Fewer but Better:
Sudden Stops, Firm Entry, and Financial Selection

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Sudden Stops, Firm Entry, and Productivity

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- **Sudden stop:** Abrupt reduction in net capital flows into an economy.

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Question:

- **What is the contribution to productivity of the forgone entrants?**

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- Is the **mass-composition margin** quantitatively important for the macroeconomic consequences of a sudden stop?

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   - During the crisis entrants are *fewer* (40% lower entry rate), *but better* (9 *p.p.* more profitable).
3. **Quantitative analysis:**
   - Medium-run: amplification and persistence.
   - Long-run: no heterogeneity doubles productivity loss, 30% larger consumption equivalent welfare cost.

Related Literature

Persistent Effects of Crises:

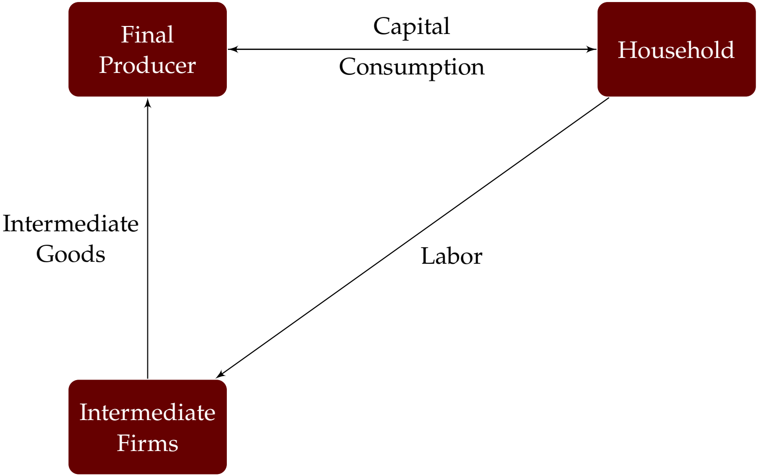
- **Motivation**: Cerra and Saxena (2008), Reinhart and Rogoff (2014).
- **Linking the short and long run**: Comin and Gertler (2006), Queralto (2014), Gornemann (2014), Guerron-Quintana and Jinnai (2014).

Firm Heterogeneity and Entry:

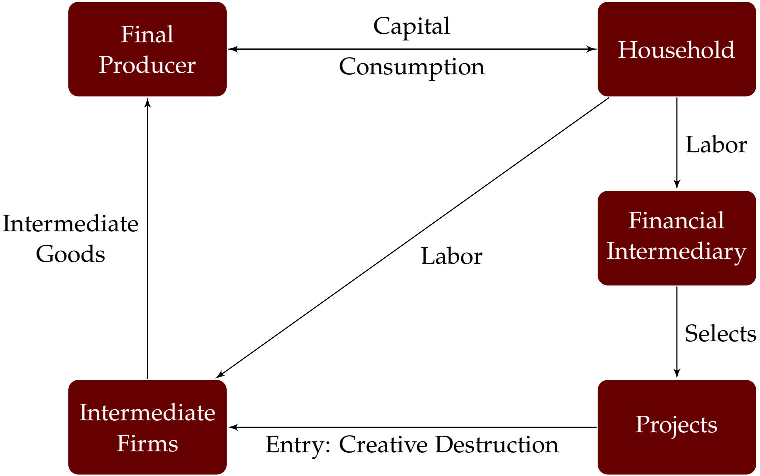
- **Short run**: Bilbiie, Ghironi and Melitz (2012), Clementi, Khan, Palazzo and Thomas (2014).
- **Long run**: Akcigit and Kerr (2013).

Model

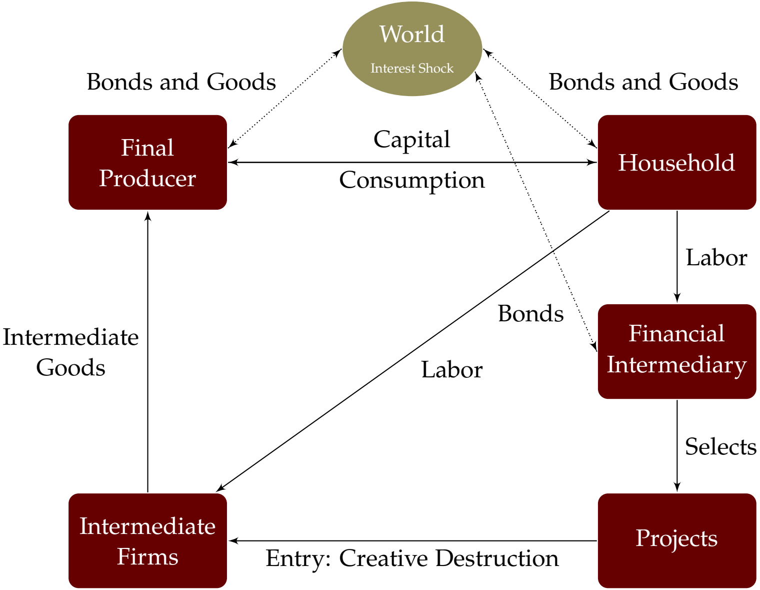
Model Overview: Standard Components



Model Overview: Endogenous Technological Change



Model Overview: Small Open Economy



Intermediate Good Producer

▸ FGP

Unit elastic demand from final good producer for variety j:

$$X_j^D(s^t) = \frac{\Gamma(s^t)}{p_j(s^t)}$$

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Every leader of type $d \in \{H, L\}$ earns the same profits ($\sigma^H > \sigma^L$).

Selection Technology

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- **Implied proportion of H-type in the entrant cohort:**

$$\tilde{\mu}^H \bar{z}^*(s^t)) = \underbrace{\frac{1}{\nu+1}}_{\substack{\text{Proportion if} \\ \text{random selection}}} \times \underbrace{\left[1-\rho+\rho\frac{1-\left(\bar{z}^*(s^t)\right)^{\nu+1}}{1-\bar{z}^*(s^t)}\right]}_{\geq 1 \text{ for } \nu>0}$$

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Financial Intermediary Decision Problem

Values

$$\max_{\bar{z}(s^t)} \left\{ \underbrace{\lambda(1-\bar{z}(s^t))}_{\text{Cohort's mass}} \times \left[\underbrace{\tilde{\mu}^H(\bar{z}(s^t))V^H(s^t) + (1-\tilde{\mu}^H(\bar{z}(s^t)))V^L(s^t)}_{\text{Cohort's expected value}} \right] \right.$$

$$\left. - \underbrace{(1-\bar{z}(s^t))R(s^t)W(s^t)\kappa}_{\text{Enaction cost}} \right\}$$

λ: Entry probability.

κ: Cost in units of labor of enacting a project.

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Aggregate Productivity

We can rewrite the production function as:

$$Y(s^t) = \underbrace{e^{\alpha \int_0^1 \ln q_j(s^t) dj}}_{(A(s^t))^\alpha} \left[\left(L^H(s^t) \right)^{\mu(s^t)} \left(L^L(s^t) \right)^{1-\mu(s^t)} \right]^\alpha \left(K(s^{t-1}) \right)^{1-\alpha}$$

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Empirical Results

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   - Interest rate spread rose by 270 bp the week after the default.
   - Non FDI financial flows decreased by more than 40%.

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Were firms born during the sudden stop *fewer, but better*?

Fewer...

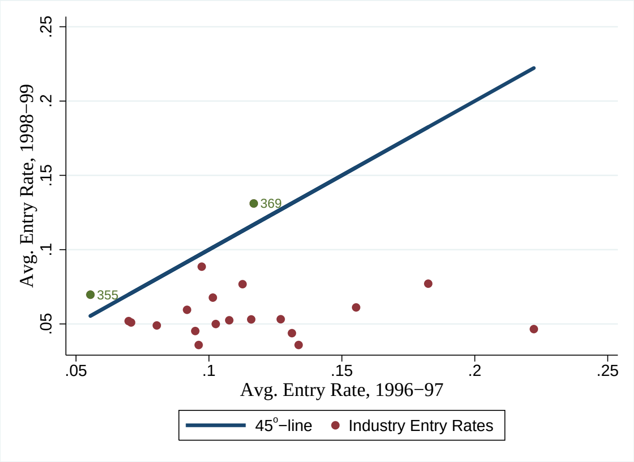

Figure: Mass (quantity)

- **Mass**: Firm entry drops on average by 40% during the crisis.

Summary:

1. The average firm born during crisis is 9*pp* more profitable.
2. The average firm born during crisis has higher labor productivity.
3. The average firm born during crisis accumulates capital faster.
4. The average firm born during crisis does not face higher exit risk.
5. Even during tranquil times, larger cohorts at the industry level are associated with lower average profitability.

Quantitative Exploration

Internally Calibrated Parameters

▸ EC

Parameter	Symbol	Value	Main identification
Patience parameter	β	0.9975	$\beta = (1+a)^{\gamma} / \bar{R}$
Success probability	λ	5.36%	Entry rate
Enaction cost	κ	6.65%	Entry cost
Labor disutility level	Θ_l	1.73	Working time
Screening accuracy	ρ	69.7%	Fast exit
Scarcity	ν	4.51	Growth
Capital adjustment cost	ϕ	20	Investment volatility

Target	Model	Data	Expression
Entry rate	2.71%	2.71%	$\lambda(1-\bar{z})$
Entry Cost	12.1%	12.1%	$\kappa(w/y)$
Working time	33.0%	33.0%	L
Fast exit	15.0%	15.0%	$(1-\rho)\bar{z}$
Growth	0.62%	0.62%	$a = \left((1+\sigma^H)^{\mu^H}(1+\sigma^L)^{1-\mu^H}\right)^{\lambda(1-\bar{z})} - 1$

- Ext. Calibrated Parameters: In accordance with SOE-RBC literature.

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Validating the Model

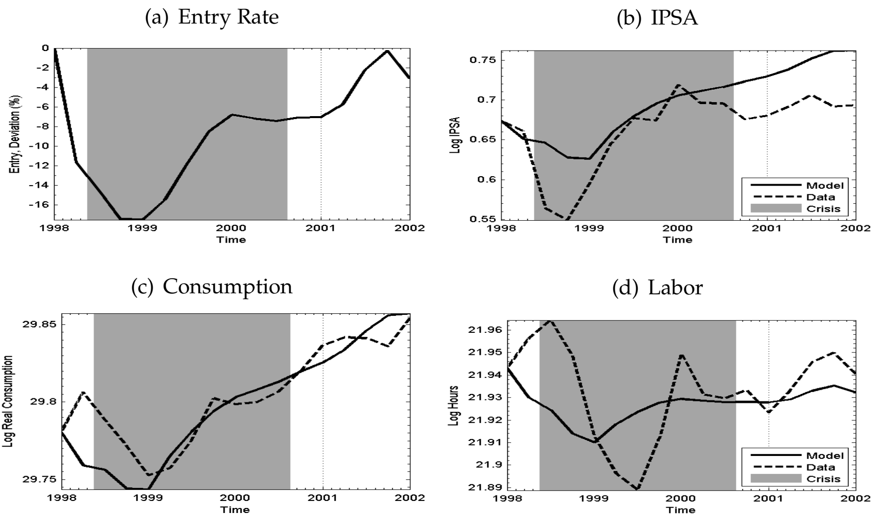

Figure: Non Targeted Macro Series

Model Comparisons

Two additional models for comparison with baseline model (*Base*):

1. **Exogenous Growth Model** (***Exo***):
   - No entry: productivity grows at a constant and exogenous rate.
   - No long-run cost: return to the original path after a shock.
2. **No Heterogeneity Model** (*NoHet*):
   - Only one step size: homogeneous entry, no selection.
   - Long-run cost: back to a parallel but lower path.

Same common parameters and same long run growth.

IRF: Mass and Composition

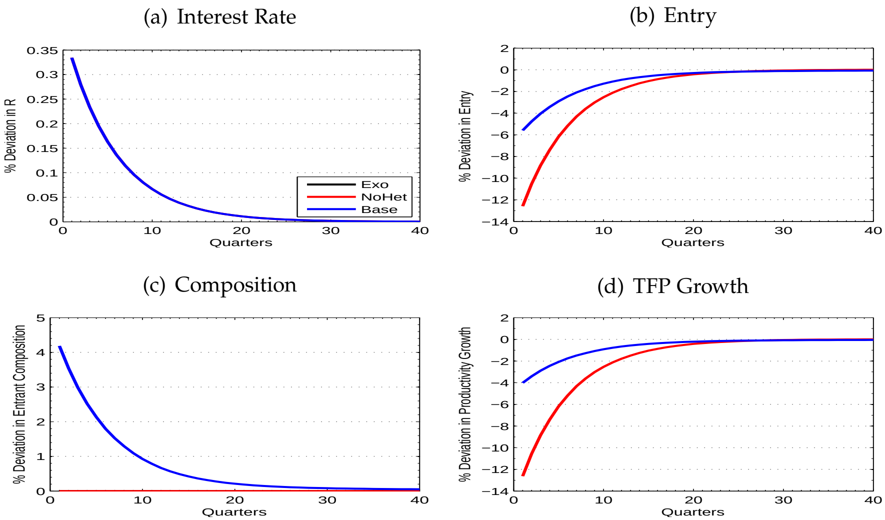

Figure: 33 basis point increase in interest rate.

The Importance of Heterogeneity and Selection

(a) Long-run Cost (b) Consumption Equivalent Welfare Cost

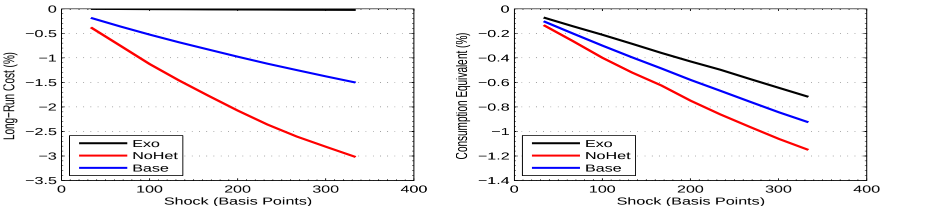

Figure: The Impact of Selection.

1. ***Exo***: No long-run cost by construction.
2. *Base* versus ***Exo***: Long-run cost is 1/3 of welfare cost.
3. *NoHet* versus *Base*: 2 times higher long-run cost. 30% higher welfare cost.

Financial Development

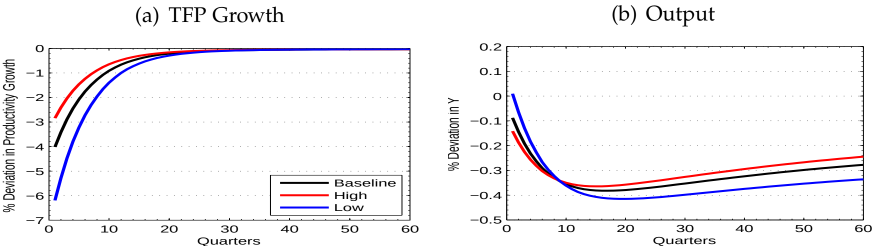

Figure: Financial Development.

1. i) **Baseline**: $\rho = 70\%$ ii) High: $\rho = 91\%$ iii) Low: $\rho = 49\%$.
2. *Lower* ρ: *more* medium-run amplification and persistence, *higher* long-run cost and *lower* short-run impact.

Conclusion

1. Tractable framework for studying heterogeneity and financial selection in a dynamic stochastic small open economy model.
2. Firm level evidence of novel *mass-composition* trade-off: Cohorts born during the Chilean sudden stop were *fewer, but better*.
3. Heterogeneity and selection are quantitatively important:
   3.1 No heterogeneity doubles the long-run cost.
   3.2 No heterogeneity increases the welfare cost by 30%.
4. Financial development introduces a trade-off between short-run impact, and long-run cost.

APPENDIX

Representative Final Good Producer

Back

Intermediate inputs and capital are combined to produce the final good:

$$\ln Y(s^t) = \alpha \int_0^1 \ln X_j^D(s^t)dj + (1-\alpha)\ln K^D(s^{t-1})$$

Working capital constraint on intermediate goods.

$$\max_{K(s^{t-1}),\left\{X_j^D(s^t)\right\}_{j\in[0,1]}} \left\{ Y(s^t) - \left(1 + \underbrace{\eta(R(s^t)-1)}_{\text{Cost wedge}}\right) \int_0^1 X_{j,t}^D p_j(s^t)dj - K^D(s^{t-1})r(s^t) \right\}$$

Demand for variety j:

$$X_j^D(s^t) \quad = \quad \frac{\alpha Y(s^t)}{p_j(s^t)\left(1+\eta(R(s^t)-1)\right)} \equiv \frac{\Gamma(s^t)}{p_j(s^t)}$$

- η: Fraction of intermediate expenditure to be held as working capital.
- Final good is the numeraire.

Incumbent's Value:

Back

Value of a type d product line:

$$V^d(s^t) = \underbrace{(1-\tau)\Pi^d(s^t)}_{\text{After-tax Profits}} + E\left[\underbrace{m(s^t,s_{t+1})}_{\text{Stochastic Discount}} \underbrace{(1-\lambda M(s^t,s_{t+1}))}_{\text{Survival Probability}} V^d(s^t,s_{t+1}) | s^t\right]$$

τ: Corporate tax.

$M(s^t,s_{t+1})$: Mass of projects enacted.

λ: Entry probability.

$m(s^t,s_{t+1})$: Stochastic discount factor of the household.

Representative Household

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$$\max_{\{B(s^t),C(s^t),L(s^t),I(s^t)\}_{t=0}^{\infty}} \sum_{t=0}^{\infty}\sum_{s^t}\beta^t\pi(s^t)\frac{1}{1-\gamma}\left(C(s^t)-\Theta_l A(s^t)\left(L(s^t)\right)^{\upsilon}\right)^{1-\gamma}$$

subject to:

$$C(s^t) \quad \leq \quad W(s^t)L(s^t)+r(s^t)K(s^{t-1})+B(s^{t-1})R(s^{t-1})+T(s^t)-I(s^t)-B(s^t)-\psi(\bullet)$$

where

$$I(s^t) \quad = \quad K(s^t)-(1-\delta)K(s^{t-1})+\Phi(\bullet)$$

As in **Neumeyer and Perri (2005)**:

- Preferences: Greenwood, Hercowitz, and Huffman (1988).
- Bond holding costs:

$$\Psi(B(s^t),Y(s^t)) \quad = \quad \frac{\psi}{2}Y(s^t)\left(\frac{B(s^t)}{Y(s^t)}-\bar{b}\right)^2$$

- Capital adjustment costs:

$$\Phi(K(s^{t-1}),K(s^t)) \quad = \quad \frac{\phi}{2}K(s^{t-1})\left[\frac{K(s^t)}{K(s^{t-1})}-(1+\bar{g})\right]^2$$

Closing the Model

Back

1. Representative household as in Neumeyer and Perri (2005)
2. The interest rate $R(s^t)$:

$$\ln\left(\frac{R(s^t)}{\bar{R}}\right) = \rho_R \ln\left(\frac{R(s^{t-1})}{\bar{R}}\right) + \sigma_s \epsilon(s^t)$$

3. Net exports:

$$NX(s^t) \quad = \quad Y(s^t) - C(s^t) - I(s^t) - \Psi(\bullet)$$

4. Debt position of the country:

$$D(s^t) \quad = \quad B(s^{t-1}) \underbrace{-\eta H(s^t) - (1-\bar{z}(s^t))\kappa W(s^t)}_{\text{Working Capital and Project Enaction}}$$

5. Composition of the intermediate good producers:

$$\mu(s^t) = \mu(s^{t-1}) + \lambda(1-\bar{z}(s^t))\left(\tilde{\mu}(\bar{z}(s^t)) - \mu(s^{t-1})\right)$$

Equilibrium Definition

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Let a lower case variable, e.g. $e(s^t) = \frac{E(s^t)}{A(s^t)}$, denote normalized variables where

$$\ln(A(s^t)) \equiv \int_0^1 \ln q_j(s^t) dj.$$

This transformation renders the model stationary.

Equilibrium

A competitive equilibrium for this small open economy, given initial conditions:

1. Households optimally choose $\{c(s^t), b(s^t), k(s^t), L(s^t)\}$.
2. Final good producers optimally choose $\left\{ \left\{ x_j^D(s^t) \right\}_{j\in[0,1]}, k^D(s^{t-1}) \right\}$.
3. Intermediate good producers optimally choose $\{x_j(s^t), p_j(s^t), L_j(s^t)\}_{j\in[0,1]}$.
4. Financial intermediary optimally chooses $\{\bar{z}(s^t)\}$;
5. Government budget is balanced every period.
6. Labor, asset, capital, final and intermediate good markets clear.
7. $\{q_j(s^t), v_j(s^t)\}_{j\in[0,1]}$ and $\{\mu(s^t), \tilde{\mu}(s^t)\}$ evolve according to their law of motion.

Probability of a Superstar

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- **Superstar:** one standard deviation above average $P_t = \frac{Revenue_t - Cost_t}{Revenue_t}$.

$$Pr(\text{Superstar} = 1 | \text{age} = 1) = \frac{e^{x_i'\beta}}{1 + e^{x_i'\beta}} \quad \text{where} \quad x_i'\beta = \alpha + \alpha_j + \alpha_r + \beta \ln(L_{i,0}) + \gamma_{\text{cohort}} + u_{i,t}$$

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	(1)	(2)	(3)	(4)	(5)
		Superstar at age 1		Superstar at age 0	Superstar at age 2
Crisis Dummy	0.540***			0.295***	0.312**
	(0.110)			(0.0970)	(0.135)
In Crisis		0.697***			
		(0.134)			
After Crisis		0.240*			
		(0.126)			
$\text{entry}_{j,0}$			-1.575**		
			(0.803)		
$\ln(L_{i,0})$	0.222***	0.216***	0.209***	0.146***	0.153**
	(0.0527)	(0.0526)	(0.0521)	(0.0436)	(0.0605)
Observations	3197	3197	3197	4220	2618

Standard errors in parentheses, bootstrapped (250), * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Cohort Effect, Age 1

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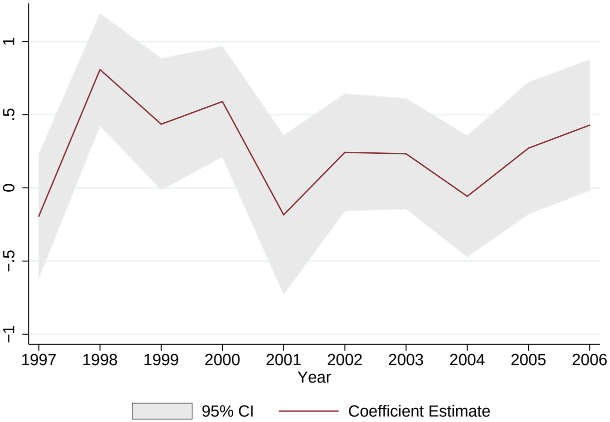

Figure: Logit Estimation by Cohort

Main Equation:

$$Profitability_{i,t} = \alpha + \beta X_{i,t} + \gamma Z_i + \bar{\gamma}\ Born\ in\ Crisis + \mu_i + \epsilon_{i,t}$$

- $X_{i,t}$: Firm level variables (e.g: size) and macro variables (e.g: unemployment).
- Z_i: Initial conditions (e.g: size at entry) and industry and region controls.
- *Born in Crisis* is 1 if the firm was born in $1998 - 2000$. Main focus is to estimate $\bar{\gamma}$.

Estimation by Hausman and Taylor (1981).

- $profitability = \frac{Revenue - Cost}{Revenue}$

Fewer but Better: 9 *p.p.* more profitable

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	(1) $P_{i,t}$	(2) $P_{i,t}$	(3) $P_{i,t}$	(4) $P_{i,t}$	(5) $\log \frac{Y_{i,t}}{L_{i,t}}$	(6) $\frac{K_{i,t}-K_{i,t-1}}{K_{i,t}}$
Crisis dummy	0.0877**			0.0814***	0.325**	0.0527**
	(0.0423)			(0.0313)	(0.136)	(0.0233)
In Crisis		0.0861**				
		(0.0397)				
After Crisis		0.00952				
		(0.0241)				
avg. Entry_{j,t_0}			-0.682**			
			(0.337)			
Relative effect at means	−31.2%	−31.3%	–	−28.4%	−32.5%	−29.2%
Sargan-Hansen (p)	0.4545	0.2333	0.1230	0.0476	0.0395	0.7702
Observations	16834	16834	16834	16371	15583	16388

Standard errors in parentheses (bootstrapped (250), clustered by firm)

Controls: Macro controls (unemp. manuf. prod. labor cost, PPI), Elec. cons., labor, capital, age, initial HHI, initial workers, industry, and geography.

Regressions (4) and (5) use initial capital to control for entry size instead of workers.

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Ex post selection?

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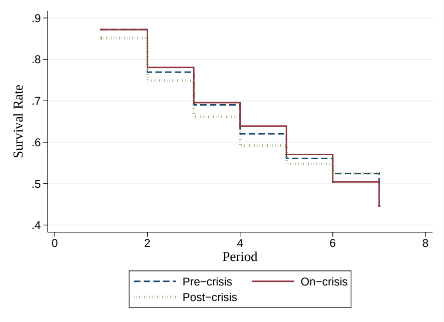
$$h_{mn}(t, \mathbf{X}_i) = h_{0mn}(t) \exp\left[\beta_1 \log(elec_{it}) + \beta_2 \log(worker_{it}) + \beta_3 \log(worker_{i0}) + \beta_4 \log(elec_{i0}) + \beta_5 \log(prft_{jt}) + \gamma \cdot industry\right]$$ [1]



1. Proportional hazard model is not rejected.
2. **Firms born in crisis do not die more**: *ex ante* Selection!

[1] Stratified by region (m) and period (n)

Externally Calibrated Parameters

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Parameter	Symbol	Value	Source
Capital share	$1-\alpha$	0.32	Mendoza (1991)
Elasticity of Substitution $(1/\gamma)$	γ	2	Mendoza (1991)
Frisch Elasticity $(1/(1-\chi))$	χ	1.455	Mendoza (1991)
Working Capital	η	1	Neumeyer and Perri (2005)
Debt adjustment cost	ψ	0.0001	Low
Depreciation rate	δ	1.94%	Bergoeing et al (2002)
Corporate tax rate	τ	0.17	Data
Long-run interest rate	$\bar{R}$	1.015	Chilean Central Bank Data
Persistence of interest rate	ρ_r	0.836	Chilean Central Bank Data
Dispersion of interest rate shock	σ_r	0.33%	Chilean Central Bank Data
Long-run debt to GDP ratio	$\bar{b}$	$4*(-0.44)$	Chilean Central Bank Data
Low profitability $(\sigma^L/(1+\sigma^L))$	σ^L	14.5%	ENIA
High profitability $(\sigma^H/(1+\sigma^H))$	σ^H	55.5%	ENIA

- In accordance with SOE-RBC literature.

Permanent Effect in the Data

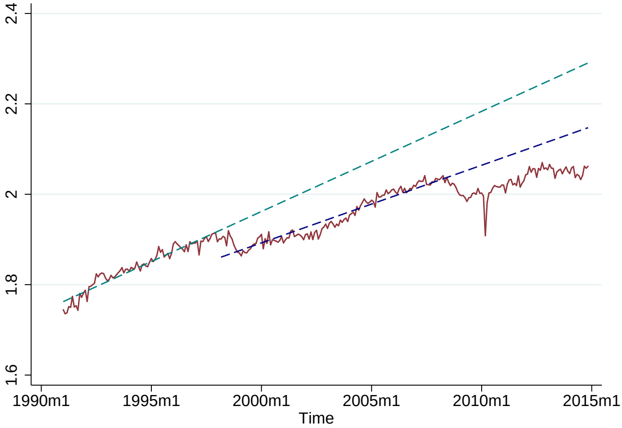

Figure: Monthly Manufacturing Production (log)