Dynamics of Corporate Credit Markets, Employment and Wages: Evidence from Colombia

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How does access to credit affect employment and wages in normal times?

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- New facts: worker level heterogeneity, firm level heterogeneity

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- New facts: worker level heterogeneity, firm level heterogeneity
- New aggregate implications: production structure and liquidity constraints

What we do

1. Provide evidence on how credit availability affects employment and wages
    - Data from Colombia linking **banks-firms-workers**
    - We identify shocks to credit supply
    - An exogenous **increase** in credit supply:
        1. Increase investment, and no effect on employment or average wages
        2. Uneven effect across types of **workers**: below median wages fall
        3. Uneven effect across **firms**: firms with more liquid assets increase employment and wages

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2. Develop a model consistent with these facts
   - Key ingredients:
     - Capital-Low-skill substitutability
     - Liquid asset to finance working capital

} **Opposing forces on employment and wages**

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   - Key ingredients:

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     - Liquid asset to finance working capital

     } **Opposing forces on employment and wages**

   - Counterfactuals:

     - What are the effects of a credit supply shock with no Capital-Low-skill substitutability or the liquid asset?
     - How do reductions in the intermediation premium influence the response to credit supply shocks

Literature and contribution

We differ from the existing literature in three dimensions:

1. Financial shocks and labor markets: Chodorow-Reich (2014),Calvo et al. (2012), Popov and Rocholl (2018), Huber (2018), Berton et al. (2018)
   - Abstracting from financial crises
   - Exploring heterogeneous effects on workers
2. Financial shocks and firms dynamics: Amiti and Weinstein (2018), Jiménez et al. (2019), Gilchrist et al. (2017), Kim (2018)
   - Relationship between internal and external financial constraints
   - Exploring the effect on wages
3. Financial frictions in small open economies: Fonseca and Van Doornik (2022), Neumeyer and Perri (2005), Quadrini (2011), Leyva and Urrutia (2020)
   - Empirics: how credit availability affects employment and wages
   - Model: bank and working capital financed with liquid funds

Data

Empirical Results

Model

Characteristics of the data: Annual between 2008 and 2018

Credit

- Sources: Administrative data (Formato 341)
- 16 Banks and 138k firms: Universe of banks and firms
- On average 2 relationships per firm, and maximum 12

SummStats Credit SummStat Firms and Workers

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Firms

- Source: Administrative data (Super Sociedades)
- 11k firms: 30% of the firms that ever reported
- Sample of large firms: on average more than 100 workers, 10M USD in sales

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Workers

- Source: Adimistrative data (PILA)
- 3.3M workers: 60% of the formal workers
- Average wage two times the minimum wage: $542 monthly USD

SummStats Credit SummStat Firms and Workers

Data

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Model

Changes in lending from a particular bank to firms with which it has a relationship

Using the credit data and following Amiti and Weinstein (2018)

1. Identification: firm-bank match uncorrelated with bank fixed effect

$$\underbrace{\frac{d_{fbt} - d_{fbt-1}}{d_{fbt-1}}}_{\text{Change in borrowing}} = \underbrace{\alpha_{ft}}_{\text{Firm}} + \underbrace{\beta_{bt}}_{\text{Bank}} + \epsilon_{fbt}$$

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2. Normalization: Deviations from the median shock per year
3. Credit supply shock at the firm level:

$$\text{Credit Supply Shock}_{ft} = \sum_b \theta_{fbt-1} \hat{\beta}_{bt}, \quad \theta_{fbt-1} = \frac{d_{fbt-1}}{\sum_b d_{fbt-1}}$$

Sample Granularity and number of relationships Connected Set More

Jordá projections at the firm level

$$\log Y_{ft+h} - \log Y_{ft-1} = \beta_0 + \beta_h \textbf{ Credit Supply Shock}_{ft} + X_{ft-1}\Gamma + \alpha_{jth} + \alpha_f + \epsilon_{fth}$$

- Y_{ft+1}: Debt, Gross Investment, Working Capital, Employment, and Av. Wages
- $h = \{0, 1, 2, 3\}$: years after the shock
- X_{ft-1}: Sales, Locations, Cash, Leverage
- α_{jth}: Sector-time fixed effects,
- α_f: Firm fixed effects,

Interpretation of β_h:

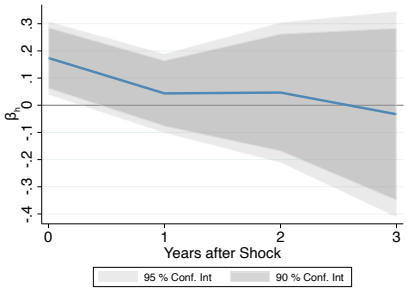
- Growth rate of Y_{ft+h} to a one unit increase of the credit supply shock relative to the median shock

Workers Decile

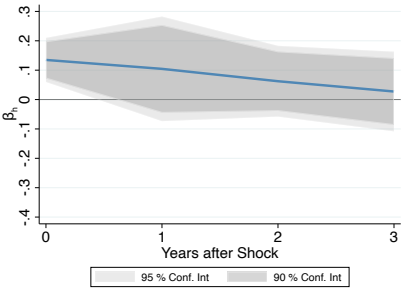
A positive credit supply shock increases firm level debt and capital

- Debt position increases with the banks by 2.34% **to a one standard deviation shock**
- Capital increases by 1.8%

Δ Debt



Δ Capital

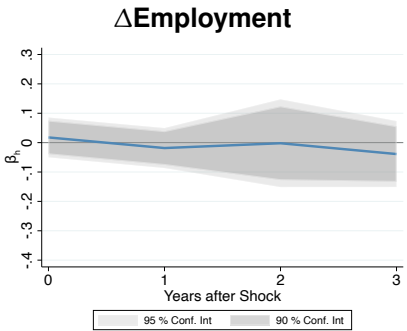


IRF Sales More debt More Capital Technical notes

Empirical Results

Fact 1. A positive credit supply shock does not have an average effect of employment or wages

There is no evidence that a positive credit supply shock affects employment or average wages



Technical notes Debt and Capital Large Shocks

Empirical Results

Fact 2. A positive credit supply shock has uneven effects across types of workers

Heterogeneous effects on workers within the firm

- Jordá projections at the workers level

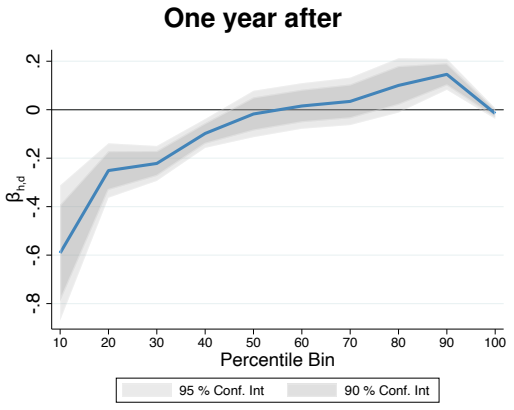
$$\log(w_{ift+h}) - \log(w_{ift-1}) = \beta_0 + \beta_h \mathbf{CSS}_{ft} + \beta_{hd} \mathbf{CSS}_{ft} \times decile_{ift-1} + X_{ift-1}\Gamma + \alpha_{fth} + \alpha_i + \epsilon_{ifth}$$

- **CSS**: Credit Supply Shock
- $h = \{0, 1, 2\}$: years after the shock
- X_{ift-1}: age and age squared
- α_{fth} : Firm-time fixed effects
- α_i: Worker fixed effects

Levels

After a positive shock of credit supply wages below the median fall while increasing at the top

- The bottom decile declines by 0.7%
- The top decile increases by 0.2%



Empirical Results

Fact 3. Uneven effect across firms: Liquidity constraints

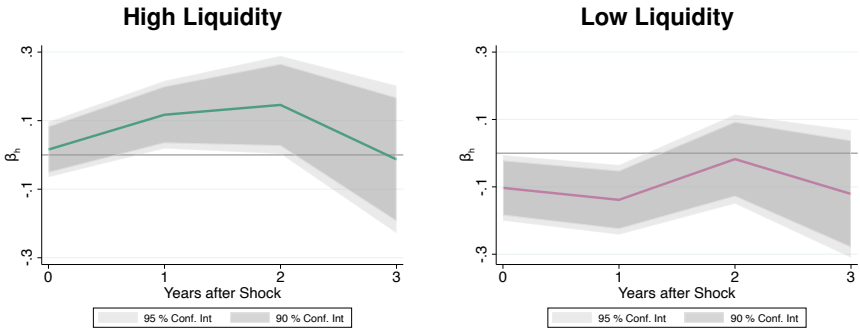
Liquid assets constraints

- Low liquidity firms: Less ability to finance current obligations
- Liquidity: cash and short term investment holdings to total assets
- Two groups: High liquidity and low-liquidity firms

$$\text{High Liquidity} = \overline{Liquidity}_f \geqslant \text{Median}\,(\overline{Liquidity}_f)$$

After a positive shock of credit supply firms with high liquidity increase working capital, firms with low liquidity decrease working capital

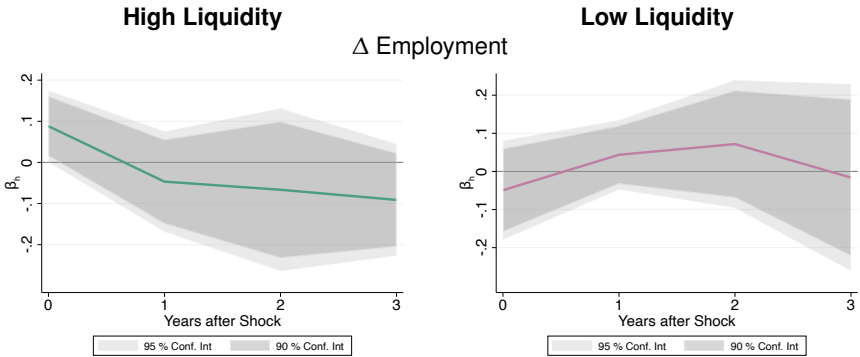
- Δ Working Capital: $\Delta \frac{\text{short-term assets}}{\text{short-term liabilities}}$



Technical notes Capital Debt Sales Composition

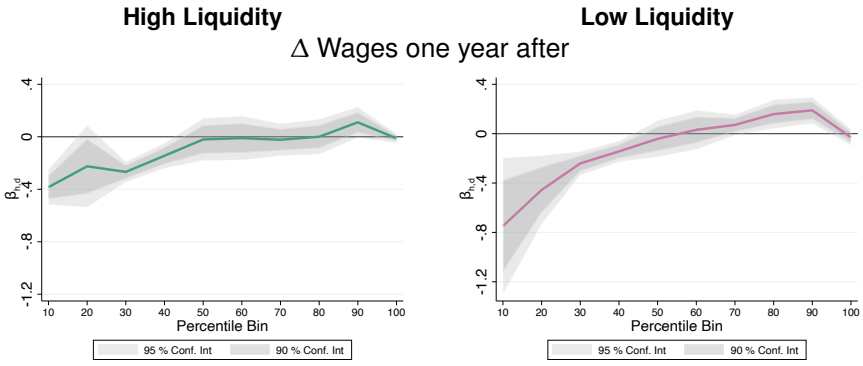
Labor demand increases in high-liquidity firms

- In High-Liquidity firms employment increase 1.3% on impact



Av. Wage Capital Technical notes

Low liquidity firms have more uneven changes in wages



Technical notes Employment

Summary of the findings

- How does access to credit affect employment and wages in normal times?

Fact 1 Does not have an effect on employment or average wages

- Why? Two mechanisms interacting

Fact 2 Capital-Low-skill substitutability:

  - Wages below the median fall, capital and wages above the median increase

Fact 3 Uneven effect on firms in terms of liquidity:

  - Liquidity constrained firms decrease working capital
  - Liquidity unconstrained firms increase labor demand

Additional Results

Data

Empirical Results

Model

What does the model include?

- Neoclassical partial equilibrium model with working capital:
  1. Two types of labor: skilled and unskilled
  2. A Liquid asset to finance working capital
  3. Banks
  4. Frictional labor market
- Change labor demand through two channels ways:
  - Fact 2 Capital skill-substitutability
  - Fact 3 Working capital constraint

} Fact 1 No effect on employment and wages

Model set-up

- Household More
  - Owner of the firm and the bank
  - Infinitely lived individuals of two types, skilled z and unskilled u
  - Each type has measure 1
  - Bargains wages with the firm More
- Banks More
  - Take deposits and lend to the firms
  - Incur in a cost when lending
  - Changes to the lending cost are the credit supply shock
- Firms More

Model set-up

- Household More
- Banks More
- Firms More
  - Borrow from the bank to finance investment
  - Save liquid assets at the bank: exogenous fixed interest
  - Cannot borrow at the deposit rate
  - Use the liquid assets to finance a fraction of the labor costs
  - Do not receive interest on early withdrawals
  - Bargain wages with the workers More
  - Portfolio and investment adjustment costs

Conclusions

- New database:
  - Administrative database from Colombia between 2008-2018 linking banks, firms, and workers
- Empirics:
  - Framework that changes how we think about the effects of credit shocks on employment and wages
  - Reveals important heterogeneous effects for firms and workers
- Model:
  - Shows how the production structure, and the liquidity position mediate the effects of credit shocks
  - These two channels are key when thinking in terms of policy

Thank you!!

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Appendix: Data

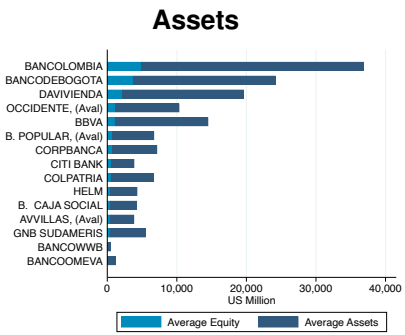
Appendix: Shock Validation

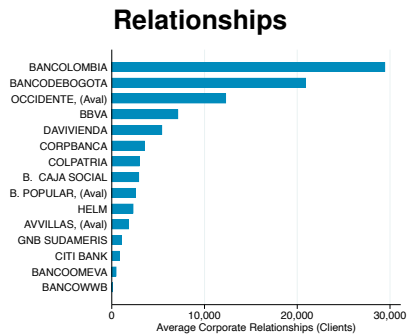
Appendix: Firm Results

Appendix: Gender

Appendix: Model

Banks Assets





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Summary Statistics: Firms and Workers

	Mean	Std. Dev	Pctile. 95	Pctile. 5
Sales*	10.97	141.50	32.69	0.22
Capital*	16.23	222.11	42.80	0.15
Debt	6569.65	46659.29	24227.43	50.18
Liquidity	0.07	0.10	0.27	0.00
Locations	1.28	0.56	2.00	1.00
		Workers		
Wage	542.96	625.46	1683.68	166.71
Age	34.83	10.32	54.00	21.00
Male	0.59	0.49	1.00	0.00

Note: * Millions US Dollars 2018 per year, Sales: Operational income. Locations: Total numbers of cities where workers report location. Leverage: demeaned debt to assets. Liquidity: Cash and current investments to assets. Equity to assets: Total equity to total assets.$^{\diamond}$ Male workers ratio.

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Characteristics of the credit supply shock

- Correlated with healthier banks ▸ More
- Idiosyncratic Shocks and the Global Financial Crisis ▸ More
- Uncorrelated with the business cycle ▸ More
- Correlated with credit growth using banks' balance sheets ▸ More
- After we aggregate at the firm level: ▸ More
  - Average Shock: 0.05
  - Standard Deviation: 0.13

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Banking Shock Estimation and Sample

- We use all firms and banks with more than one relationship
  - Banks with more than 5 credit operations
  - 138683 firms and 16 banks
- We estimate and validate the shock using three samples:
  1. Firms with at least 4 consecutive periods: 126950 firms
  2. Formato 341 and PILA: 17599
  3. Formato 341, PILA and Super Sociedades: 13723

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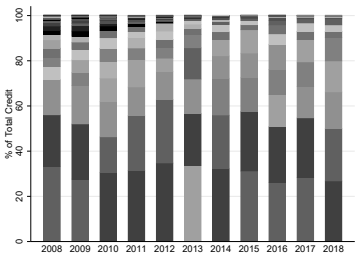
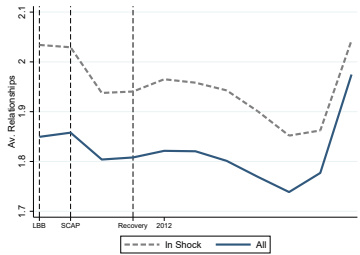
Identification: Borrowing Relationships and Credit Concentration

- Three banks have 60% of total credit
- On average firms have two relationships

Credit Concentration



Relationships



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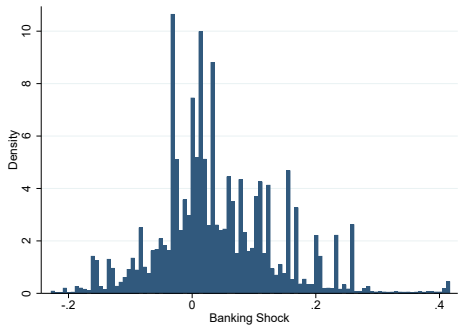
Distribution of the Credit Supply Shock



Note: Distribution of the estimates β's from the regression $\Delta\%L_{fbt} = a + \alpha_{ft} + \beta_{bt} + \epsilon_{fbtfbt}$

Back

Connected Set

Year	Allocation	Size	Fraction
2008	55484	55484	100%
2009	57145	57145	100%
2010	49486	49486	100%
2011	47091	47091	100%
2012	49965	49965	100%
2013	51506	51506	100%
2014	52567	52567	100%
2015	57021	57021	100%
2016	58925	58925	100%
2017	56797	56797	100%
2018	66399	66399	100%

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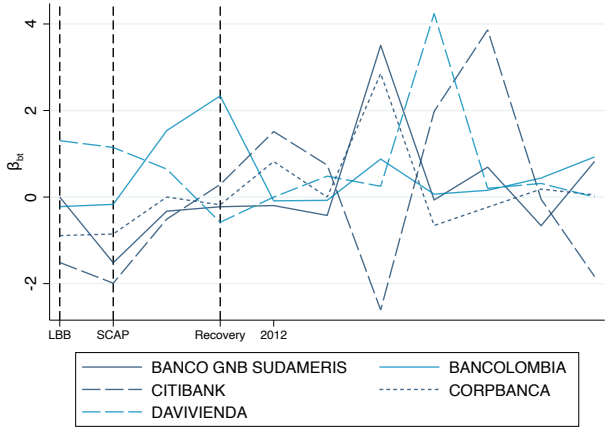
Cross Section: Healthier Banks have positive Banking Shocks

	(1)	(2)	(3)
	Banking Shock		
Dividends Dummy	0.42**		
	(0.09)		
CASA		0.45**	
		(0.22)	
Capital to Liabilities			-0.53***
			(0.16)
Time FE	Yes	Yes	Yes
N	149	149	149

Note: Robust Standard errors in parentheses clustered at the bank level.* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Back

CitiBank had a negative shock during the Global Financial Crisis



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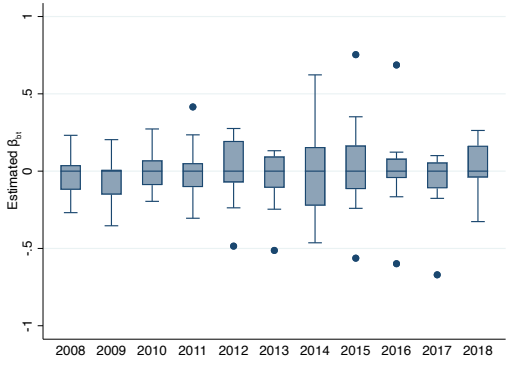
The credit supply shock is uncorrelated with the business cycle

	(1)	(2)	(3)	(4)
		$\hat{\beta}_{bt}$		
$\hat{\beta}_{bt-1}$	0.36***	0.36***	0.36***	0.37***
	(0.12)	(0.12)	(0.12)	(0.12)
Cyclical component GDP		0.39		
		(0.87)		
Cyclical component GDP_{t-1}			-0.02	
			(0.91)	
Cyclical component GDP_{t+1}				1.24
				(0.93)
Cons	-0.00	-0.01	-0.00	-0.02
	(0.02)	(0.01)	(0.02)	(0.02)
N	137	137	137	123

Note: Robust Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Back

Variation of the credit supply shock over time



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Cross-Section: $\hat{\beta}_{bt}$ is positively correlated with Commercial Credit Growth from Banks Balance Sheets

	Shock
Δ% Comm. Credit	0.38^{***}
	(0.08)
Time FE	Yes
N	145

Note: Robust Standard errors in parentheses clustered at the bank level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Back Robustness

Robustness: All Samples

	(1) All Firms	(2) PILA-341	(3) Super Sociedades
	0.32^{***}	0.48^{**}	0.59^{**}
	(0.08)	(0.21)	(0.20)
Time FE	Yes	Yes	Yes
hline *N*	145	145	145

Note: Robust Standard errors in parentheses clustered at the bank level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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Technical Notes:

Note: Robust standard errors clustered at the firm and time level. All specifications include as controls lagged log sales, cash, log of number of locations, and demeaned leverage. Sample sizes: $h = 0$: 25244, $h = 1$: 19599, $h = 2$:16987, $h = 3$:13628.

Back Capital and debt Back Employment and wages Back Liquidity Capital Back Liquidity Labor

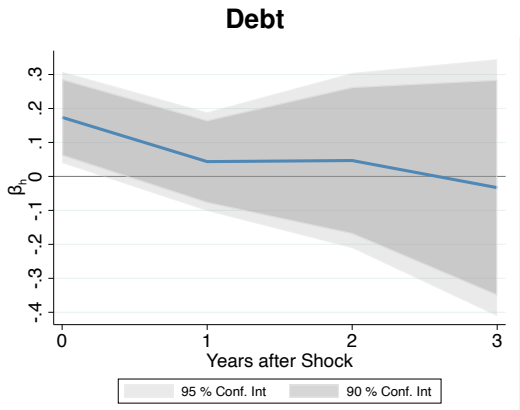
Technical Notes:

Note: Robust standard errors clustered at the firm and time level. All specifications include as controls lagged age and age squared. Sample sizes: $h = 1$: 2976639, $h = 2$:1879977.

Back Workers

A positive credit supply shock increase firm level debt with banks

- Debt position increases with the banks by 2.34%



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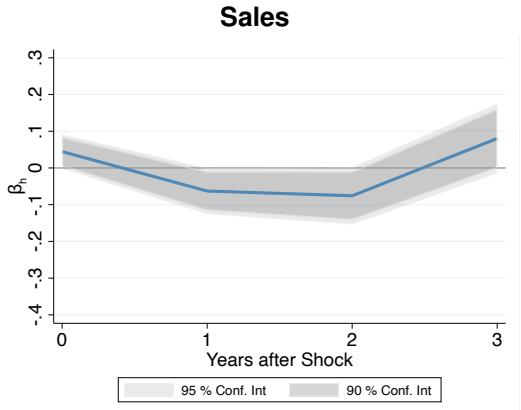
Sales


Sales
.3
.2
.1
0
-.1
-.2
-.3
-.4
β_h
0
1
2
3
Years after Shock
95 % Conf. Int
90 % Conf. Int

Sales

1. Banking Debt: A positive banking shock increases the book value of banking debt

	(1) $\Delta \log(BankingDebt)$	(2) $\Delta \log(BankingDebt)$
Credit Shock	0.18**	0.18**
	(0.07)	(0.07)
Sales		0.09***
		(0.02)
Locations		0.08
		(0.10)
Cash		0.37**
		(0.12)
Leverage		-1.97***
		(0.20)
Firm FE	Yes	Yes
Time $\times$ Sector FE	Yes	Yes
N	19030	18993

Note: Robust Standard errors in parentheses clustered at the firm and time level.* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

back

2. Gross Investment: A positive banking shock increases investment

	(1)	(2)
	$\Delta \log(Capital)$	
Credit Shock	0.12**	0.14**
	(0.04)	(0.04)
Sales		-0.29***
		(0.04)
Locations		0.02
		(0.04)
Cash		0.13
		(0.10)
Leverage		0.13
		(0.09)
Firm FE	Yes	Yes
Time $\times$ Sector FE	Yes	Yes
N	21266	21191

Note: Robust Standard errors in parentheses clustered at the firm and time level.* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

back

Heterogeneous effects on workers

- Unconditional quantile regressions:

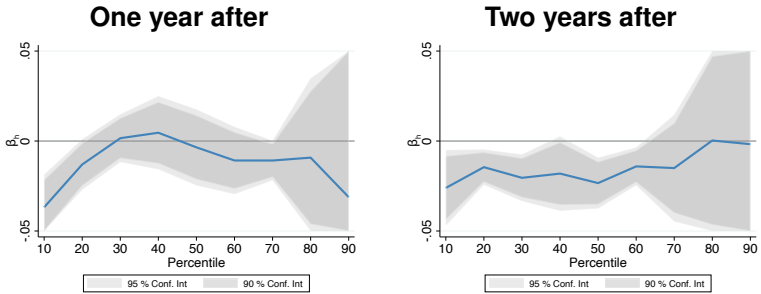
$$p\Big(\log(w_{ift+h})\Big) = \beta_0 + \beta_h \textbf{ Credit Supply Shock}_{ft} + X_{ift-1}\Gamma + \alpha_{fth} + \alpha_i + \epsilon_{ifth}$$

- $h = \{0, 1, 2\}$: years after the shock
- X_{ift-1}: age and age squared
- α_{fth} : Firm-time fixed effects
- α_i: Worker fixed effects

Back

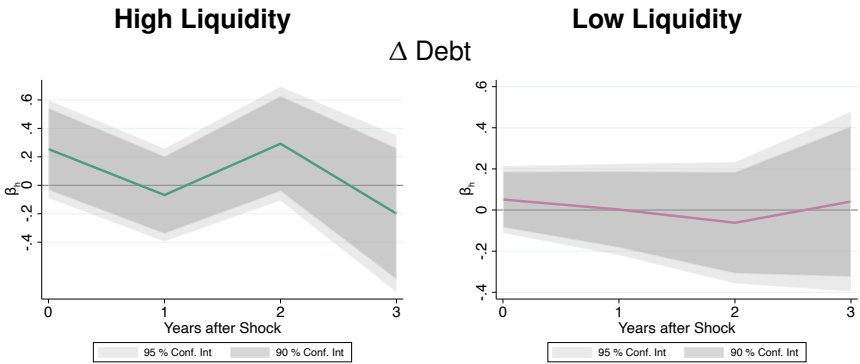
A positive credit supply shock reduces wages on the bottom half of the distribution

- The bottom decile declines by 0.65% one year after the shock
- The bottom half declines by 0.36% two years after the shock



Technical notes Back Firm

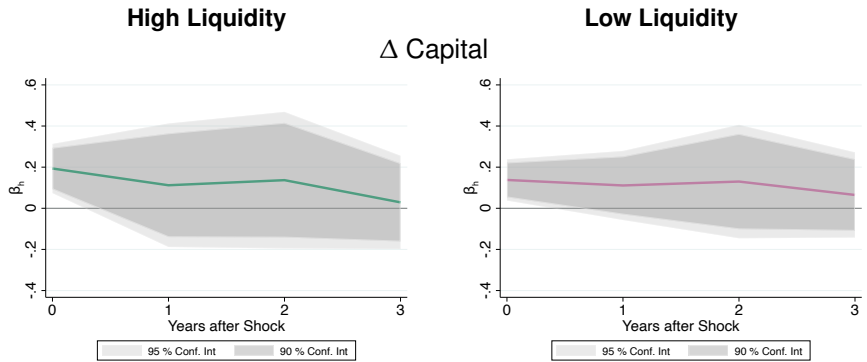
No heterogeneous effect on debt in terms of liquidity



Note: Robust standard errors clustered at the firm and time level. All specifications include as controls lagged log sales, cash, log of number of locations, and demeaned leverage. Sample sizes: $h = 0$: 25244, $h = 1$: 19599, $h = 2$:16987, $h = 3$:13628.

Back

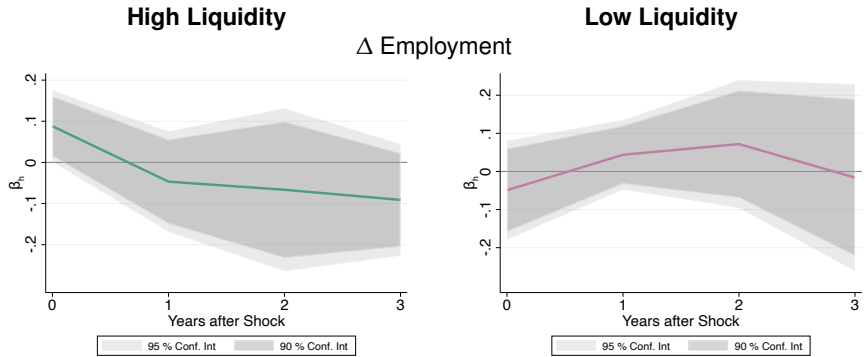
In response to a positive credit supply shock all firms change similarly their capital stock



Back Debt

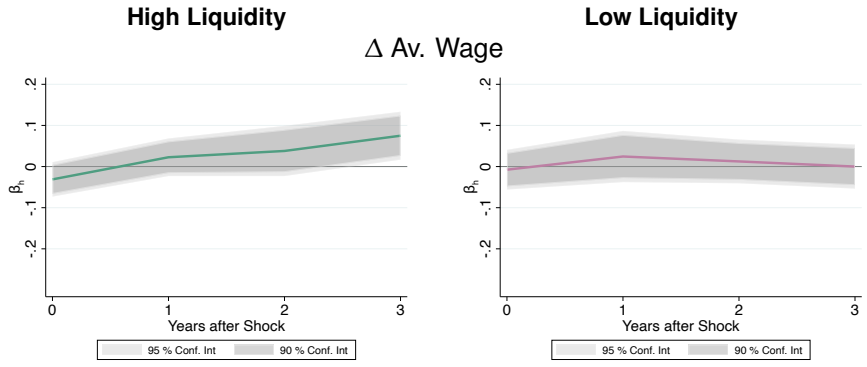
Labor demand increases in high-liquidity firms

- In High-Liquidity firms employment increase 1.3% on impact



Back Capital Technical notes

Labor demand increases in high-liquidity firms



Back Emp Back Capital Technical notes

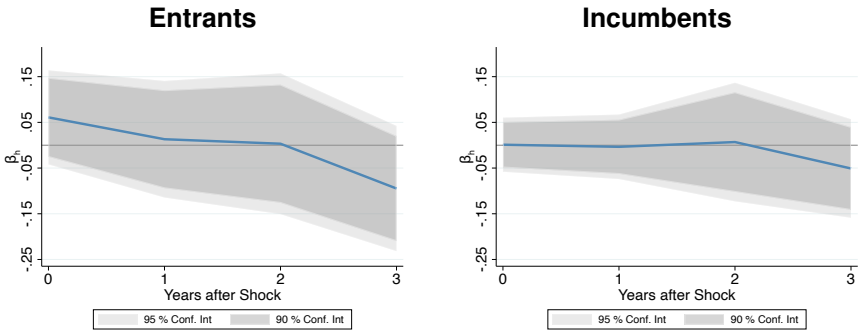
Additional Results and Robustness

- No evidence of compositional effects More
- No evidence of differences in terms of sales or number of workers Emp Sales
- Large shocks increase average employment More

Back

Compositional Effect? Are firms hiring new workers at lower wages?

- No differences in the number of incumbents or entrants employees



Note: Robust standard errors clustered at the firm and time level. All specifications include as controls lagged log sales, cash, log of number of locations, and demeaned leverage. Sample sizes: $h = 0$: 25244, $h = 1$: 19599, $h = 2$:16987, $h = 3$:13628.

Back Back Liquidity

Heterogeneity in terms of size: Employment

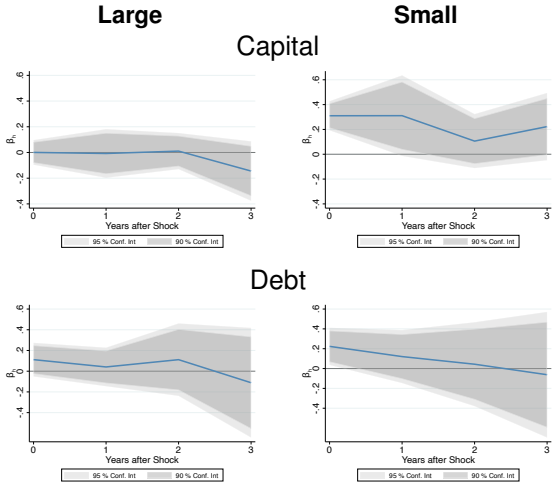
- Two groups: Large and small firms

$$\text{Large} = \overline{Employment}_f \geqslant \text{Median}\,(\overline{Employment}_f)$$

- Employment: number of workers

Back

In response to a positive credit supply shock small firms increase more their capital stock



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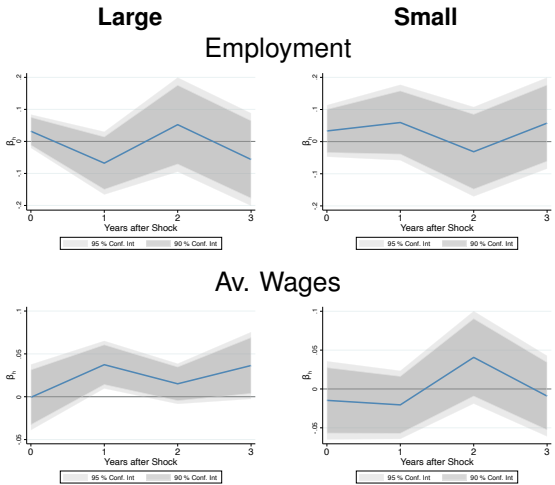
Back

In response to a positive credit supply shock size does not suggest differences in labor demand



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Back

Heterogeneity in terms of size: Employment

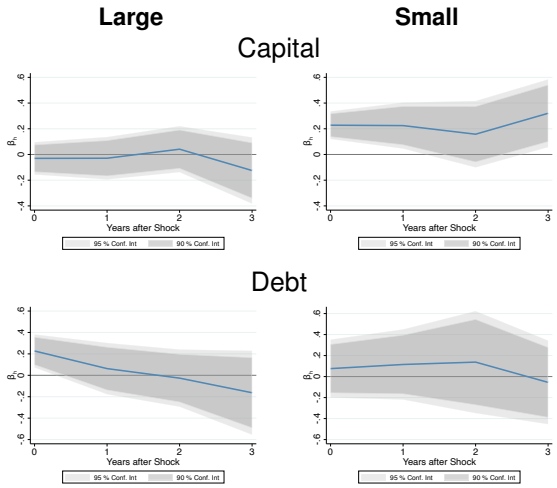
- Two groups: Large and small firms

$$\text{Large} = \overline{Sales}_f \geqslant \text{Median}\left(\overline{Sales}_f\right)$$

- Annual sales

Back

In response to a positive credit supply shock small firms increase more their capital stock



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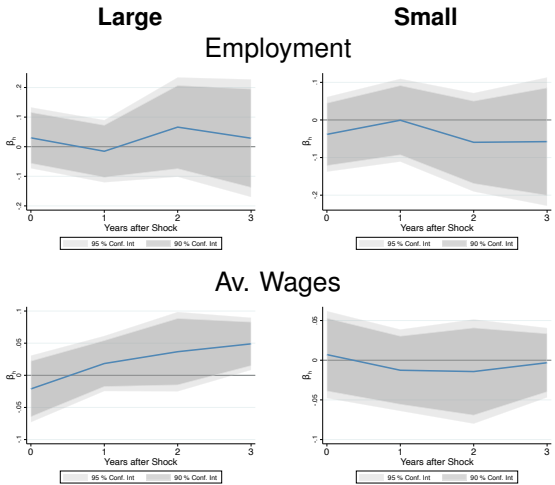
Back

In response to a positive credit supply shock size does not suggest differences in labor demand



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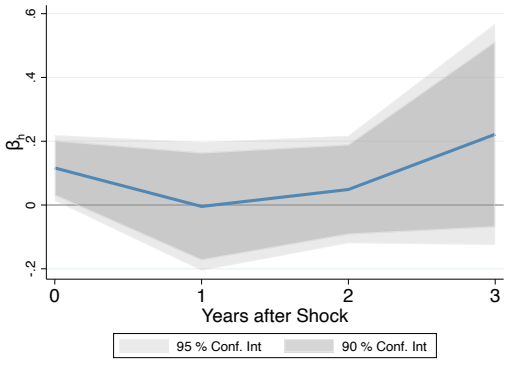
Back

Large shocks increase employment on impact: Reconciling our results with Financial Crises Results in developed economies

- Large shock: One Standard deviation above or below the median shock per year
- The direction of the shock does



Note: Robust standard errors clustered at the firm and time level. All specifications include as controls lagged log sales, cash, log of number of locations, and demeaned leverage. Sample sizes: $h = 0$: 23125, $h = 1$: 16609, $h = 2$:12688, $h = 3$:10130.

Back Emp and wages Back

Appendix: Data

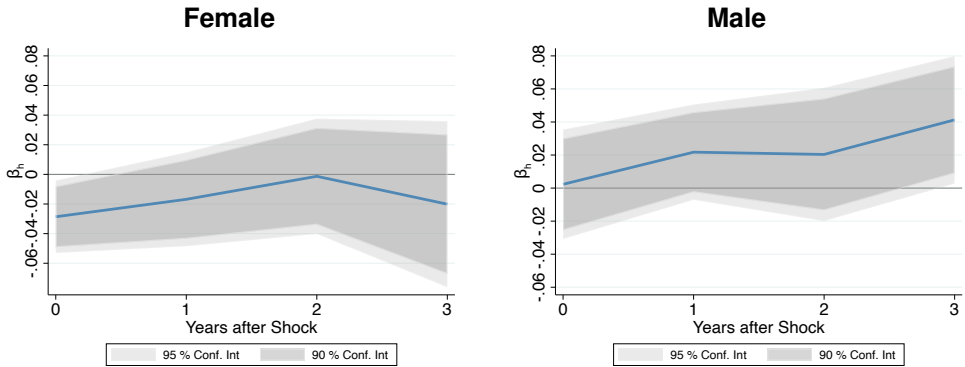
Appendix: Shock Validation

Appendix: Firm Results

Appendix: Gender

Appendix: Model

Fact 1: Positive short term effect on debt and investment, no effect on cash



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Appendix: Data

Appendix: Shock Validation

Appendix: Firm Results

Appendix: Gender

Appendix: Model

Household

- Each member $i_n \in [0,1]$: employed l_n or unemployed u_n
- Evolution of employment: workers' flow into and out of jobs
- Chooses consumption c and savings d'^h to:

$$V_H(s, d^h, l_u, l_z) = \max_{c, d'^h} U(c, l_u, l_z) + \beta \, \mathbb{E} \, V_H(s', d'^h, l'_u, l'_z)$$

subject to

$$c + d^h = w_u l_u + w_z l_z + \frac{1}{M(s'|s)} d'^h + \pi^F + \pi^B$$

$$l'_n = (1 - \rho_n) \, l_n + p(\theta_n) \, u_n, \; n = \{u, z\}$$

- $M(s'|s)$: household stochastic discount factor
- $\theta_n = \frac{v_n}{u_n}$: market tightness
- ρ_n : exogenous rate of job separation
- $p(\theta_n)$: probability of finding a job
- Preferences:

$$U(c, l_u, l_z) = \frac{c^{1-\sigma}}{1-\sigma} - \phi \frac{l_u^\nu}{\nu} - \phi \frac{l_z^\nu}{\nu}, \; \nu > 1, \; \phi > 0$$

Back

Banks

- Pass through financial intermediary

$$V^B(s, d, d^h, m, Z) = \max_{d'} \pi^B + \mathbb{E}\, M(s'|s) V^B(s', d', d'^h m', Z')$$

s.t

$$\pi^B = \overbrace{R \times d}^{\text{payments debt in } t-1} + \overbrace{m'_f}^{\text{New deposits}} - \underbrace{d'}_{\text{New debt}} \underbrace{- R^m \times m_f + \theta(R^m - 1) \sum_{n=u,z} w_n l_n}_{\text{Withdrawals}} - \underbrace{Z\,\tau(d')}_{\text{Lending cost}}$$

- $\tau(d')$: Debt elastic credit supply, $\tau'(d') > 0$, $\tau''(d') < 0$.
- The financial intermediation shock follows an AR(1) process

$$\log(Z_t) = \eta \log(Z_{t-1}) + \upsilon_t$$

Back Functions

Search Block

- Each firm negotiates wages in a local labor market

Nash Bargaining

$$\arg\max_{w_n} \tilde{V}_n(w_n)^{\mu_u} \tilde{J}_n(w_n)^{1-\mu_n}$$

- $\tilde{J}_n(w_n)$ marginal benefit of an extra worker
- $\tilde{V}_n(w_n)$ marginal benefit employment

Matching Function

$$m(u_n, v_n) = \phi_0 u_n^{\phi_1} v_n^{1-\phi_1}$$

Labor market clearing

$$u_n = 1 - l_n$$

Back

Functional Forms

Investment:

$$x = k' - (1 - \delta)k$$

Portfolio Adjustment costs:

$$\kappa(d', k) = \frac{\kappa_t}{2}\left(\frac{d'}{k} - \bar{d}\right)^2$$

Capital Adjustment costs: Neumeyer and Perri (2005)

$$h(k', k) = \frac{\phi}{2}k\left(\frac{k'}{k} - 1\right)^2$$

- δ is the depreciation rate
- $\bar{d}$ leverage in steady state

Back

Functional Forms

Bank lending cost:

$$\tau(d') = \frac{\tau}{2}\frac{d'^2}{k}$$

- Debt elastic interest rate

Back

Labor Demand

$$f(k, l_u, l_z) = \Big(\mu \underbrace{(l_z)^{\eta}}_{\substack{\textit{Abstract} \\ \eta:\uparrow k \to \uparrow l_z}} + (1-\mu) \underbrace{\Big(\mu_r k^{\eta_r} + (1-\mu_r))(l_u)^{\eta_r}\Big)^{\frac{\eta}{\eta_r}}}_{\substack{\textit{Routine} \\ \eta_r:\uparrow k \to \downarrow l_u}} \Big)^{\frac{1}{\eta}}$$

Wages:

$$w_u = \Big(\mu_u MPL_u + \mu_u \zeta_u \theta_u + \frac{(1-\mu)\phi l_u^{(\nu-1)}}{u_1(c, l_z, l_u)}\Big) \times \frac{1}{1 + \mu_u(R^m - 1 + \lambda_{f1})\theta}$$

$$w_z = \underbrace{\Big(\mu_z MPL_z + \mu_z \zeta_z \theta_z + \frac{(1-\mu)\phi l_z^{(\nu-1)}}{u_1(c, l_z, l_u)}\Big)}_{\text{Nash Bargaining}} \times \underbrace{\frac{1}{1 + \mu_z(R^m - 1 + \lambda_{f1})\theta}}_{\textit{Working Capital}}$$

Labor Demand

Wages:

$$w_u = \left(\mu_u MPL_u + \mu_u \zeta_u \theta_u + \frac{(1-\mu)\phi l_u^{(\nu-1)}}{u_1(c, l_z, l_u)}\right) \times \frac{1}{1 + \mu_u(R^m - 1 + \lambda_{f1})\theta}$$

$$w_z = \underbrace{\left(\mu_z MPL_z + \mu_z \zeta_z \theta_z + \frac{(1-\mu)\phi l_z^{(\nu-1)}}{u_1(c, l_z, l_u)}\right)}_{\text{Nash Bargaining}} \times \underbrace{\frac{1}{1 + \mu_z(R^m - 1 + \lambda_{f1})\theta}}_{\textit{Working Capital}}$$

- λ_{f1t} is the Lagrange multiplier on money holdings
- Following Vom Lehn (2020) for the production function
- Tension in the effect on wages
  - The working capital constraint reduces all types of wages
  - More demand for capital reduces w_u and increases w_z
- Binding liquid assets constraint amplifies the working capital effect

Back Marginal Products of Labor

Intra temporal first Order conditions

Labor Supply

$$wu = \psi(l_u)^{\nu-1}$$
$$wz = \psi(l_z)^{\nu-1}$$

Capital rental rate

$$r_k = (1-\mu)\mu_r \frac{f(k, l_u, l_z)^{1-\eta}}{k^{1-\eta_r}(\mu_r k^{\eta_r} + (1-\mu_r) l_u^{\eta_r})^{1-\frac{\eta}{\eta_r}}}$$

Back

Inter temporal first Order conditions

Capital Euler Equation

$$M(s)((1 + h_1(k', k)) = \mathbb{E}\left(M(s')(r_k' + (1 - \delta) - h_2(k', k')) - \kappa_2(d'', k')\right)$$

Liquid assets Euler Equation

$$M(s) = \mathbb{E}\left(M(s')r_m(1 + \lambda_{1f}')\right)$$

Debt demand Euler Equation

$$(1 - \kappa_1(d', k)) = \mathbb{E}\left(M(s')R\right)$$

Debt supply Euler Equation

$$M(s)(1 + fb\tau'(d')) = \mathbb{E}(M(s')R)$$

Back

Market Clearing Conditions

- Labor demand equals labor supply
- Debt demand equal debt supply
- Goods market clearing condition:

$$c + x + \kappa(d', k) - \frac{\tau}{2} fb \frac{d'}{k} = f(k, l_u, l_z) \underbrace{-d'^h + m_f}_{\text{trade balance}}$$

Back

Equilibrium

Given initial conditions k_0, d_0, and m_0, a state of contingent shock fb_t, and a steady-state debt holdings position $\bar{d}$, an equilibrium is a sequence of allocations -k_t, c_t, d_t, m_t - and prices -w_{zt}, w_{ut}, r_m, R, $M(s)$- such that the labor market and the debt market clear. The household holds a trade deficit with the rest of the world

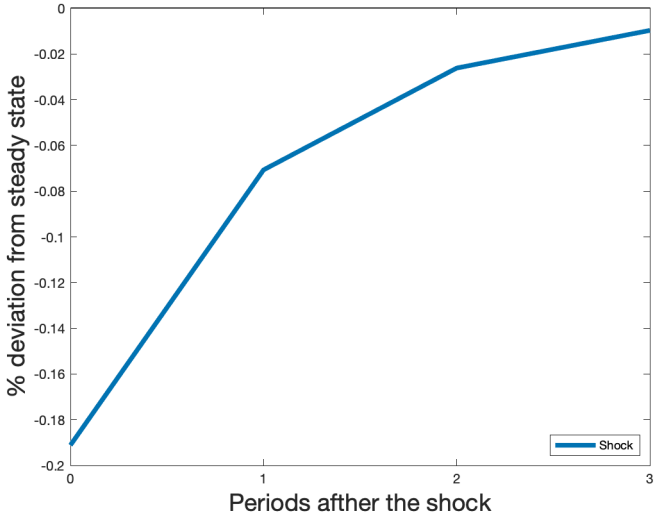
Back

Calibration

Parameter	Symbol	Value	Source
	Using micro data		
Persistence Shock	η	0.3698	AR(1) OLS estimation
Std. Dev Shock	σ_{fb}	0.1911	AR(1) OLS estimation
Steady-State debt holdings	d	0.48	To match av. leverage
Portfolio adjustment costs	κ	0.9	Match estimates debt
Investment adjustment costs	ϕ	0.5	Match estimates debt
	Colombian aggregate data		
Discount factor	β	0.9241	Inverse p5 Inter bank rate
Int. cost in steady state	τ	0.1053	Diff. corp. and borrowing rate
Unemployment rate in steady state	$\tilde{u}_n$	0.102	Unemployment rate
	Literature		
Depreciation	δ	0.0844	Standard Lit.
Capital weight	μ_r	0.39	Vom Lehn (2020)
Skilled weight	μ_a	0.38	Vom Lehn (2020)
Substitution capital-unskilled labor	η_r	0.4	Vom Lehn (2020)
Substitution skilled-routine	η_a	-2.22	Vom Lehn (2020)
Risk aversion	σ	2	Standard Lit.
Elasticity of labor supply	$\frac{1}{\nu-1}$	0.32	Leyva and Urrutia (2020)
Disutility of labor	ψ	1.8	Neumeyer and Perri (2005)
Nash Bargaining parameters	μ_u	0.5	Standard Lit.
Matching function	$\phi_0 \phi_1$	0.5	Standard Lit.
Probability of filling a vacancy in steady state	$\tilde{q}(\theta_n)$	0.7	Standard Lit.

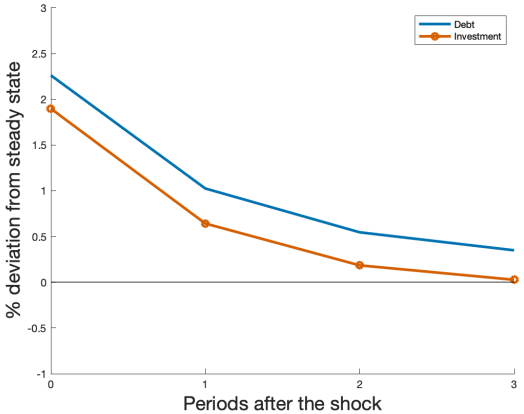
Back

Impulse response functions to a Shock to the financial intermediation cost: IRF Shock



Base line Impulse Response Functions: Debt and Capital

- Target the response of debt on impact
- Change in capital is a result of the model

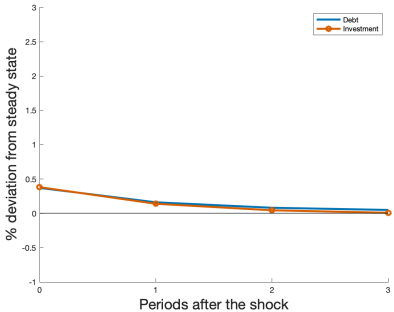


Back Shock Differences in Elasticities

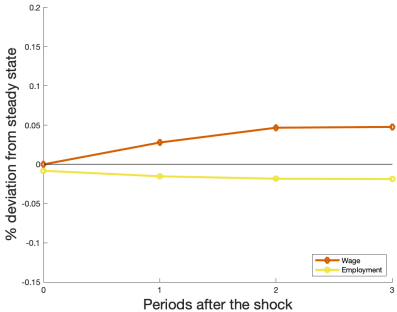
Impulse response functions with one type of labor, $y = k^{\alpha} l^{1-\alpha}$

- Can not capture the effect on types of workers
- Does not increase investment or capital as before

Debt and Investment



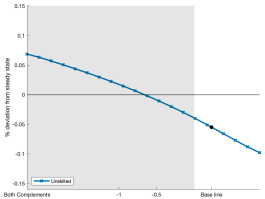
Labor market



Back Shock

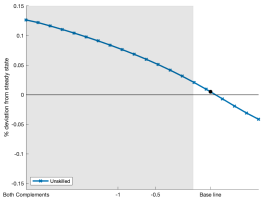
What happens if low-skilled workers are more complements to capital? More substitutes?

t=1

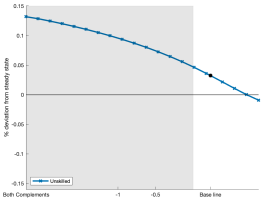


t=2

Changing η_r



t=3



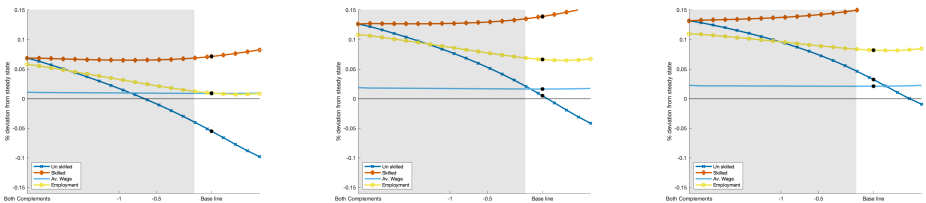
Back High-Skilled

What happens if low-skilled workers are more complements to capital? More substitutes?

- The negative effect on l_u persists even if $\eta_r < 0$
- Average employment, wages and l_z do not respond changes in η_r

t=1 | **t=2** | **t=3**

Changing η_r



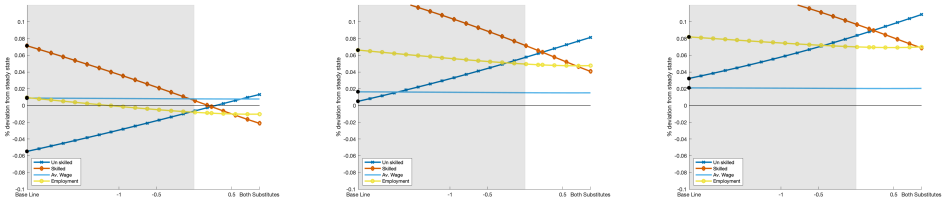
Back High-Skilled

What happens if high-skilled workers are more substitutes to capital? More complements?

- The key parameter is the elasticity of substitution between low-skilled and capital
- But increases the positive effect on low-skilled workers over time

t=1 | **t=2** | **t=3**

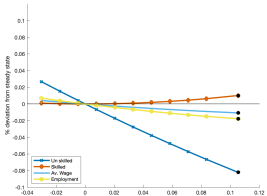
Changing η



Back Low-Skilled

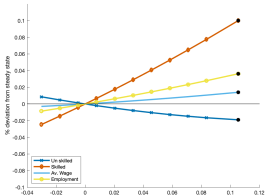
What happens if the bank becomes more efficient? Reduction of τ

t=1

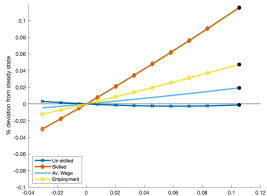


t=2

Changing η



t=3



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