

Notes: Robust standard errors clustered by firm in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Firms controls are average age of workers; average tenure; male to female workers ratio; share of workers with less than high school completed, share of workers with exactly high school completed and share of workers with more than high school completed; average log wage; share of white workers; share of workers by occupational groups (managers and professionals (skill 1), Technicians and associate professionals (skill 2), Clerks, service workers and machine operators (skill 3), Elementary occupations (skill 4)) and CNAE 2-digit sector dummies.

Results (cont.): Export status and changes in the share of workers trained in current year or before, switchers, instrument

	1	2
First Stage		
A: Dependent Variable - Export Status		
Log real exchange rate	0.00441*** (0.00131)	0.00438*** (0.00131)
F-Stat	11.31	11.17
Second Stage		
A: Dependent Variable - Share of workers receiving technical upgrading		
Export	0.0802** (0.0359)	0.0835** (0.0368)
B: Dependent Variable - Share of workers receiving training in other modalities		
Export	0.0212 (0.0272)	0.0250 (0.0277)
Firm Fixed Effects	Yes	Yes
Year effects	Yes	Yes
Firm Controls	No	Yes
Observations	29,347	29,347

Notes: Robust standard errors clustered by firm in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Firms controls are average age of workers; average tenure; male to female workers ratio; share of workers by schooling level (less than high school completed, exactly high school completed and more than high school completed); average log wage; share of white workers; share of workers by occupational groups: share of managers and professionals (skill 1), Technicians and associate professionals (skill 2), Clerks, service workers and machine

Results (cont.): Export status and changes in the share of workers trained by skill/occupation, switcher only, instrument

	1	2
First Stage		
A: Dependent Variable - Export Status		
Log real exchange rate	0.00397** (0.00192)	0.00407** (0.00191)
F-Stat	10.67	10.77
Second Stage		
	1	2
A: Dependent Variable - Share of managers and professionals receiving technical upgrading (skill 1)		
Export	0.0524 (0.0672)	0.0494 (0.0649)
B: Dependent Variable - Share of technicians and associate professionals receiving technical upgrading (skill 2)		
Export	0.0864 (0.229)	0.0968 (0.241)
C: Dependent Variable - Share clerks, service workers and machine operators receiving technical upgrading (skill 3)		
Export	0.0611* (0.0345)	0.0630* (0.0349)
D: Dependent Variable - Share of trained workers in elementary occupations (skill 4) receiving technical upgrading		
Export	0.104** (0.0420)	0.106** (0.0425)
Firm Fixed Effects	Yes	Yes
Year effects	Yes	Yes
Firm Controls	No	Yes
Observations	18,170	18,170

Notes: Robust standard errors clustered by firm in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Firms controls are average age of workers; average tenure; male to female workers ratio; share of workers by schooling level (less than high school completed, exactly high school completed and more than high school completed); average log wage; share of white workers; share of workers by occupational groups: share of managers and professionals (skill 1), Technicians and associate professionals (skill 2), Clerks, service workers and machine operators (skill 3), Elementary occupations (skill 4); and CNAE 2-digit sector dummies.

Results (cont.): Returns to training among exporting firms

	1	2	3	4	5	6
A: Dependent Variable - log hourly wage						
Received technical training (=1 if yes)	0.0349*** (0.00240)	0.0213*** (0.00256)	0.00958*** (0.00210)	0.00745*** (0.00199)	0.00516** (0.00239)	0.00586*** (0.00219)
ln(firm size)		0.0555*** (0.00376)		0.0330*** (0.000813)		0.0231*** (0.00018)
Individual Fixed Effects	No	No	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	No	No	No	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	No	Yes	No	Yes	No	Yes
State Effects	No	Yes	No	Yes	No	Yes
Observations	28,410,893	24,485,651	28,410,893	24,485,651	28,410,893	24,485,651

Notes: Robust standard errors clustered by firm in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Firms controls are log number of workers in firm; average age of workers; average tenure; male to female workers ratio; share of workers by schooling level: share of workers with less than high school completed, share of workers with exactly high school completed and share of workers with more than high school completed; average log wage; share of white workers; share of workers by occupational groups: share of managers and professionals (skill 1), Technicians and associate professionals (skill 2), Clerks, service workers and machine operators (skill 3), Elementary occupations (skill 4); and CNAE 2-digit sector dummies.

Conclusions

- Exporting has a robust, positive effect on the share of workers who received technical training at the firm level, controlling for firm characteristics.
- Results support the hypothesis that exporting requires an upgrading of skills and that this is partially achieved by training the existing workforce.
- Future work: Look at effects of exporting on the demand for specific, export related skills/tasks using detailed information on skill content of occupations.