

Spatial Concentration of Skilled Labor: The Case of Chilean Manufacturing

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Human-Capital Spillovers

- Human-capital spillovers are an important source of economic growth at both national and regional levels (Lucas, 1988; Black and Henderson, 1999).
- Search for human-capital spillovers
 - Wage hedonic approach
 - Skilled workers become more productive in high skill-intensive regions and receive high wages (Rauch, 1993; Moretti, 2004b).
 - Production function approach
 - Firms/plants are more productive in high skill-intensive regions (Moretti, 2004a).
- What is the mechanism of spillovers?

Absorptive Capacity Hypothesis

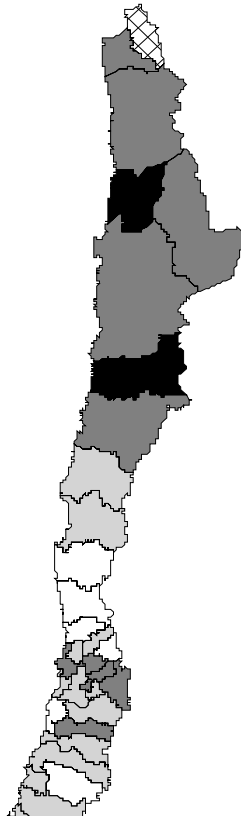
- Firms must invest in research and development in order to access new knowledge created by either other firms or the public sector (Cohen and Levinthal, 1989; Cockburn and Henderson, 1998).
- Is the presence of skilled workers a key channel by which knowledge is transmitted across firms or plants?

Objective

- Test the absorptive capacity hypothesis.
- Explore the role of spillovers in plants' location choice and exit.
 - Do entrants prefer a location where their productivity can be improved via spillovers? (Head and Mayer, 2003).
 - Are high-productivity plants less likely to exit skill-intensive regions? (Bernard and Jensen, 2007).

Agglomeration of Skill-Intensive Production in Chile

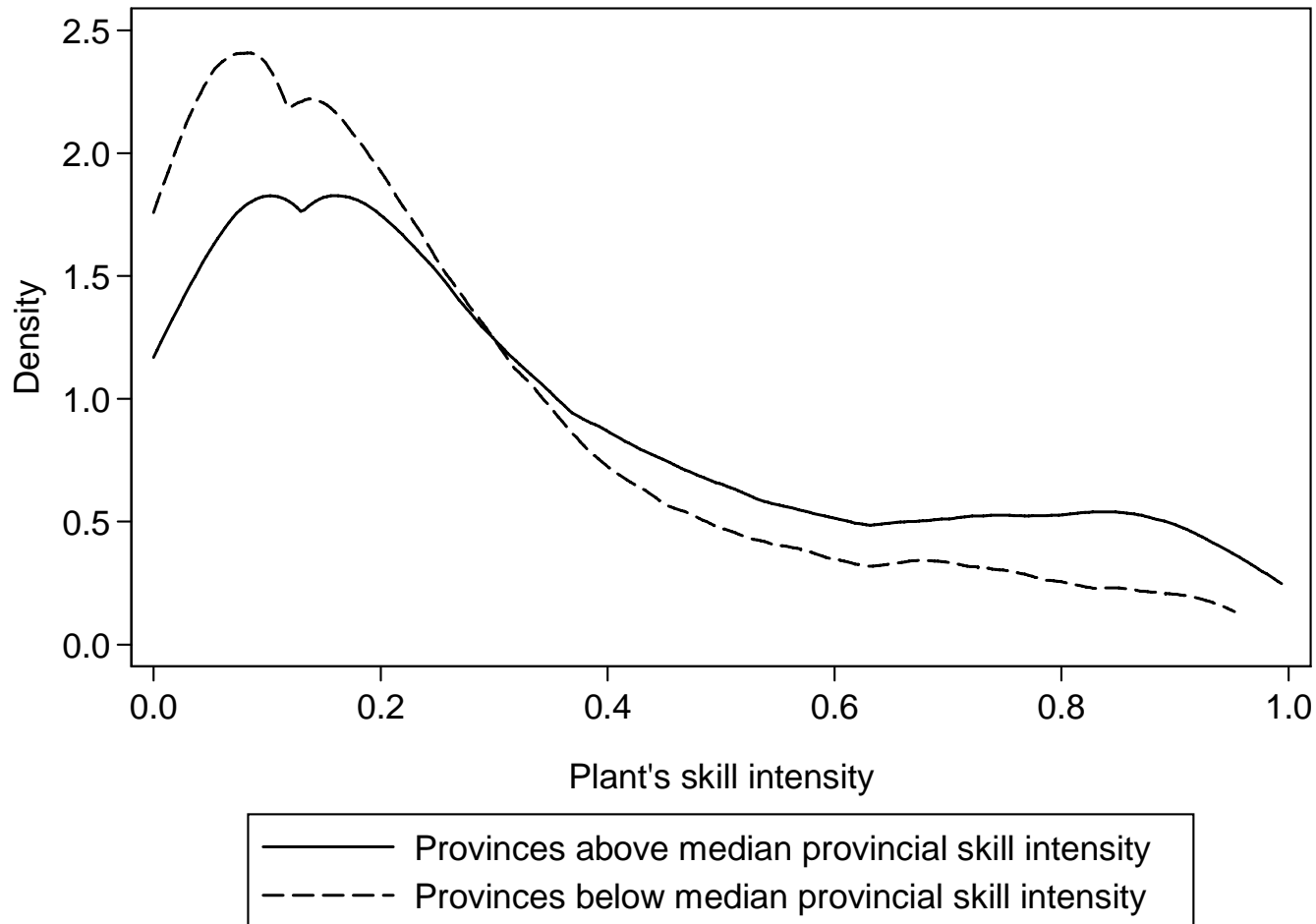
- Northern provinces



- Southern provinces



Entrants' Skill Intensity and Provincial Skill Intensity



Plant-Level Production Function

- Production function

$$\ln Y_{irt} = \beta_0 + \beta_1 \ln L_{irt}^s + \beta_2 \ln L_{irt}^u + \beta_3 \ln M_{irt} + \beta_4 \ln E_{irt} + \beta_5 \ln K_{irt} + \beta_6 \ln G_{irt} + \beta_7 \eta_{irt-1} S_{irt} + \omega_{irt} + \varepsilon_{irt}$$

G_{irt} : agglomeration economies

S_{irt} : knowledge resources accessible to a plant

η_{irt-1} : the one-period lagged share of skilled workers to total workers of plant i

ω_{irt} : plant-, time- and location-specific productivity shock

Estimation Issues

$$\omega_{irt} = \chi_{it} + \tau_{rt}$$

χ_{it} : plant's productivity shock

τ_{rt} : unobserved regional shocks

- Simultaneity problems.
 - Plant's productivity shock is likely correlated with conventional input use (Olley and Pakes, 1996).
 - Plants might be attracted to a region with positive unobserved regional shocks (Rosenthal and Strange, 2004).
- OLS yields biased parameter estimates of the production function
- Levinsohn and Petrin's (2003) approach
 - Use material input as a proxy for plant's productivity, ω .

Parameter Estimates of Plant-Level Production Function

Variable	ISIC							
	31	32	33	34	35	36	37	38
$\ln G$	0.022*** (0.006)	0.036*** (0.007)	0.007 (0.013)	0.004 (0.010)	-0.008 (0.013)	-0.023 (0.017)	0.016 (0.019)	0.017*** (0.006)
ηS	0.706*** (0.195)	0.243 (0.467)	0.792 (0.672)	0.956** (0.551)	2.307*** (0.458)	0.450 (0.395)	1.178** (0.540)	0.559** (0.274)
OBS.	4504	1991	1318	923	1860	583	253	2489

Note: *, ** and *** indicate statistical significance at the 10%, 5% and 1%, respectively.

Value in parenthesis is the bootstrapped standard error based on 200 iterations.

ISIC Code: 31 Food Processing, 32 Textiles, 33 Wood, 34 Paper, 35 Chemicals, 36 Glass, 37 Basic Metals, 38 Machinery.

- Agglomeration economies (Localization economies)
 - Food, textile and machinery industries.
- Human-capital spillovers
 - Food, paper, chemical, basic metals and machinery industries.

Entrants' Location Choice

- Entrant chooses its location where the expected discounted profit, represented by the following value function, is the highest among alternative regions.

$$v_t(X_{it}, Z_{rt}) = \alpha_{11} \ln AG_{irt} + \alpha_{12} \ln AS_{irt} + \alpha_2 \ln MP_{rt} + \alpha_{31} \ln w_{rt} \\ + \alpha_{32} \ln POPDEN_{rt} + \alpha_{33} UNIV_r + d_r + \mu_{irt}$$

$$\ln AG_{irt} = \hat{\beta}_6 \ln G_{irt}$$

$$\ln AS_{irt} = \hat{\beta}_7 \eta_{irt} S_{irt}$$

$\mu_{irt} \sim$ Type I extreme value distribution

- Estimate a conditional logit model of location choice (McFadden, 1984) .

Parameter Estimates of Entrants' Location Choice Model

	(1)	(2)
$\ln AG$	6.371*** (1.168)	7.172*** (0.739)
$\ln AS$	1.782*** (0.573)	1.522*** (0.383)
Number of plants	970	2434
20 or more employees only	Yes	No
Log Likelihood	-2436	-5858

Note: * and *** indicate statistical significance at the 10% and 1%, respectively. Value in parenthesis is the standard error.

- Entrants prefer a province where their productivity increases through agglomeration economies and human-capital spillovers.

Plants' Exit

- An incumbent decides whether to continue or stop production by comparing the expected discounted profit and the opportunity cost of continuing the operation.

$$E\left[v_{t+1}(X_{it+1}, Z_{rt+1}) | I_t\right] = \gamma_0 + \gamma_1 \ln prod_{irt} + \gamma_{21} age_{irt} + \gamma_{22} \ln size_{irt} + \gamma_{23} \ln K_{irt} / L_{irt} \\ + \gamma_{24} EXP_{irt} + \gamma_{25} FDI_{irt} + \gamma_3 \ln MP_{rt} + \gamma_{41} \ln w_{rt} + \gamma_{42} \ln POPDEN_{rt} + \alpha_{43} UNIV_r \\ + d_t + d_r + d_i + \kappa_{irt}$$

prod : Plant's overall productivity

$\kappa_{irt} \sim$ Logistic distribution

- Estimate a logit model of plant death.

Estimation Results for Plants' Exit Model

Variable	(1)	(2)
Productivity	-0.174** (0.089)	-0.167*** (0.066)
OBS.	10579	16345
20 or more employees only	Yes	No
Log Likelihood	-2956	-4898

Note: *, ** and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

- High-productivity plants are less likely to exit. A part of the productivity arises from agglomeration economies and human-capital spillovers

Effect of Provincial Skill Intensity on Plants' Productivity, Location Choice and Exit

- Results
 1. High skill-intensive plants can benefit from spillovers by locating high skill-intensive provinces (Absorptive capacity).
 2. High skill-intensive provinces are more likely to attract high skill-intensive plants.
 3. High skill-intensive plants are less likely to exit from high skill-intensive provinces.
- How much does the provincial skill intensity contribute to an improvement of productivity, attracting high skill-intensive plants and lowering the probability of exit for high skill-intensive plants?

Elasticity of Productivity, Entry and Exit with respect to Provincial Skill Intensity

ISIC	Plant's skill intensity (η)	Elasticity of		
		Productivity	Entry	Exit
Average	Low	0.028	0.049	-0.004
	Mean	0.112	0.196	-0.018
	High	0.200	0.349	-0.032

Note: Low, Mean and High correspond to mean minus one standard deviation, mean and mean plus one standard deviation of plant's skill intensity, respectively.

- Doubling provincial skill-intensity
 - increases the productivity of high (low) skill-intensive plants by 20 (3) %,
 - increases the probability of attracting high (low) skill-intensive plants by 35 (5) %, and
 - decreases the probability of exiting for high (low) skill-intensive plants by 3 (0.4) %.

Conclusions

- Own investment in skills is required over time to utilize knowledge created by other firms (Absorptive capacity hypothesis).
- High skill-intensive plants are attracted to skill-intensive regions, where the probability of exit is lower for high skill incumbents.
- Regional development: Investments in education and skill not only increase the supply of human capital (which helps attract plants to a region) but also raise the regional skill intensity, the source of human-capital spillovers.