Direct and Indirect Effects of Financial Access on SMEs

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Introduction

- Lack of credit believed to be a major growth barrier.
- But we know little about overall—direct and indirect—impact of credit to SMEs.
  - SMEs understudied relative to their importance.
  - Few studies explore indirect effects on peer firms.
- Indirect effects key to measuring broader impacts on society.
- **This project:** randomize access to a new loan product for SMEs within and across local markets in China.
- Research questions: (1) What are the direct and indirect effects on firms? (2) What are the implied welfare effects?

Related literature

- Well-identified studies about impact of finance.
  - Large firms using policy variation: Banerjee and Duflo (2014).
  - Microenterprises using randomized grants: De Mel, McKenzie and Woodruff (2008).
  - Microfinance: Banerjee, Karlan and Zinman (2015) overview.
- Evidence on indirect and equilibrium effects.
  - On firms for R&D, subsidies and training: Bloom, Schankerman and Van Reenen (2013), Rotemberg (2017), McKenzie and Puerto (2018).
  - On households: Duflo and Saez (2003), Angelucci, De Giorgi (2009), Mobarak, Rosenzweig (2014), Guiteras, Levinsohn, Mobarak (2019).
- **Intended contribution:** experimental evidence about credit's direct and indirect effects on SMEs, model-based welfare accounting.

Outline from here

1. Experimental design and data.
2. Conceptual framework.
3. Results.
4. Conclusion.

Loan product

- In 2013 Rural Credit Cooperatives (RCC) introduced a new loan product to SMEs in Jiangxi.
  - Targeted to clusters of firms in specialized local "markets".
  - Savings on administering / monitoring costs for RCC.
  - No collateral required.
  - Standardized application, decision in 2 weeks.
- Financial conditions:
  - Maximum loan RMB 500,000, monthly interest rate about 0.7%.
  - Pay interest every month, repay after 2 years.

Design

- **Treatment**: loan officer visited treated firms monthly for a year, provided information about the loan and help in applying.
- We randomized treatment to firms in 78 markets.
  - In 31 "control markets" we treated no firms.
  - In 10 "half-half" markets we treated half of the firms.
  - In 37 "majority treated" markets we treated 80% of the firms.
- Surveyed half of the firms in all markets, total sample 3,117.
  - Baseline: 2013 summer, before the intervention.
  - Midline: 2015 summer, to give time for firms to borrow and grow.
  - Endline: 2016 summer.
  - Data on manager, balance sheet, finances, operations.

Markets

Summary statistics

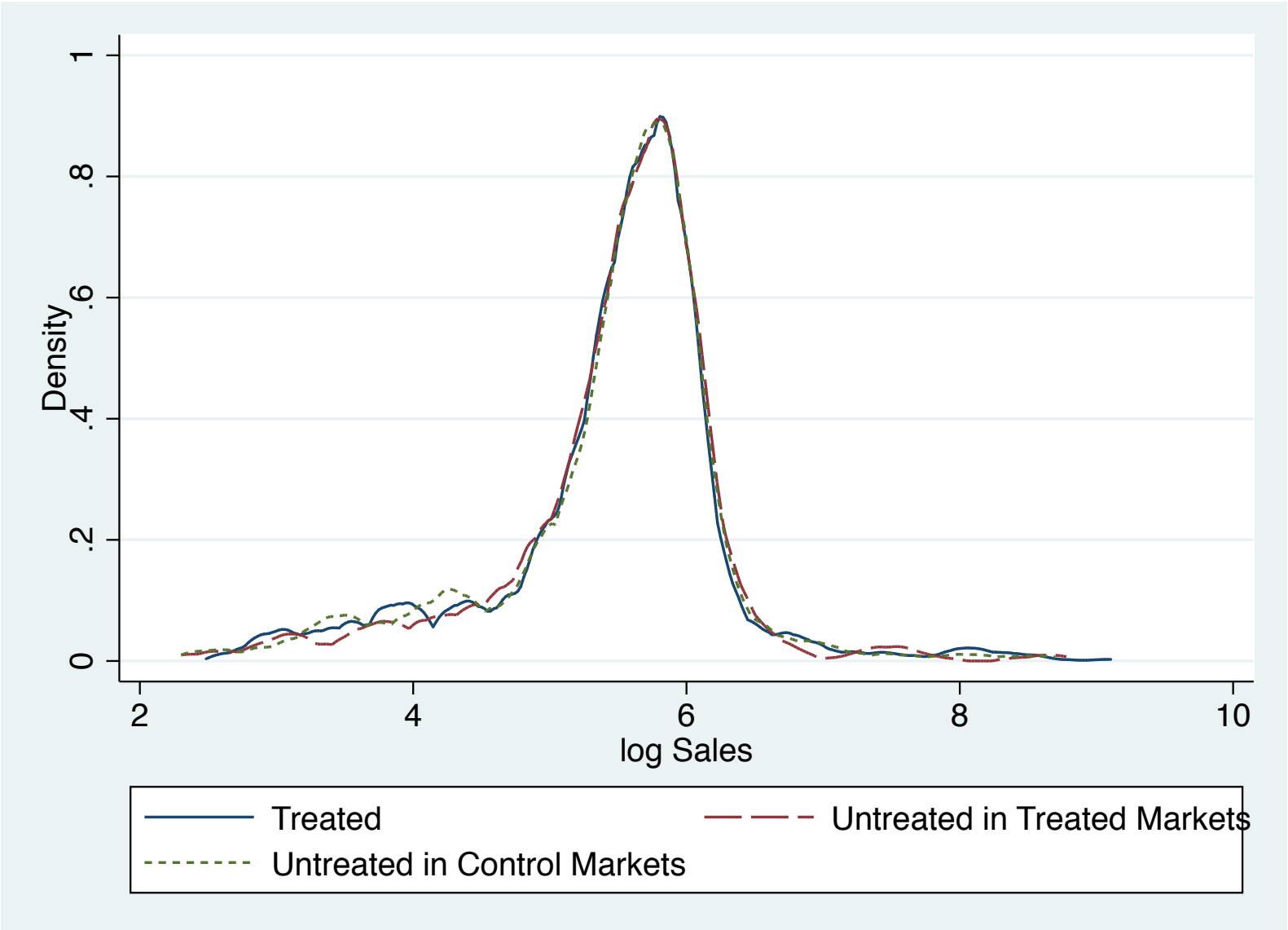
	All Sample	Treated	Untreated	Difference
Number of Observations	*3117*	*1404*	*1697*	
Firm age	6.6	6.55	6.63	-0.08
	(4.38)	(4.48)	(4.31)	(0.652)
Sector - Retail (%)	68.68	69.75	67.80	1.94
	(46.39)	(45.95)	(46.74)	(0.2720)
Number of employees	8.96	9.01	8.93	0.09
	(5.63)	(5.93)	(5.38)	(0.692)
Profit (10,000 RMB)	51.60	51.04	52.06	-1.02
	(69.36)	(66.45)	(71.68)	(0.6996)
Sales (10,000 RMB)	333.13	342.37	325.51	16.86
	(469.27)	(516.01)	(426.97)	(0.3459)
Political connection (1=Yes, 0=No)	0.16	0.16	0.15	0.013
	(0.37)	(0.37)	(0.36)	(0.3661)
Prior loan (1=Yes, 0=No)	0.25	0.24	0.25	-0.01
	(0.43)	(0.43)	(0.43)	(0.7058)
Loan size	29.38	31.77	27.47	4.30
	(85.07)	(104.24)	(65.85)	(0.5104)
Attrition (endline)	0.14	0.14	0.15	-0.01
	(0.34)	(0.34)	(0.36)	(0.3239)

Loan outcomes by endline

Dep. var.:	RCC loan	
	(1)	(2)
treatment	0.318***	
	(0.045)	
treated * 50 market		0.380***
		(0.069)
treated * 80 market		0.351***
		(0.051)
untreated * 50 market		0.144**
		(0.071)
untreated * 80 market		0.123***
		(0.035)
constant	0.07***	0.034**
	(0.016)	(0.013)
Observations	2,781	2,781

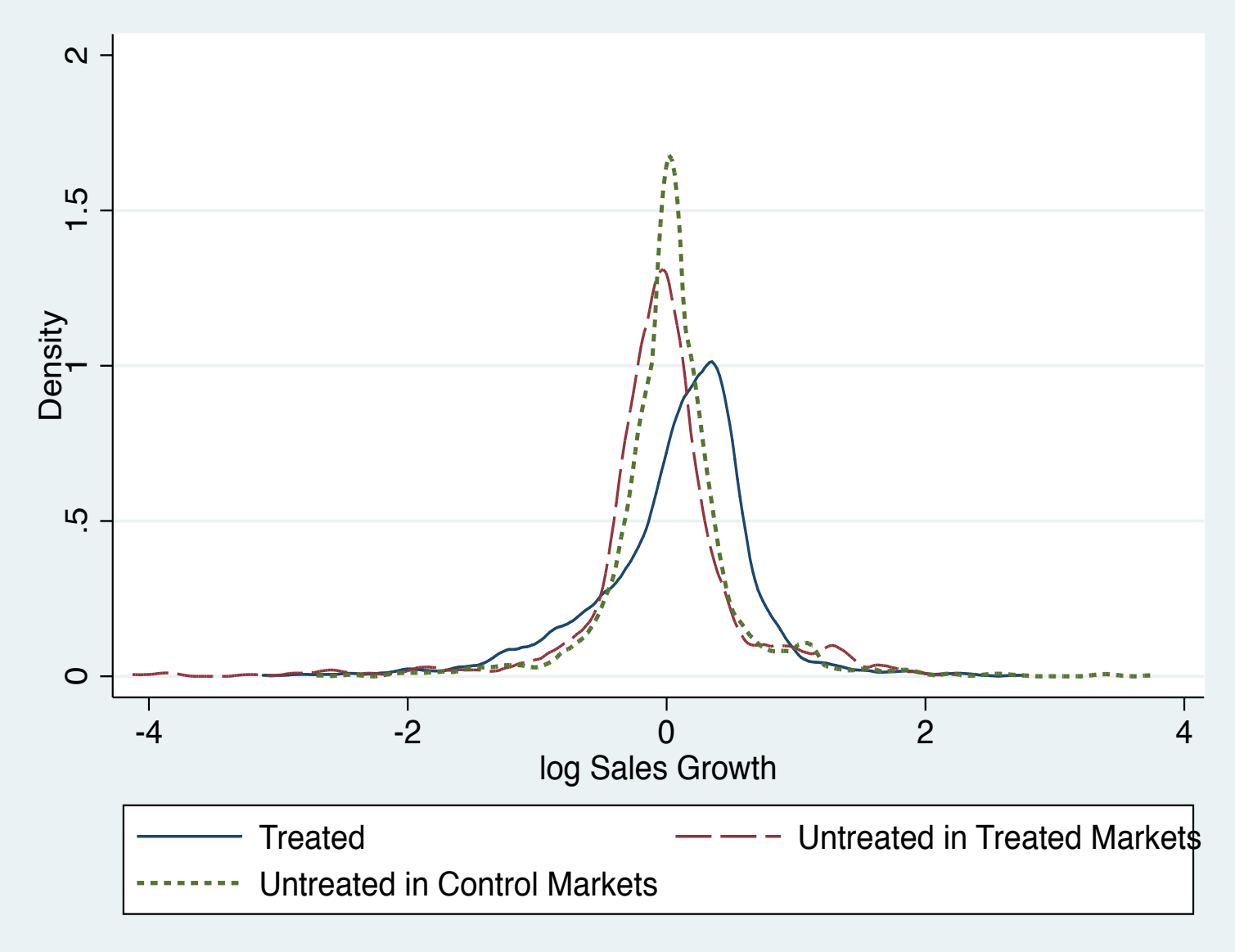
- Large treatment effect.
- Spillovers, suggest information diffusion.

Log sales at baseline



- Randomization check.

Change in log sales



- Positive direct and negative indirect effects.

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Conceptual framework: business stealing

- Preference over differentiated goods i in markets m

$$U = Q_0 + \left[\int Q_m^{1-1/\theta} dm\right] \text{ where } Q_m = \left[\int q_{mi}^{1-1/\sigma} di\right]^{\frac{\sigma}{\sigma-1}} \text{ and } \sigma > \theta.$$

- Monopolistically competitive firms produce with labor, face exogenous wage and differ in productivity: $Q_i = \omega_i L_i$.
  - Numeraire Q_0 produced perfectly competitively $Q_0 = L_0$.
- Consider a treatment that increases firm productivity by factor e^{γ}.
- Treatment introduced to share S_m of firms in market m.
  - Treated firms random within a market.
- **Proposition.** To a first-order approximation, effect on revenue of i

$$\Delta \log R_i \approx (\sigma - 1)\gamma \cdot T_i - (\sigma - \theta)\gamma \cdot S_m.$$

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Estimating equation

- Basic specification:

$$y_{it} = \kappa \cdot Post_t + \beta \cdot Post_t \times Treatment_i + \delta \cdot Post_t \times Share\ Competitors\ Treated_i + Firm\ f.\ e. + \varepsilon_{it}$$

- *Post* is indicator for the midline or endline survey, firm fixed effects remove time-invariant heterogeneity.
  - Cluster standard errors by market.
- Interpretation of coefficients:
  - β represents direct effect of treatment;
  - δ represents indirect effect of competitors' treatment.

Main outcomes

Dep. var.:	log sales	profit	log employment	log wage bill	fixed assets	log materials	shutdown
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
post	0.037**	4.32**	0.042***	0.064***	2.54*	0.023	0.088***
	(0.016)	(1.65)	(0.013)	(0.013)	(1.49)	(0.022)	(0.014)
post*treatment	0.102***	11.34***	0.071***	0.083***	5.47	0.080**	-0.037***
	(0.034)	(3.36)	(0.023)	(0.023)	(4.19)	(0.039)	(0.010)
post*share competitors treated	-0.088**	-9.47*	-0.065**	-0.066**	-3.01	-0.049	-0.000
	(0.041)	(5.57)	(0.030)	(0.031)	(4.30)	(0.044)	(0.021)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,220	8,220	8,220	8,214	8,220	8,213	8,220
Number of firms	2,781	2,781	2,781	2,779	2,781	2,781	2,781

- Large direct and indirect effects on main outcomes.

Specification check 1: effects at baseline

Dep. var.:	log sales	profit	log employment	log wage bill	fixed assets	log materials
	(1)	(2)	(3)	(4)	(5)	(6)
treatment	-0.027	0.190	-0.031	-0.025	0.873	-0.018
	(0.045)	(4.449)	(0.036)	(0.038)	(2.809)	(0.055)
share competitors treated	0.046	-2.113	0.031	0.026	0.005	0.051
	(0.057)	(5.541)	(0.045)	(0.048)	(3.518)	(0.068)
Observations	2,781	2,781	2,781	2,779	2,781	2,781

- No effects at baseline, confirming both within- and across-market randomizations.

Specification check 2: Indirect effects by treatment

Dep. var.:	log sales	profit	log employment	log wage bill	fixed assets	log materials
	(1)	(2)	(3)	(4)	(5)	(6)
post	0.039**	4.593***	0.044***	0.066***	2.828*	0.024
	(0.016)	(1.660)	(0.014)	(0.014)	(1.536)	(0.022)
post*treatment	0.073	6.471	0.04	0.043	0.468	0.056
	(0.092)	(10.87)	(0.056)	(0.055)	(5.670)	(0.124)
post*share competitors	-0.043	-3.430	-0.027	-0.015	3.181	-0.019
treated*treated	(0.113)	(14.46)	(0.065)	(0.065)	(7.165)	(0.151)
post*share competitors	-0.096**	-10.89**	-0.074**	-0.077**	-4.466	-0.056
treated*untreated	(0.045)	(4.331)	(0.034)	(0.035)	(4.898)	(0.05)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,220	8,220	8,220	8,214	8,220	8,213
Number of firms	2,781	2,781	2,781	2,779	2,781	2,781

- Robust negative indirect effect, insufficient power to estimate all three effects.

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Business outcomes

Dep. var.:	log num suppliers	log num clients	renovation	new product	advertising cost	log markup	log rent
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
post	0.022	0.046***	0.106***	0.06***	0.05	0.011	0.028
	(0.019)	(0.013)	(0.016)	(0.01)	(0.047)	(0.012)	(0.083)
post*treatment	0.052	0.084***	0.243***	0.231***	0.21**	0.022	0.048
	(0.035)	(0.031)	(0.02)	(0.017)	(0.082)	(0.024)	(0.099)
post*share competitors treated	-0.042	-0.072**	-0.049*	-0.047***	0.037	-0.037	0.011
	(0.036)	(0.033)	(0.028)	(0.018)	(0.066)	(0.03)	(0.161)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,212	8,220	8,220	8,220	8,220	8,220	8,220
Number of firms	2,781	2,781	2,781	2,781	2,781	2,781	2,781

- Treated firms seem to attract clients by offering better services.
  - Consistent with model's logic on business stealing.
- No evidence of impact on markup over variable cost or on rents.

Financial and other outcomes

Dep. var.:	RCC loan amount	other loan	other loan amount	trade credit supplier	trade credit client	log sales diff
	(1)	(2)	(3)	(4)	(5)	(6)
post	1.22***	0.022	3.03**	0.039***	0.036***	0.002
	(0.40)	(0.018)	(1.22)	(0.0076)	(0.008)	(0.009)
post*treatment	8.61***	0.025	2.15	0.068***	0.075***	0.001
	(1.29)	(0.025)	(1.89)	(0.014)	(0.020)	(0.002)
post*share	1.63	-0.022	-3.24*	-0.041**	-0.072***	-0.002
competitors treated	(1.13)	(0.035)	(1.73)	(0.017)	(0.022)	(0.008)
Firm FE	Yes	Yes	Yes	Yes	Yes	No
Observations	8,220	8,220	8,220	8,220	8,220	5,167
Number of firms	2,781	2,781	2,781	2,781	2,781	2,766

- No crowding out of existing loans: firms genuinely credit-constrained, as in Banerjee and Duflo (2014).
- No evidence of misreporting.

Market-level outcomes

Dep. var.:	log market revenue	market profits	shutdown rate	renovation rate	product intro rate
	(1)	(2)	(3)	(4)	(5)
post	0.049**	147.7*	0.095***	0.098***	0.059***
	(0.022)	(74.86)	(0.011)	(0.015)	(0.01)
post*share market treated	0.033	23.03	-0.05***	0.197***	0.176***
	(0.038)	(129.3)	(0.018)	(0.032)	(0.023)
Market FE	Yes	Yes	Yes	Yes	Yes
Observations	234	234	234	234	234
Number of markets	78	78	78	78	78

- Insignificant effects on sales and profit.
- Market-wide gains in survival, renovation, product introduction.

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Combining direct, diffusion and business stealing effects

- Two-step approach:

$$\textit{treatment} \xrightarrow{1} \textit{borrowing} \xrightarrow{2} \textit{outcomes}$$

  where

  1. Direct and diffusion effects of treatment on borrowing;
  2. Direct and business stealing effects of borrowing on outcomes.

- For impacts of borrowing, suppose true model is

$$y_i = \beta \cdot B_i + \delta \cdot Z_i + \nu_i$$

  where B_i is borrowing and Z_i is share of competitors that borrow.
  - Key: borrowing by treated and by untreated have same effects.

- Estimate as IV using randomly assigned T_i and S_i as instruments.

Effects of borrowing: results

	First stage		IV		
Dep. var.:	borrow	share competitors borrow	log sales	profit	log employment
	(1)	(2)	(3)	(4)	(5)
treatment	0.248***	0.015*			
	(0.044)	(0.008)			
share competitors	0.124***	0.358***			
treated	(0.038)	(0.048)			
post*borrow			0.431***	53.27***	0.316***
			(0.138)	(16.08)	(0.093)
post*share			-0.396**	-45.04**	-0.294***
competitors borrow			(0.154)	(17.88)	(0.104)
Firm and Post FE	No	No	Yes	Yes	Yes
F statistic	26	29			
Observations	2,781	2,781	8,220	8,220	8,220
Number of firms	2,781	2,781	2,781	2,781	2,781

Model-predicted welfare effects

- Suppose treating share $S > 0$ of a market yields random shares of $Z^T = \alpha S$ treated and $Z^U = \psi(1 - S)$ untreated borrowers.
- **Proposition.** Welfare gain from treating share S of firms is, as a share of market revenue, approximately

$$Z^T \cdot (\beta + \delta)\frac{\textit{Profit}}{\textit{Revenue}} + Z^T \cdot \frac{\beta}{\sigma - 1} + Z^U \cdot \textit{Per-firm effect}$$

  where β and δ are IV estimates and terms are

  1. Producer surplus: sum of direct and indirect profit effects.
  2. Consumer surplus: reduction in cost of purchasing current bundle.
  3. Spillover: additional producer and consumer surplus from diffusion.
- For a given σ all terms can be computed from estimates.
  - Atkin et al (2016) report 4.4, Dolfen et al (2019) report 4.3-6.1 for the retail elasticity of substitution.

Welfare effect estimates

Welfare gain per firm in market	Treat all firms		Treat 50% of firms	
	share of profit	USD	share of profit	USD
Panel A: sigma=6				
producer surplus	1.2%	900	0.6%	500
consumer surplus	19.7%	14,800	9.9%	7,400
spillover			3.9%	2,900
total	20.9%	15,700	14.3%	10,800
Panel B: sigma=11				
producer surplus	1.2%	900	0.6%	500
consumer surplus	9.9%	7,400	4.9%	3,700
spillover			2.0%	1,500
total	11.1%	8,300	7.6%	5,700

- Large gains in consumer surplus even with conservative values of σ.

Return on capital

	sigma=6	sigma=11
private return	82%	82%
business stealing	-76%	-76%
consumer surplus	107%	53%
social return	114%	60%

- Let

$$\textit{Priv return} = \beta \cdot \frac{\textit{profit}}{\textit{loan size}}$$

and

$$\textit{Soc return} = \textit{Priv return} - \textit{Business stealing} + \textit{Consumer surplus}.$$

- Private return between Banerjee-Duflo (2014) estimate of 105% and De Mel et al (2008) estimate of 60%.
- Social return different but still very large.

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Conclusion

- We examined impact of financial access on SMEs.
- Large positive direct effects.
- Large negative business-stealing and positive diffusion effects.
- Model-based account of direct and indirect effects on firms and consumers implies sizeable welfare gains.