Exporting Firms and the Demand for Skilled Tasks

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Motivation

- Explore relationship between exporting and skilled tasks
  - theory and evidence from Chilean manufacturing firms

- Combine two strands of literature:
  - exporting, skills and quality (Verhoogen, 2008; Brambilla, Lederman and Porto, 2012; Bastos, Silva, Verhoogen, 2014)
  - trade and tasks (Feenstra and Hanson, 1996; Antras, Garicano, and Rossi-Hansberg, 2006; Grossman and Rossi-Hansberg, 2008; 2012; Acemoglu and Zilibotti, 2001; Acemoglu and Autor, 2011; Costinot and Vogel, 2010)

Intuition

- Production involves many tasks:
  - Management, accounting, clerical, design, packaging, logistics, sales representation, operational production, input control, monitoring, supervision, other services
- Tasks are executed by workers with different skills:
  - Technology: some tasks are skill-intensive, others are unskilled-intensive

- Firms produce goods of varying quality; exporters produce higher quality goods (for higher-income consumers)
- Production of quality is intensive in some, but not necessarily all, skill-intensive tasks
- Firms are heterogeneous:
  - More productive firms become exporters and hire more skilled workers (and more workers overall)
  - The demand for skilled workers will, however, be biased towards those skilled tasks required to produce exportable (quality) goods

This Paper

- Presents (partial equilibrium) model of exports & demand for skilled tasks
  - Exporters demand more skilled tasks & employ more skilled workers relative to unskilled workers than non-exporters

- Provides evidence using the Chilean ENIA
  - Data from 2001 to 2005
  - Information on firms' tasks, e.g., directors, specialized workers (engineers, professionals), administrators, blue-collar operators, and maintenance services workers
  - Combined with administrative customs data on firms' exports

- We show that:
  - Chilean exporters utilize more skills than non-exporters
  - *Composition* matters
    - exporters require the services of skilled specialized workers as opposed to skilled administrative workers
    - exporters demand less unskilled labor in unskilled-intensive tasks

Model: Outline

- Objective: establish theoretical links between export intensity and skilled tasks

- Quality demand is modeled with Logit utility (as in Verhoogen)

- Firms choose quality, quantity and price to maximize profits

Model: Outline

- Quality is produced with a collection of tasks
- Quantity is produced with a collection of tasks
- Quality and Quantity are produced separately

- A given task (in quantity or quality production) can be performed by either skilled or unskilled workers
- Assume Ricardian (fixed coefficient) technology
- Given skilled and unskilled wages, determine cutoff of relative skilled utilization in both activities

Model: Cut-offs for Utilization of Skills

tasks are in increasing order of skilled intensity; tasks above i_x^* in output production and above i_ϑ^* in quality production are performed exclusively by skilled workers; the quality cutoff is lower than the output cutoff because quality production is more skilled intensive than output production (by assumption)

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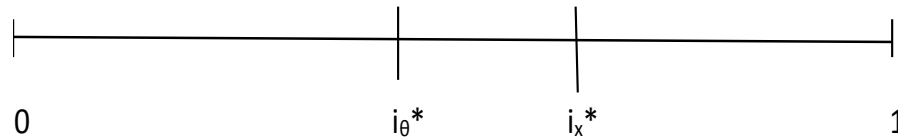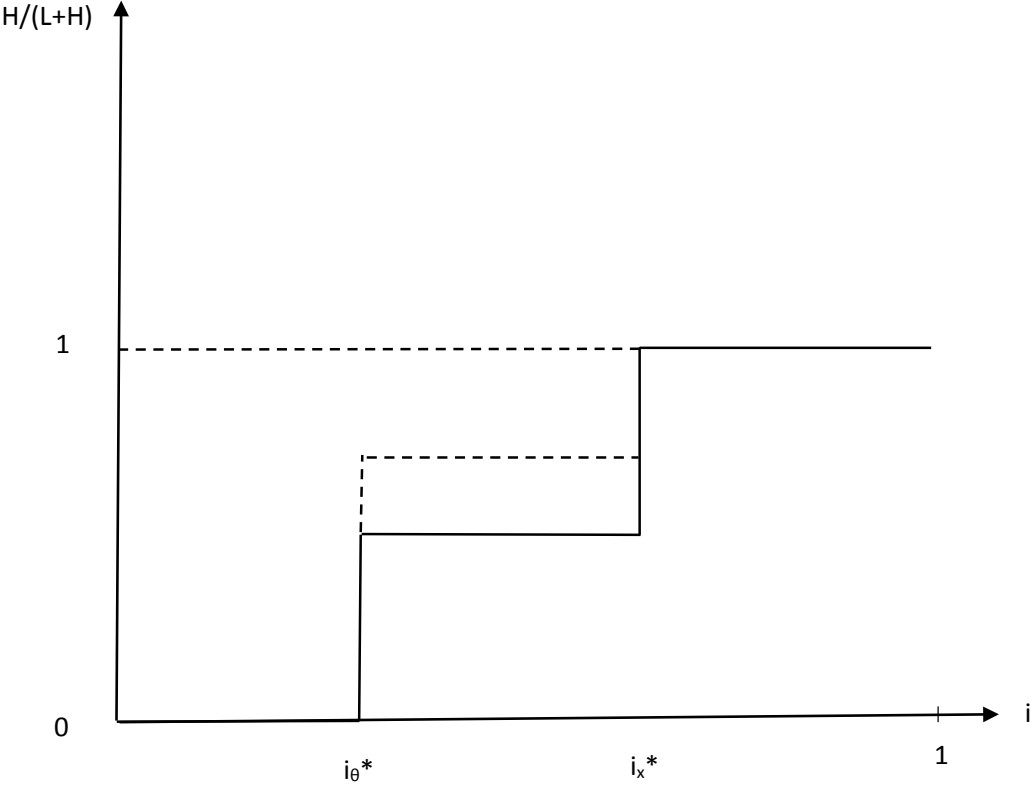
Production

- Quantity: constant returns to scale in tasks – thus constant marginal costs

- Quality: decreasing returns to scale in tasks – thus increasing marginal cost

- Firm productivity λ affects quality (but no quantity to simplify)
  - more productive firms have lower marginal costs and thus choose higher quality
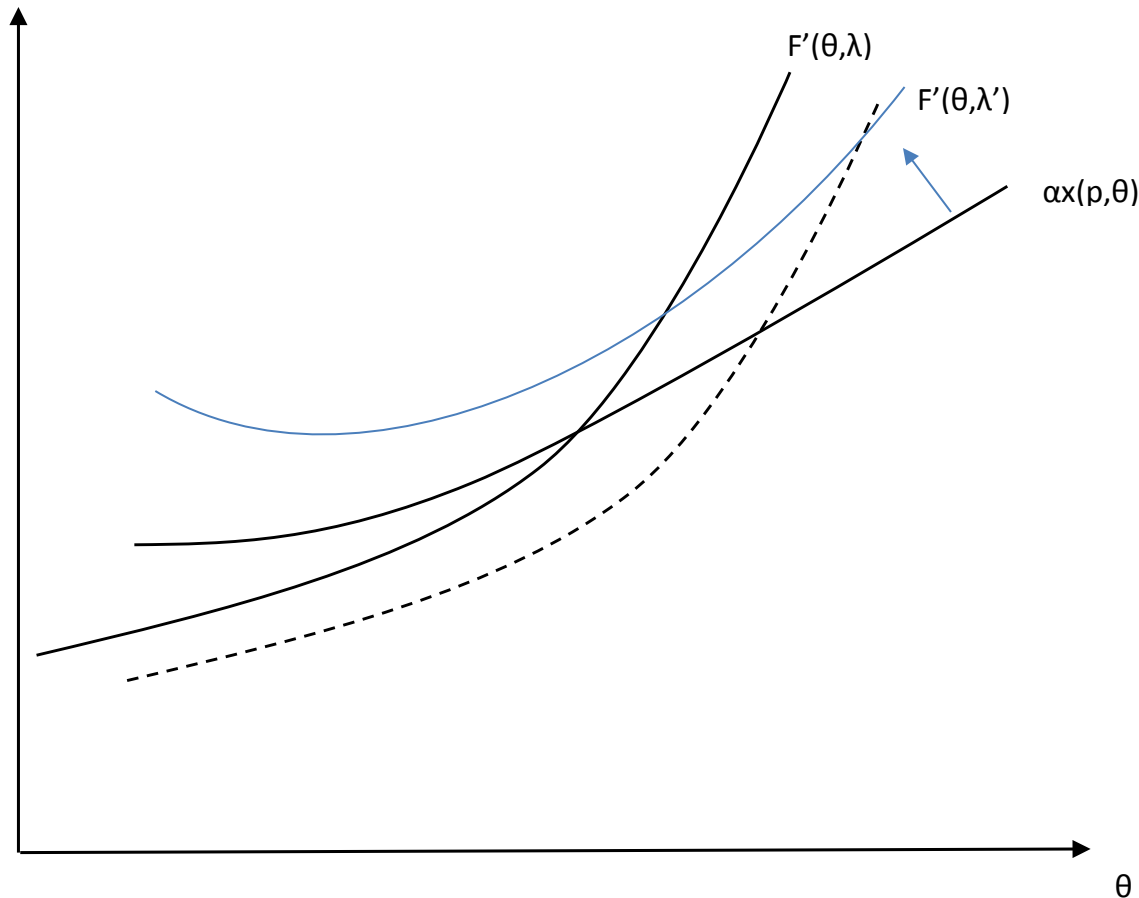
Relative Skill Utilization Across Tasks: Effect of Higher Productivity

Profit Maximization: Marginal Costs and Marginal Revenue as Functions of Quality

Exporting and Skill Utilization

- Exporting requires a fixed cost

- More productive firms self-select into exporting

- They produce higher quality goods for export

  - Since quality production is relatively more skill-intensive than quantity production, utilization of skilled workers is higher in exporting firms

  - Higher export intensity is also associated with more skills at the interior of the task space (e.g., same skills of CEOs but more engineers in middle tasks)

Chilean Data

- Encuesta Nacional Industrial Anual (ENIA)
- All manufacturing plants with 10 workers or more
- Customs data: records on firms exports by destination: 2001-2005
- Built 5-year panel of Chilean manufacturing firms
  - industry affiliation, ownership type, sales, exports, input use, imports of materials, labor
  - detailed employment records; define tasks: management (directors), administrative services (accountants, lawyers), engineers (specialized skilled production workers), blue-collar activities (non-specialized unskilled production workers), and general maintenance services (unskilled non-production workers).
- Skilled labor: managers, administrative workers, and engineers
- Highly-skilled labor: managers and engineers
- Unskilled workers: blue-collar, non-specialized and general maintenance workers
- Production workers: engineers and blue-collar operatives
- Non-production workers: managers, administrative and maintenance workers

Summary Statistics

Table 1
Summary Statistics
National Annual Industrial Survey
Chile 2001 - 2005

	All Firms	Exporters	Non-Exporters
A) Skilled and Unskilled Labor			
log skilled employment	2.37	2.47	2.36
log highly-skilled employment	1.78	1.91	1.77
log unskilled employment	2.88	2.88	2.87
share skilled employment	38.69	40.62	38.53
share highly-skilled employment	25.95	26.79	25.88
share unskilled employment	61.31	59.38	61.47
B) Production and Non-Production Labor			
log production employment	3.17	3.12	3.17
log non-production employment	2.03	2.16	2.02
share production employment	73.21	70.15	73.47
share non-production employment	26.79	29.85	26.53
C) Tasks			
log managerial employment	0.60	0.79	0.58
log engineering employment	1.22	1.36	1.21
log services employment	1.22	1.34	1.21
log blue-collar employment	2.71	2.72	2.71
log maintenance employment	0.46	0.48	0.46
share managerial employment	7.17	8.68	7.04
share engineering employment	18.78	18.11	18.84
share services employment	12.74	13.84	12.65
share blue-collar employment	54.42	52.04	54.63
share maintenance employment	6.88	7.33	6.85
D) Exports			
exports/sales	0.05	0.32	0.00

Regression Model

- Regression model:

$$y_{ijt} = \mathbf{x}'_{ijt}\beta + \gamma E_{ijt} + \phi_i + \phi_{jt} + \epsilon_{ijt},$$

  - *E*: export intensity of firm i
  - **x**: firm controls (log total employment, log sales, initial conditions)
  - firm and industry-year fixed effects

  - add controls sequentially

OLS-FE Results

Table 2
The Demand for Tasks and Exports
(log employment)
OLS-FE

	(1)	(2)	(3)	(4)
A) Skilled and Unskilled Labor				
log highly-skilled	0.33***	0.19***	0.19**	0.19***
	(0.087)	(0.073)	(0.073)	(0.073)
log skilled	0.31***	0.16***	0.16***	0.16***
	(0.074)	(0.058)	(0.058)	(0.058)
log unskilled	0.11	-0.13	-0.13	-0.13
	(0.101)	(0.082)	(0.082)	(0.082)
B) Production and Non-Production Labor				
log production	0.27***	0.00	0.00	0.00
	(0.073)	(0.015)	(0.015)	(0.015)
log non-production	0.14**	0.03	0.03	0.03
	(0.056)	(0.041)	(0.041)	(0.041)
C) Tasks				
log managers	0.09	0.02	0.01	0.01
	(0.073)	(0.067)	(0.067)	(0.067)
log engineers	0.37***	0.22**	0.22**	0.22**
	(0.103)	(0.089)	(0.090)	(0.090)
log services	0.29***	0.16**	0.15**	0.15**
	(0.083)	(0.070)	(0.070)	(0.069)
log blue-collar	0.14	-0.11	-0.11	-0.11
	(0.111)	(0.093)	(0.093)	(0.093)
log maintenance	-0.15*	-0.20***	-0.20***	-0.20***
	(0.080)	(0.078)	(0.077)	(0.077)

Endogeneity and IVs

- Export intensity can be endogenous

- Use IV approach

- Two instruments (Verhoogen, 2008; Park et al., 2010; Brambilla, Lederman and Porto, 2012)

  – Export share weighted average of destination GDP

  – Export share weighted average of destination bilateral real exchange rate

First Stage Results

Table 3
First Stage Results
(exports /sales on z^0 and z^1)

	(1)	(2)	(3)	(4)
average real gdp	0.0877***	0.0880***	0.0885***	0.0879***
(z_{jt}^0)	(0.0099)	(0.0098)	(0.0090)	(0.0088)
average real gdp * initial sales	0.0012*	0.0011*	0.0010*	0.0011*
$(z_{jt}^0 * s_{j0})$	(0.0006)	(0.0006)	(0.0006)	(0.00068)
average real exchange rate	-0.0271	-0.0268	-0.0263	-0.0277
(z_{jt}^1)	(0.0202)	(0.0201)	(0.0190)	(0.0189)
average real exchange rate * initial sales	0.0018	0.0018	0.0017	0.0018
$(z_{jt}^1 * s_{j0})$	(0.0014)	(0.0014)	(0.0013)	(0.0013)
R^2	0.4682	0.4688	0.4682	0.4683
F-statistic	4703.13	4776.59	4954.79	5007.10
Prob $> F$	0.0000	0.0000	0.0000	0.0000

IV-FE Results

Table 4
The Demand for Tasks and Exports
(log employment)
IV-FE

	(1)	(2)	(3)	(4)
A) Skilled and Unskilled Labor				
log highly-skilled	0.45***	0.31***	0.31***	0.31***
	(0.127)	(0.101)	(0.102)	(0.102)
log skilled	0.41***	0.26***	0.26***	0.26***
	(0.108)	(0.079)	(0.079)	(0.079)
log unskilled	-0.07	-0.32***	-0.32***	-0.32***
	(0.120)	(0.123)	(0.123)	(0.123)
B) Production and Non-Production Labor				
log production	0.29***	0.02	0.02	0.02
	(0.091)	(0.017)	(0.018)	(0.018)
log non-production	0.10	-0.02	-0.03	-0.03
	(0.060)	(0.048)	(0.047)	(0.047)
C) Tasks				
log managers	-0.05	-0.12	-0.13	-0.13
	(0.107)	(0.099)	(0.099)	(0.099)
log engineers	0.55***	0.40***	0.40***	0.40***
	(0.152)	(0.126)	(0.127)	(0.127)
log services	0.25**	0.11	0.10	0.10
	(0.105)	(0.099)	(0.098)	(0.098)
log blue-collar	-0.07	-0.33**	-0.34**	-0.34**
	(0.132)	(0.137)	(0.137)	(0.137)
log maintenance	-0.03	-0.09	-0.09	-0.09
	(0.100)	(0.102)	(0.102)	(0.101)

IV-FE Results

Table 5
The Demand for Tasks and Exports
(shares of employment)
IV-FE

	(1)	(2)	(3)	(4)
A) Skilled and Unskilled Labor				
share highly-skilled	0.08***	0.09***	0.09***	0.09***
	(0.029)	(0.030)	(0.030)	(0.030)
share skilled	0.07**	0.09***	0.09***	0.09***
	(0.029)	(0.031)	(0.031)	(0.031)
B) Production and Non-Production Labor				
share production	0.04***	0.01	0.01	0.01
	(0.012)	(0.009)	(0.009)	(0.009)
C) Tasks				
share managers	-0.01***	-0.00	-0.00	-0.00
	(0.005)	(0.005)	(0.005)	(0.005)
share engineers	0.09***	0.09***	0.09***	0.09***
	(0.030)	(0.030)	(0.030)	(0.030)
share services	-0.01	-0.00	-0.00	-0.00
	(0.007)	(0.007)	(0.007)	(0.007)
share blue-collar	-0.05*	-0.08***	-0.08**	-0.08***
	(0.029)	(0.031)	(0.031)	(0.031)
share maintenance	-0.01***	-0.01	-0.01	-0.01
	(0.005)	(0.004)	(0.004)	(0.004)