Financial Technology Adoption

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Motivation

New financial technologies are rapidly changing the way that households shop, save, borrow, and make other financial decisions

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Payment technologies can benefit both sides of the market

- Consumers benefit from lower transaction costs
  - Costs of traveling to a bank (Bachas, Gertler, Higgins, Seira 2018)
  - Crime risks of carrying cash (Economides & Jeziorski 2017)
- Retail firms
  - Reduce risk of cash theft (Rogoff 2014)
  - Attract consumers who prefer these payment technologies


ACEPTAMOS TODAS LAS TARJETAS DE CRÉDITO...
RECUPERA TU ENERGÍA
Coca-Cola

Contribution

How supply side responds to consumer financial technology adoption; **spillovers** on other consumers

- Spillovers may be large due to **indirect network externalities**

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Research question: How do the supply and demand sides of the market respond to consumers' financial technology adoption?

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How supply side responds to consumer financial technology adoption; **spillovers** on other consumers

- Spillovers may be large due to **indirect network externalities**

Research question: How do the supply and demand sides of the market respond to consumers' financial technology adoption?

Exploit natural experiment that shocked financial technology adoption on one side of market

- Mexico distributed 1 million debit cards to cash transfer beneficiaries

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Exploit natural experiment that shocked financial technology adoption on one side of market

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Combine administrative data on debit card rollout with rich collection of microdata on consumers and retail firms

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   - Other consumers adopt cards (21% ↑)
   - Richer shift 12% of supermarket consumption to corner stores
3. Corner store sales ↑ 3%
4. Consumer gains
   - Beneficiaries who receive cards: 3% ↑ consumer surplus
     - Half as large as if Walmart enters municipality
   - Nearly half of total consumer gains are spillovers

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4. Data on firm technology adoption; outcomes for firms and other consumers
   - Combine nine data sets, both administrative and survey

Administrative data

1. Administrative data on debit card rollout
   - Number of beneficiaries and payment method $\times$ locality $\times$ month
     - Provided by Prospera (cash transfer program)
   - All card transactions by cash transfer recipients who receive card
     - Provided by Bansefi (government bank administering accounts)

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   - Universe of card transactions by all cardholders (7 billion transactions)
     - Accessed on-site at Mexico's Central Bank

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3. Consumer card adoption
   - Quarterly number of debit cards $\times$ issuing bank $\times$ municipality
     - Provided by National Banking and Securities Commission

Survey data

1. Income–expenditure survey: nationally representative household sample
   - All consumption including cash
   - Includes type of store at which each item purchased
     - Census tract identifiers accessed on-site at National Statistical Institute

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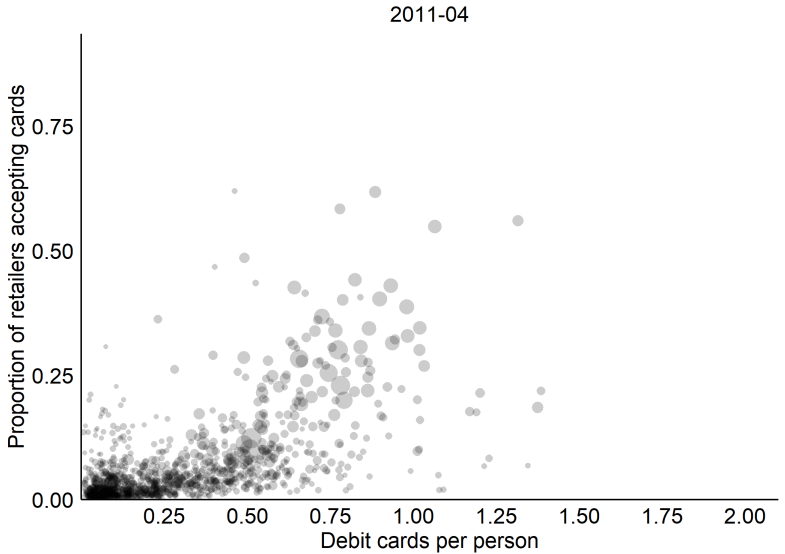
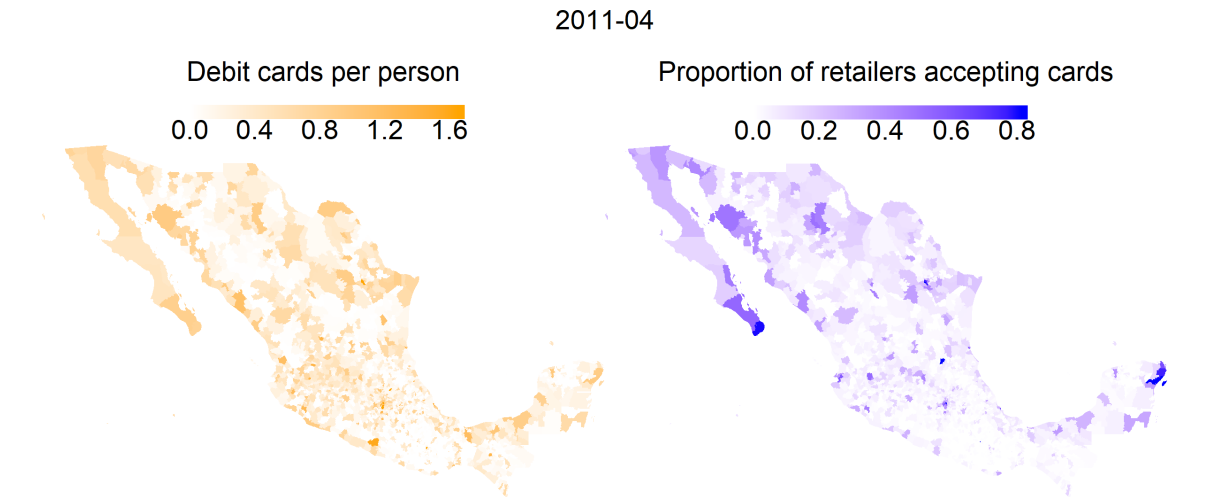
3. High-frequency price data
   - 10 million price quotes at barcode-level product $\times$ store $\times$ week level
     - Accessed on-site at National Statistical Institute

▸ Related literature

Debit cards and point-of-sale terminals over time (Mexico)



Debit cards and POS over time and space (Mexico)



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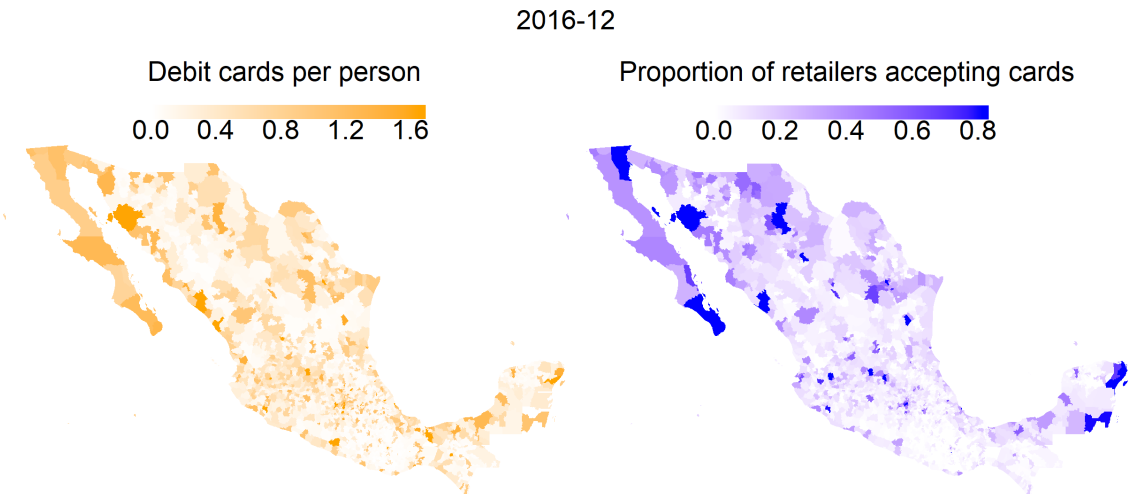


Natural experiment from debit card rollout

Over 2009–2012, Mexico's conditional cash transfer program Prospera distributed about 1 million debit cards

- In urban localities (population $>$ 15,000)

Pre-intervention: Urban recipients of government cash transfer program

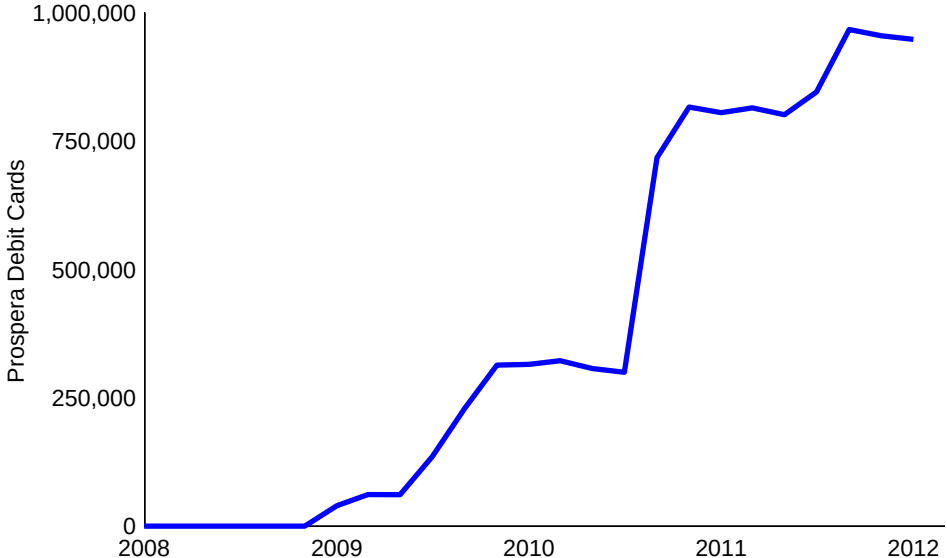
- Receive transfers in a Bansefi bank account
- Paid every two months ($150 average)

Intervention: Visa debit cards attached to accounts

- Can withdraw funds from any bank's ATM
- Use as debit cards at stores accepting Visa

▸ Transactions at ATM/branch ▸ Distance ▸ Savings ▸ Calendar of transfer dates ▸ Pamphlet

Debit card rollout over time



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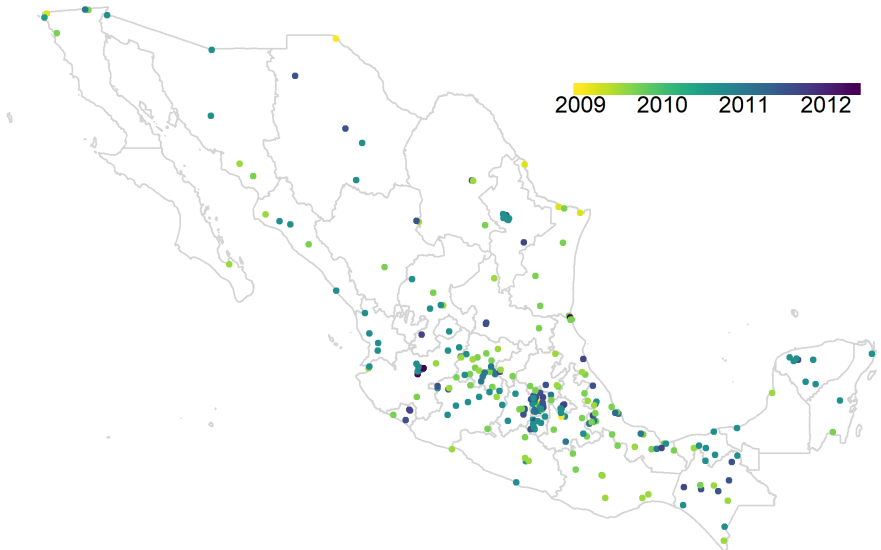
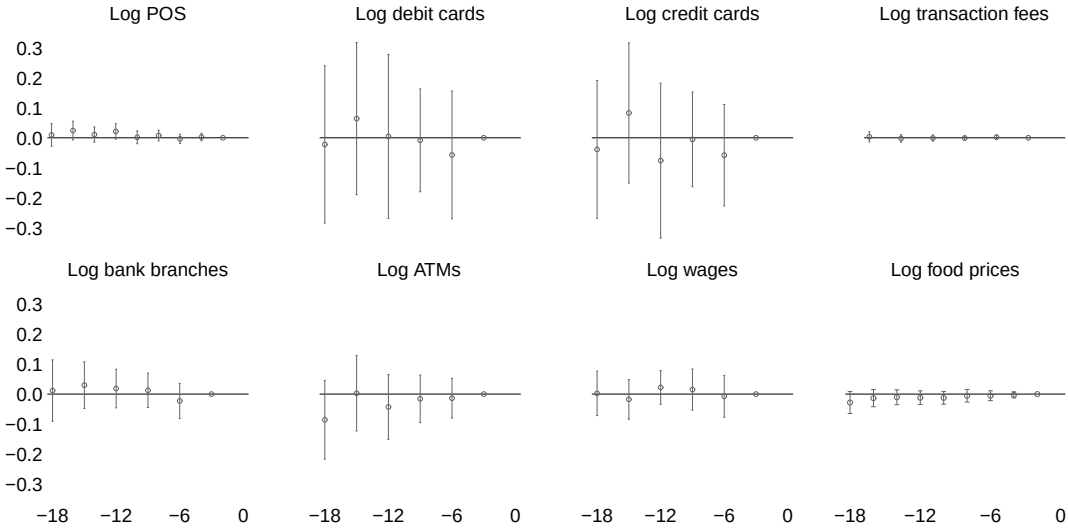


Balanced pre-trends in financial and other variables



New cardholders make purchases at POS

Data: All transactions made by Prospera beneficiaries (Bansefi, 2007–2015)

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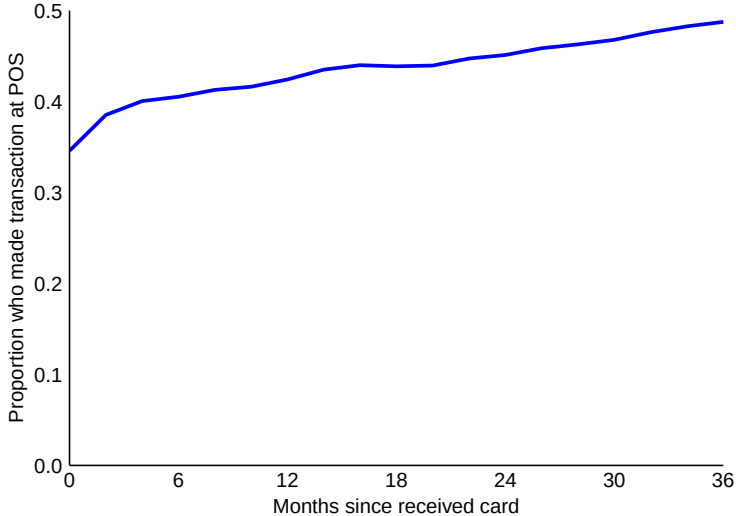

Corner stores increase adoption of POS

Data: Universe of point-of-sale terminal "contract changes" (adoptions, cancellations, etc.), 2006–2017

$$\log \textit{Number of POS}_{jt} = \xi_j + \delta_t + \sum_k \phi_k D_{jt}^k + \varepsilon_{jt}$$

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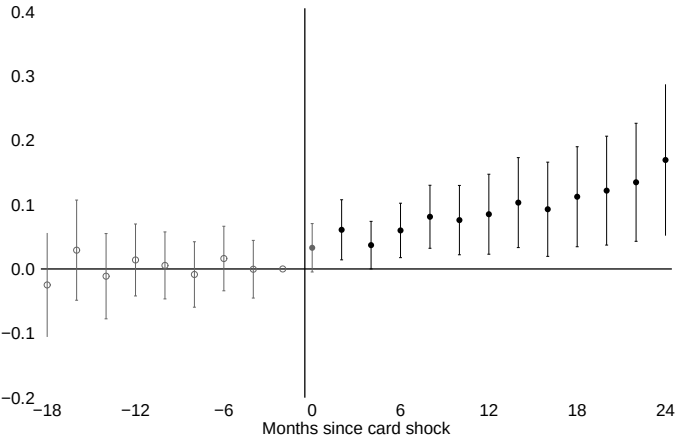

Supermarkets do not change adoption of POS

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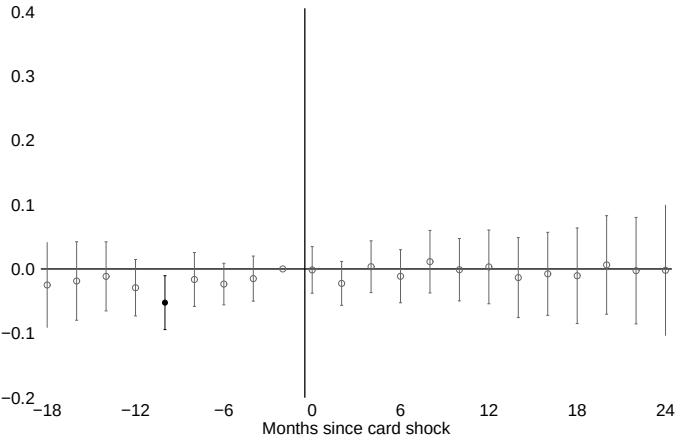

Spillovers to other consumers' card adoption

Data: Total debit cards by bank by municipality by quarter, 2008–2014

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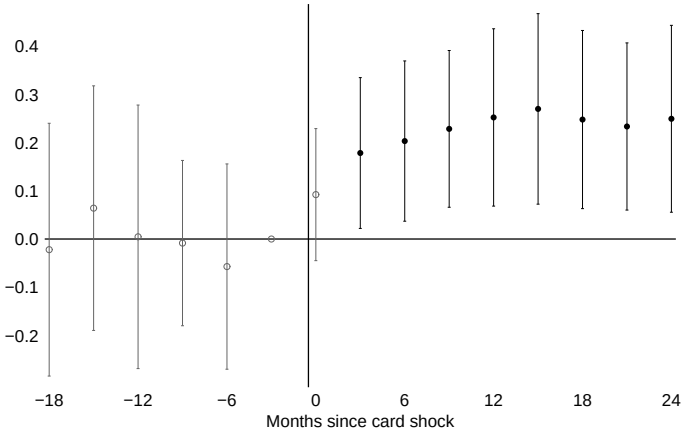

Increased consumption at corner stores

Data: Consumption module of repeated cross-section survey, 2006–2014

$$\log Spending_{it}^{s} = \lambda_{j(i)} + \theta_{q(i)t} + \gamma D_{j(i)t} + \sum_{q=2}^{5} \psi_q \mathbb{I}(quintile = q)_{it} \times D_{j(i)t} + \varepsilon_{it}$$

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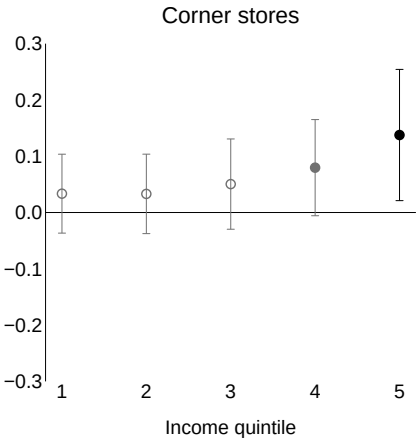

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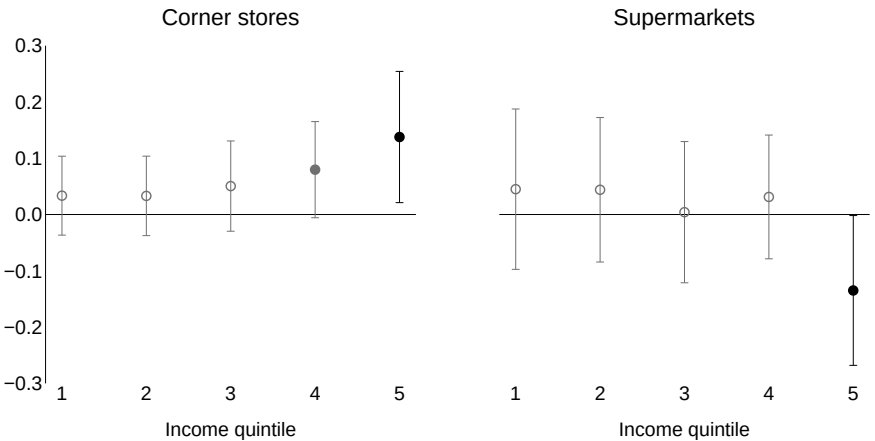
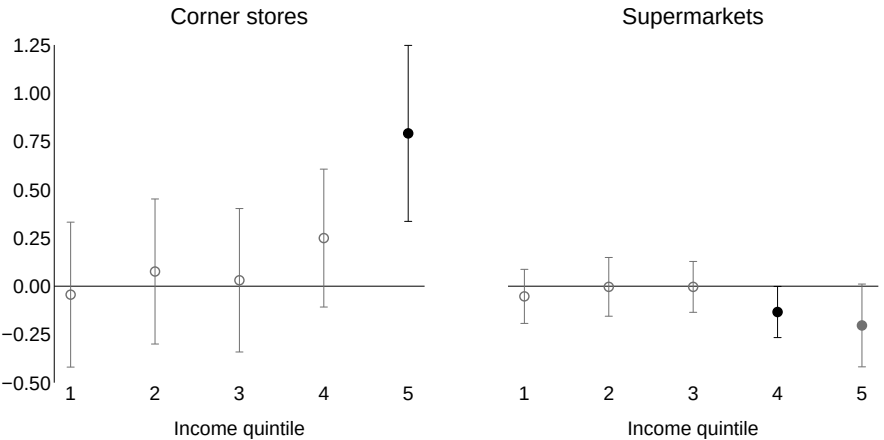


Driven partly by changing number of trips

Data: Consumption module of repeated cross-section survey, 2006–2014

$$\textit{Weekly trips}^{s}_{it} = \lambda_{j(i)} + \theta_{q(i)t} + \gamma D_{j(i)t} + \sum_{q=2}^{5} \psi_q \mathbb{I}(\textit{quintile} = q)_{it} \times D_{j(i)t} + \varepsilon_{it}$$



Corner store sales and profits increase

Data: Mexico's Economic Census (panel)

- Includes all sales (including cash) for universe of retailers
- 1.7 million retailers in 2008 and 1.9 million in 2013

$$y_{it} = \gamma_i + \delta_t + \beta D_{j(i)t} + \varepsilon_{it}$$

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	(1) Log Merchandise Sales	(2) Log Merchandise Costs	(3) Log Wage Costs	(4) Log Rent	(5) Number Employees	(6) asinh Profits	(7) Supermarket asinh Profits
	0.034**	0.027*	−0.011	−0.013	0.006	0.139***	−0.254
	(0.017)	(0.016)	(0.010)	(0.013)	(0.013)	(0.050)	(2.39)
Number of firms	532,374	532,374	532,374	532,374	532,374	532,374	13,873
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

▸ By period ▸ Prices ▸ Wages ▸ Fired ▸ Transaction fees ▸ Consumption ▸ Size ▸ Owners ▸ Churning

Consumer gains from supply-side POS adoption

Goals

- Estimate welfare effects for three types of consumers
  1. Prospera beneficiaries who receive cards
  2. Existing cardholders (gain from shock-induced retail POS adoption)
  3. New adopters (adopt in response to shock-induced retail POS adoption)
- Quantify what proportion of total consumer gains are spillovers to other consumers

Estimate a demand model that combines features of

- Atkin, Faber, Gonzalez-Navarro (2018)
- Björnerstedt & Verboven (2016)
- Einav et al. (2017)

Consumer gains from supply-side POS adoption

For each shopping trip, consumer makes discrete–continuous choice

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For each shopping trip, consumer makes discrete–continuous choice

Discrete choice over which store

Consumer gains from supply-side POS adoption

For each shopping trip, consumer makes discrete–continuous choice

Discrete choice over which store

Continuous choice over goods at store

- Cobb-Douglas preferences over goods
- Preferences for store characteristics enter utility

$$u_{ist} = \left(\prod_g x_{igst}^{\phi_{a(i)gst}} \right)^{\alpha_{k(i)}} \cdot \exp\left(\theta_{k(i)} POS_{ist} + \xi_{a(i)k(i)st} + \varepsilon_{ist} \right)$$

for consumer i of type k in census tract a at store type s at time t; g indexes goods

Consumer gains from supply-side POS adoption

Plug in Marshallian demand $x_{igst} = \phi_{a(i)gst}(y_{it}/p_{a(i)gst})$

Integrate over ε_{ist} assuming extreme value 1 and integrate over POS_{ist}

Subtract off outside option $s = 0$ (open air markets)

Leads to equation for difference in log expenditure shares (at census tract $\times$ consumer type $\times$ store type $\times$ time):

$$\log \phi_{akst} - \log \phi_{ak0t} = -\alpha_k(\log P_{ast} - \log P_{a0t}) + \theta_k \overline{POS}_{z(a)kst} + \eta_{j(a)ks} + \delta_{kst} + \nu_{akst}$$

where $\log P_{ast} = \sum_g \phi_{agst} \log p_{agst}$ (Stone price index)

Consumer gains from supply-side POS adoption

$$\log \phi_{akst} - \log \phi_{ak0t} = -\alpha_k(\log P_{ast} - \log P_{a0t}) + \theta_k \overline{POS}_{z(a)kst} + \eta_{j(a)ks} + \delta_{kst} + \nu_{akst}$$

Estimate using data from existing cardholders only

- θ_k only identified for this group

Endogeneity of demand

- Hausman instrument for prices
- Debit card shock as instrument for POS adoption

$-\theta_k/\alpha_k$ is price-equivalent value of no stores with POS $\rightarrow$ all stores with POS

$-(\theta_k/\alpha_k)\Delta POS_{ks}$ is value to consumers of supply-side response to shock

▸ Consumer surplus derivation

Consumer gains from supply-side POS adoption

Dependent variable: log share of expenditures at store type *s* minus log share at outside option	(1)	(2)
Log price difference ($-\alpha$)	−3.23**	−3.76
	(1.56)	(4.33)
Log price difference $\times$ $\mathbb{I}$(Income $>$ median)		1.56
		(3.94)
Share of stores with POS (θ)	0.93***	0.80***
	(0.27)	(0.33)
Share of stores with POS $\times$ $\mathbb{I}$(Income $>$ median)		0.01
		(0.36)
First-stage joint F-test	26.80	25.64
Number of observations	6,454	8,190
Locality $\times$ store type fixed effects	Yes	
Locality $\times$ store type $\times$ $\mathbb{I}$(Income $>$ median) fixed effects		Yes
Store type $\times$ time fixed effects fixed effects	Yes	
Store type $\times$ time fixed effects $\times$ $\mathbb{I}$(Income $>$ median) fixed effects		Yes

Consumer gains from supply-side POS adoption

Beneficiaries: 2.7% ↑ consumer surplus on average

- About half as large as effect of Walmart coming to municipality (Atkin, Faber, Gonzalez-Navarro 2018)

Existing cardholders: 0.4% ↑ consumer surplus

New card adopters: depends on cost of adoption

- Bounds: 0–0.6% ↑ consumer surplus

43–47% of **total** ΔCS is spillovers to non-beneficiaries

- Intuition:
  - Twice as many existing cardholders as beneficiaries
  - Existing cardholders richer, and absolute spending enters CS formula

▸ Consumer surplus derivation

Conclusion

Network externalities and adoption costs constrain adoption of financial technologies

Large spillovers of an adoption subsidy targeted to a subset of consumers

- Nearly half of consumer welfare benefits of policy shock to financial technology adoption accrue to other consumers

Policies to increase financial technology adoption can target subset of consumers

- Much less costly
- Can start feedback loop of adoption between supply and demand
- Seems to be ApplePay's current strategy in US

Appendix

Related literature

1. Direct impacts of FinTech adoption on consumer behavior
   - Borrowing (Bartlett, Morse, Stanton, Wallace 2018)
   - Saving (Blumenstock, Callen, Ghani 2018)
   - Risk sharing and resilience to shocks (Jack & Suri 2014)
2. Supply side of FinTech markets
   - Online lenders (Buchak, Matvos, Piskorski, Seru 2018; Fuster, Plosser, Schnabl, Vickery 2018)
   - Retail FinTech adoption (Agarwal et al. 2018; Crouzet, Gupta, Mezzanotti 2018)
   - Initial coin offerings (Howell, Niessner, Yermack 2018)

- This paper studies supply-side response to consumer adoption and spillovers back onto demand side

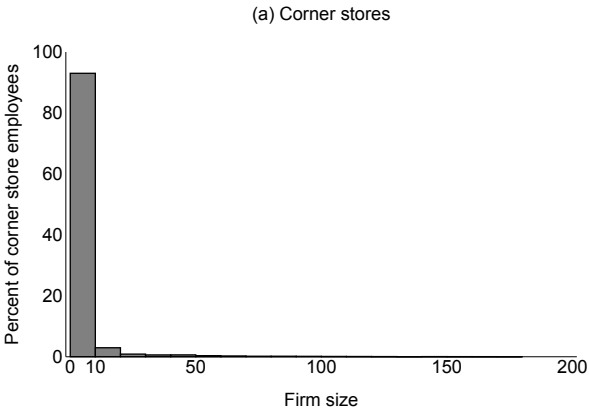
Related literature

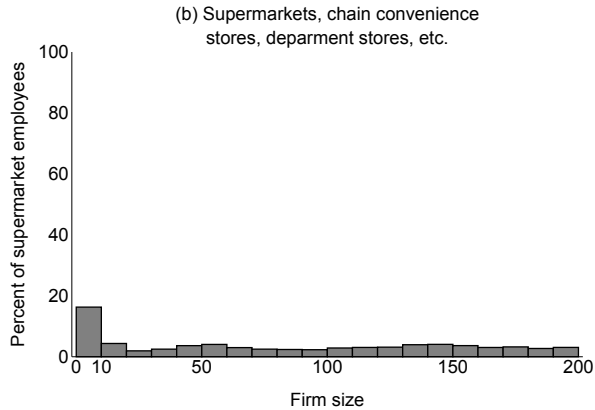
3. Constraints to technology adoption
   - Upfront costs (Basker, 2012; Bryan, Chowdhury, Mobarak 2014)
   - Learning externalities (Conley & Udry 2010; Banerjee, Chandrasekhar, Duflo, Jackson 2013)
   - ▸ This paper studies a different constraint: network externalities

4. Adoption of goods with network externalities (Katz & Shapiro 1985)
   - ATMs (Saloner & Shepard 1995)
   - Payment technologies (Rysman 2007)
   - Mobile phones (Björkegren 2018)
   - ▸ This paper exploits exogenous variation in cost of adoption for a subset of consumers $\Rightarrow$ can isolate spillovers onto other consumers

▸ Context and identification

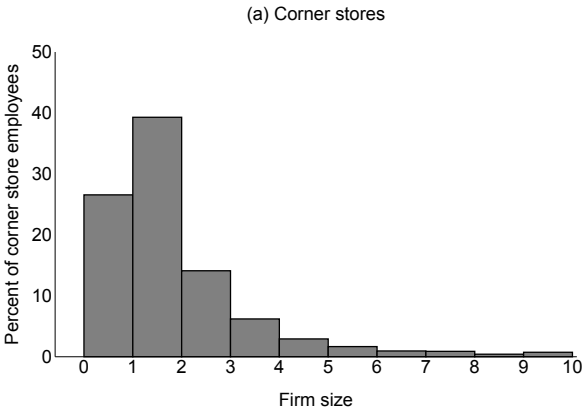
Distribution of retail employment share by firm size

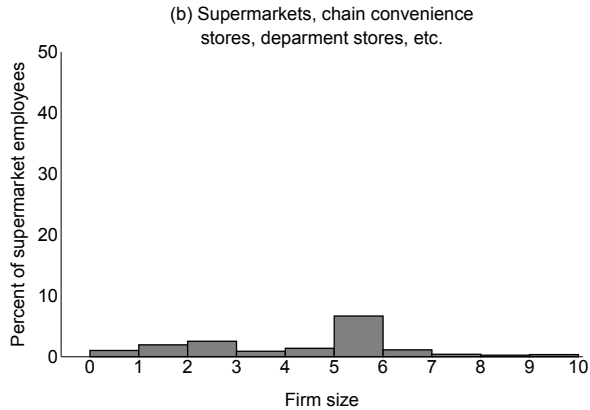




▸ Profits

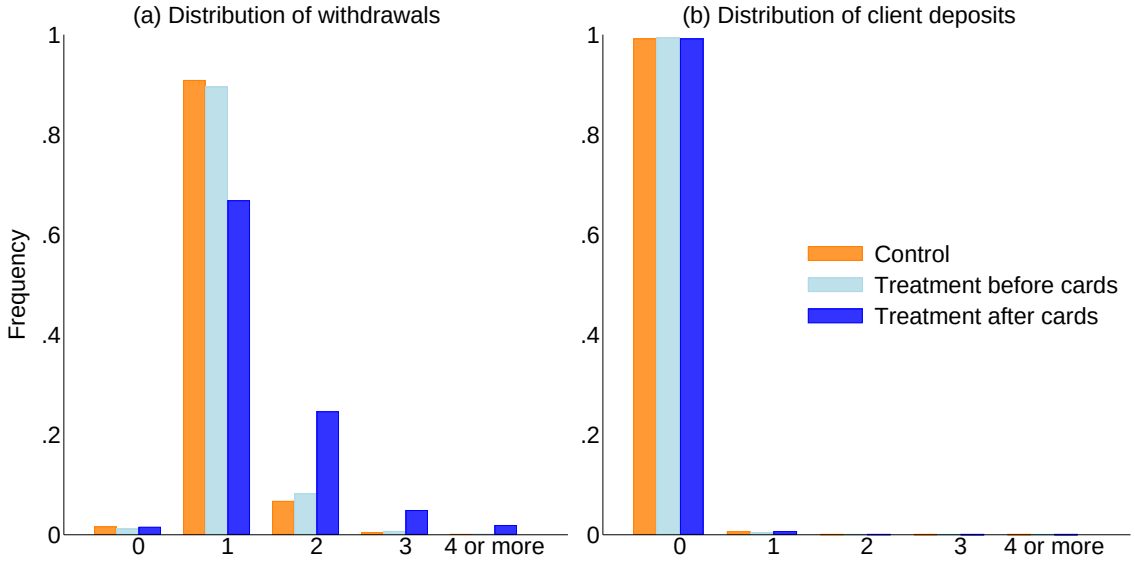
Employment share distribution of retailers with $<$ 10 employees





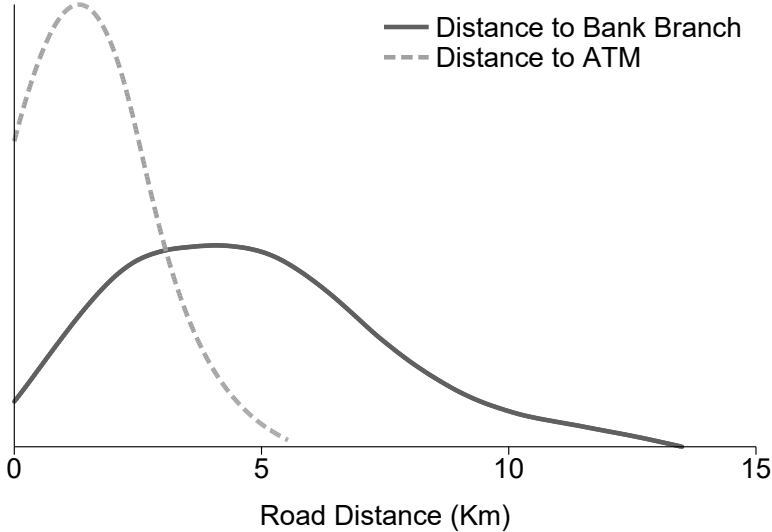
▸ Profits

Transactions at branch or ATM

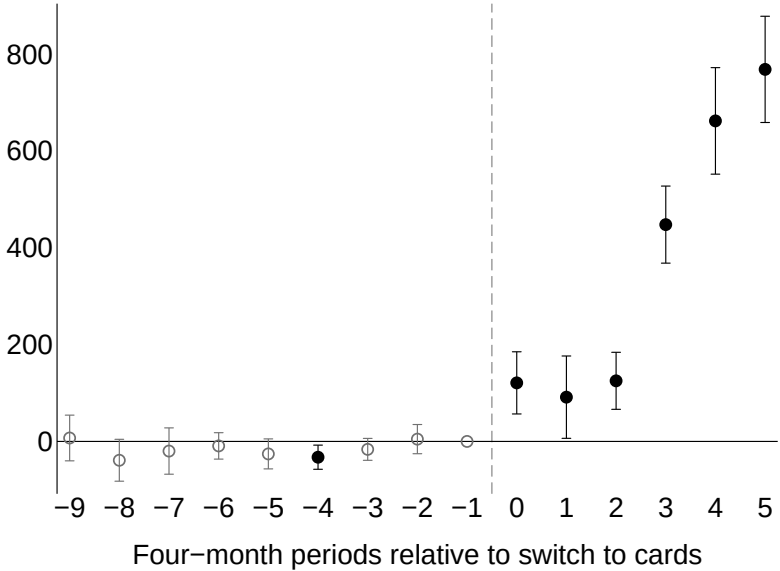


▸ Rollout details ▸ Rollout timing

Travel distance to access money ↓

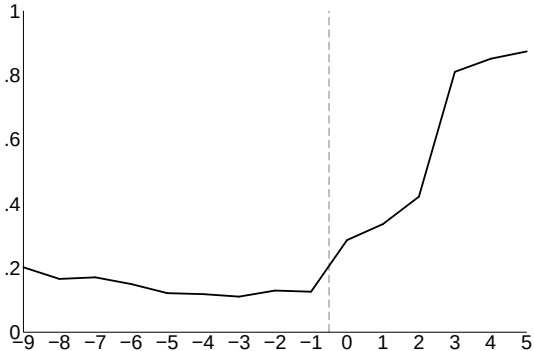


Increased savings by beneficiaries

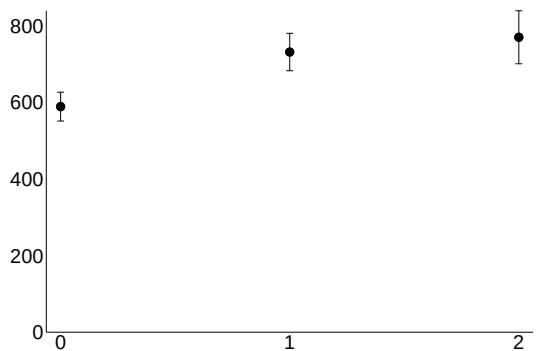


Decomposition of increased savings by beneficiaries

Proportion who save



Stock of savings conditional on saving



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Calendar of transfer dates

Oportunidades

Calendario Fijo de Retiro de Apoyos Monetarios

GOBIERNO FEDERAL SEDESOL

Entidad: **15 MEXICO**

Zona de Atención: **150303**

Municipio: **33 ECATEPEC DE MORELOS**

Localidad: **1 ECATEPEC DE MORELOS**

AGEB: [redacted] Código Postal: **55450**

Domicilio: [redacted]

Folio Titular: [redacted]

Nombre Titular: [redacted]

Identificador de Familia: [redacted]

Fase de Incorporación: **35**

Esquema de Apoyos: **Urbano 1**

Colonia: [redacted]

Estimada Titular:

Los apoyos del bimestre de corresponsabilidad	los puede retirar a partir del
Noviembre - Diciembre del 2008	Lunes 20 de Abril del 2009
Enero - Febrero del 2009	Lunes 1 de Junio del 2009
Marzo - Abril del 2009	Lunes 13 de Julio del 2009
Mayo - Junio del 2009	Lunes 14 de Septiembre del 2009
Julio - Agosto del 2009	Lunes 16 de Noviembre del 2009
Septiembre - Octubre del 2009	Lunes 11 de Enero del 2010

Bimestre de Generación de Calendario: **Corresponsabilidad Noviembre - Diciembre del 2008**

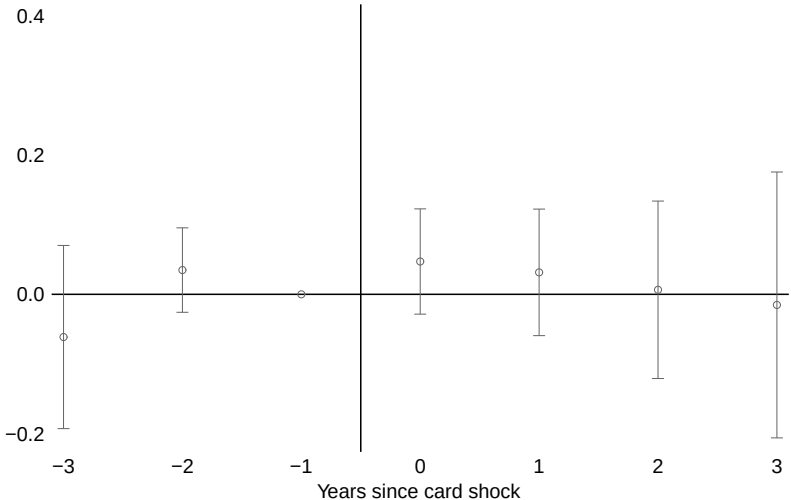
Titular beneficiaria: Usted podrá retirar sus apoyos con su Tarjeta de Débito a partir de la fecha indicada en cajeros automáticos ó establecimientos autorizados (que aceptan tarjetas VISA).

Recuerde que en cajeros automáticos podrá realizar dos operaciones (retiros ó consultas) gratuitas al bimestre, también puede utilizar su Tarjeta para comprar en establecimientos que aceptan Tarjetas de Débito VISA.

Pamphlet provided with debit card

No change in number of beneficiaries

$$\log \textit{Number of Beneficiaries}_{jt} = \xi_j + \delta_t + \sum_k \phi_k D_{jt}^k + \varepsilon_{jt}$$



Rollout not correlated with observables

Test using discrete time hazard

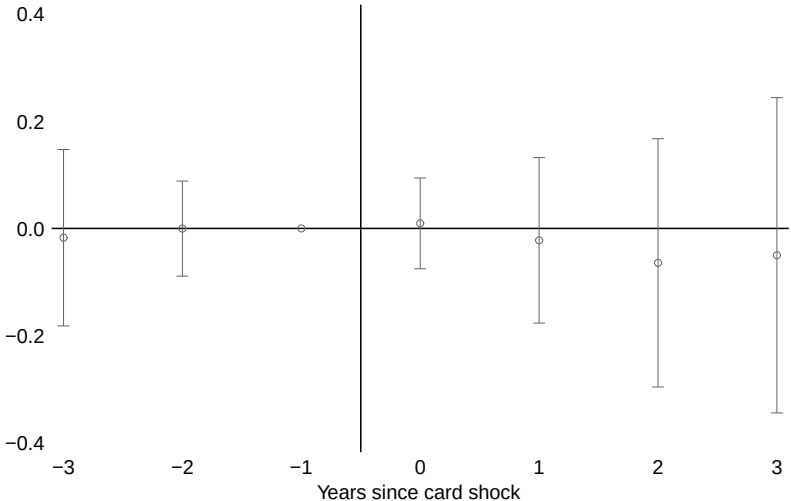
	(1)	(2)	(3) Discrete Time Hazard	(4) Discrete Time Hazard
Variable	Mean	Standard Deviation	Linear Probability	Proportional Hazard
Log point-of-sale terminals	4.47	2.11	0.0002	0.0043
			(0.0095)	(0.0842)
Δ Log point-of-sale terminals	0.81	0.38	−0.0260	−0.2360
			(0.0185)	(0.1601)
Log bank accounts	9.27	3.27	0.0061	0.0537
			(0.0052)	(0.0435)
Δ Log bank accounts	1.78	3.61	0.0049	0.0495
			(0.0065)	(0.0558)
Log commercial bank branches	2.58	1.42	−0.0225	−0.2160
			(0.0187)	(0.1508)
Δ Log commercial bank branches	0.61	0.95	−0.0215	−0.2267
			(0.0240)	(0.2178)
Log Bansefi bank branches	0.58	0.41	0.0033	0.0420
			(0.0241)	(0.2001)
Log commercial bank ATMs	3.15	1.74	0.0130	0.1203
			(0.0103)	(0.0997)
Log population	11.26	1.24	0.0117	0.1072
			(0.0159)	(0.1317)
% mayor = PAN	19.58	39.77	−0.0003	−0.0027
			(0.0003)	(0.0023)
Δ % mayor = PAN	−12.08	57.67	0.0002	0.0021
			(0.0002)	(0.0016)

	(1)	(2)	(3) Discrete Time Hazard	(4) Discrete Time Hazard
Variable	Mean	Standard Deviation	Linear Probability	Proportional Hazard
% illiterate (age 15+)	6.14	3.69	0.0004	0.0049
			(0.0048)	(0.0417)
% not attending school (age 6-14)	4.15	1.65	0.0003	0.0063
			(0.0094)	(0.0848)
% without primary education (age 15+)	40.98	9.59	0.0018	0.0145
			(0.0019)	(0.0169)
% without health insurance	45.68	16.15	−0.0011	−0.0099
			(0.0008)	(0.0066)
% with dirt floor	5.28	4.83	0.0051**	0.0513**
			(0.0024)	(0.0209)
% without toilet	5.89	3.60	−0.0063	−0.0526
			(0.0040)	(0.0335)
% without water	6.45	9.12	−0.0007	−0.0058
			(0.0010)	(0.0094)
% without plumbing	3.94	6.39	0.0021	0.0180
			(0.0015)	(0.0122)
% without electricity	4.29	2.24	0.0052	0.0430
			(0.0048)	(0.0394)
% without washing machine	33.64	14.33	−0.0006	−0.0071
			(0.0010)	(0.0098)
% without refrigerator	16.80	9.73	0.0010	0.0068
			(0.0017)	(0.0153)

▸ Pre-trends

Rollout not correlated with political party

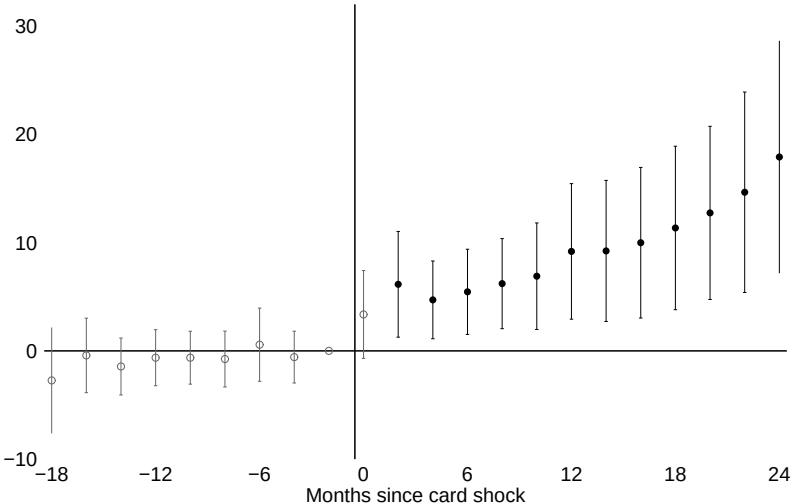
$$\mathbb{I}(Mayor_{jt} = PAN) = \xi_j + \delta_t + \sum_k \phi_k D_{jt}^k + \varepsilon_{jt}$$



▸ Pre-trends

Corner stores increase adoption of POS

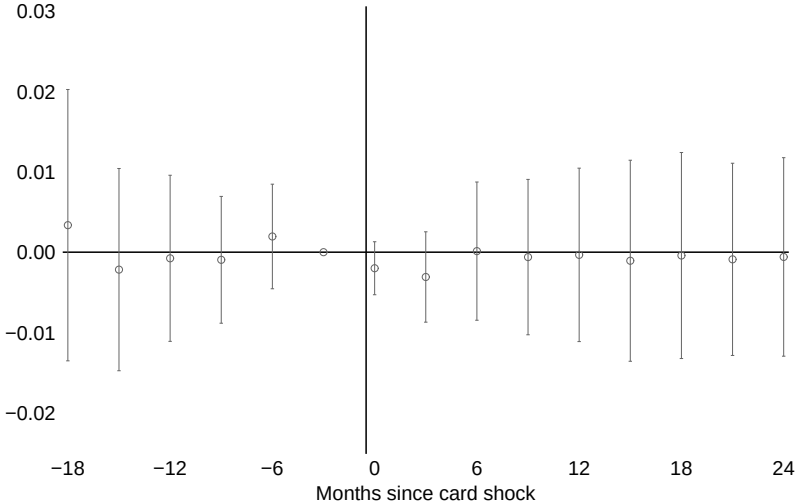
$$\textit{Number of POS}_{jt} = \xi_j + \delta_t + \sum_k \phi_k D^k_{jt} + \varepsilon_{jt}$$



▸ In logs

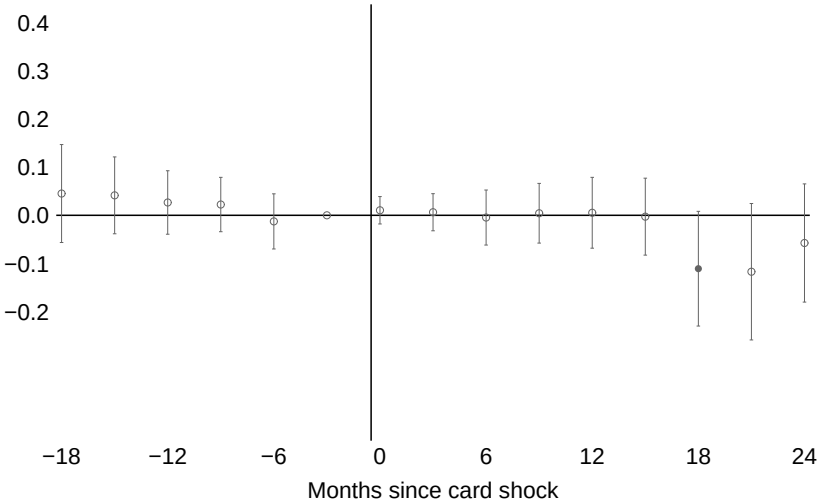
Banks do not appear to respond to shock

$$\log \textit{Transaction fee}_{jt} = \lambda_j + \delta_t + \sum_k \phi_k D^k_{jt} + \varepsilon_{jt}$$



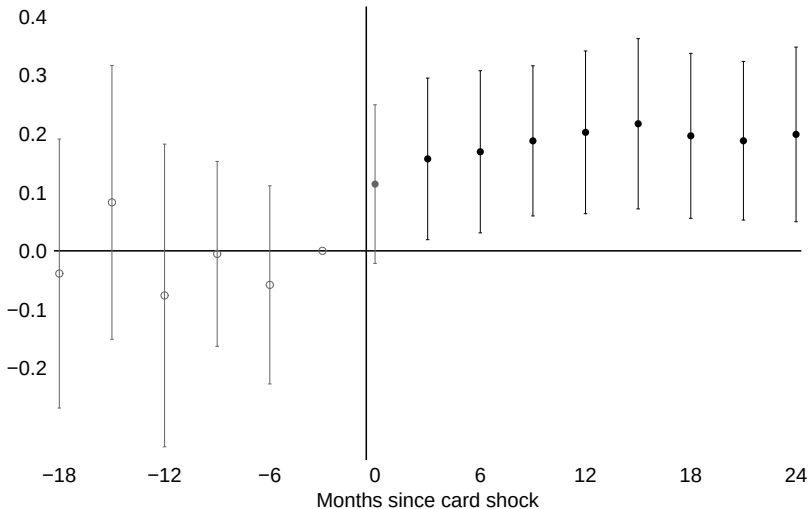
Banks do not appear to respond to shock

$$\log \textit{Commercial bank branches}_{jt} = \lambda_j + \delta_t + \sum_k \phi_k D^k_{jt} + \varepsilon_{jt}$$



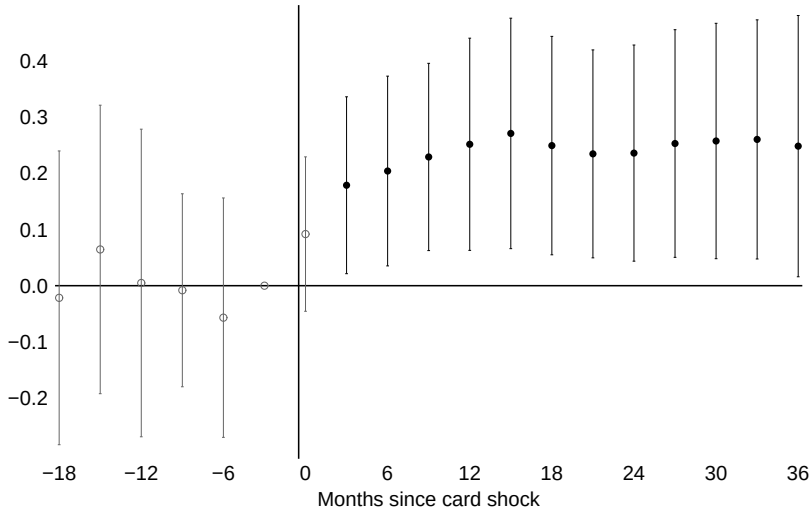
Spillovers to other consumers' card adoption

$$\log \textit{Number of Credit and Debit Cards}_{mt} = \xi_m + \delta_t + \sum_k \phi_k D^k_{mt} + \varepsilon_{mt}$$



Spillovers to other consumers' card adoption (longer run)

$$\log \textit{Number of Debit Cards}_{mt} = \xi_m + \delta_t + \sum_k \phi_k D^k_{mt} + \varepsilon_{mt}$$



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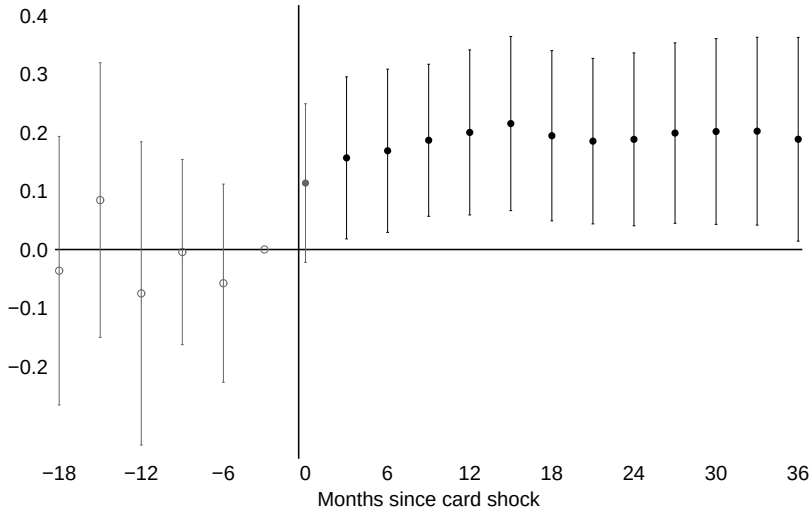
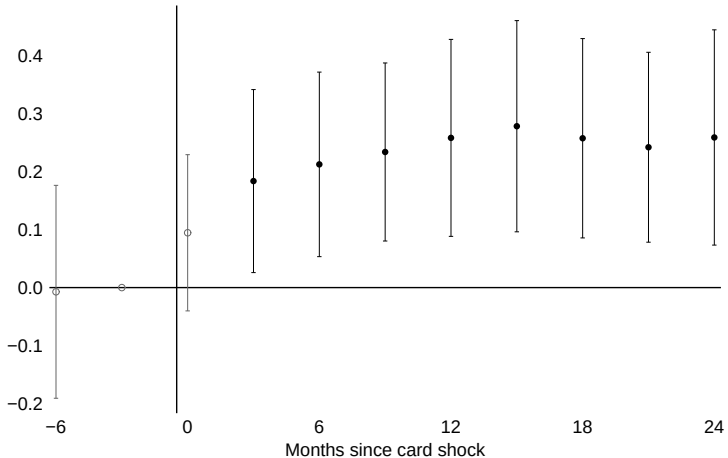


Spillovers to other consumers' card adoption (balanced over time)

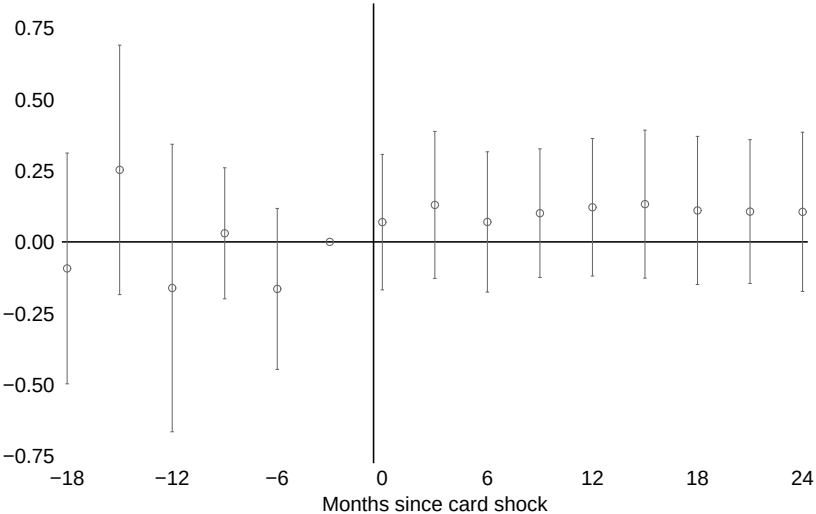
All 255 municipalities in rollout:

$$\log \textit{Number of Debit Cards}_{mt} = \xi_m + \delta_t + \sum_k \phi_k D^k_{mt} + \varepsilon_{mt}$$



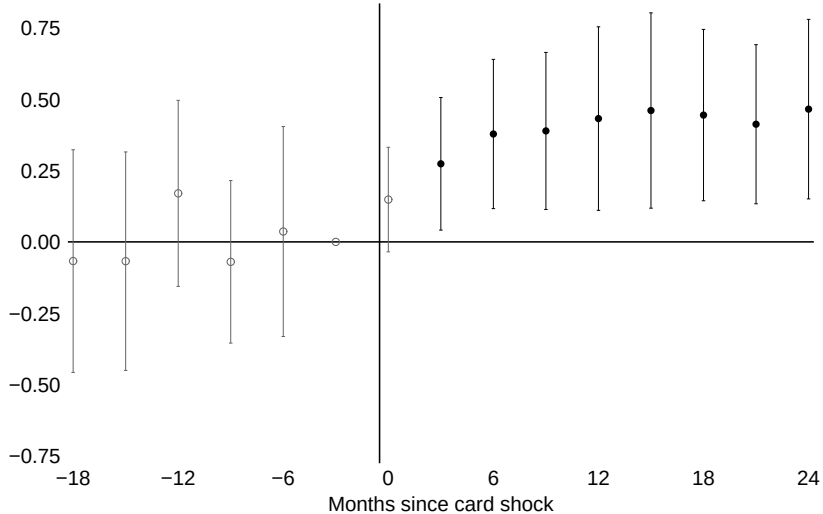
Word-of-mouth learning?

Municipalities where beneficiaries prefer supermarkets



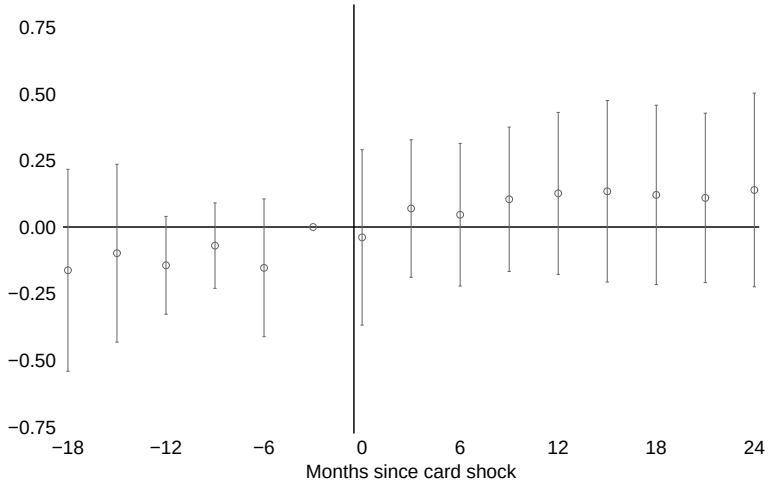
Word-of-mouth learning?

Municipalities where beneficiaries prefer corner stores



Word-of-mouth learning?

Municipalities where beneficiaries prefer supermarkets, below median baseline card adoption

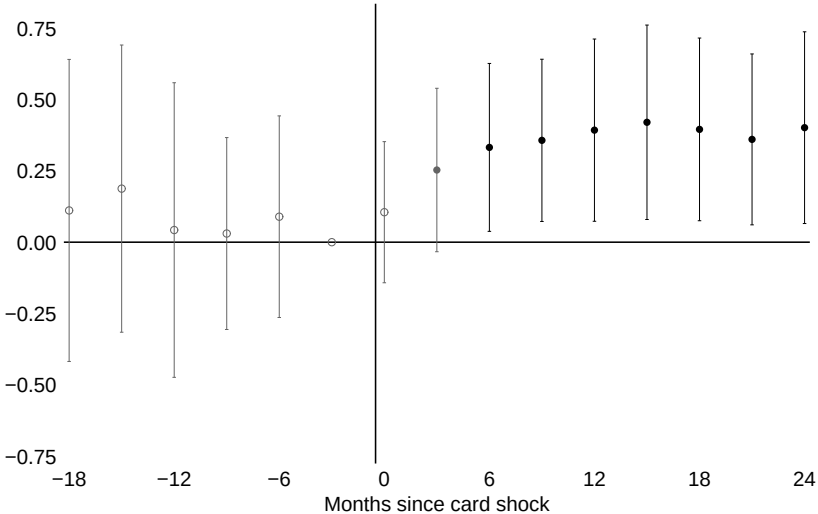


Word-of-mouth learning?

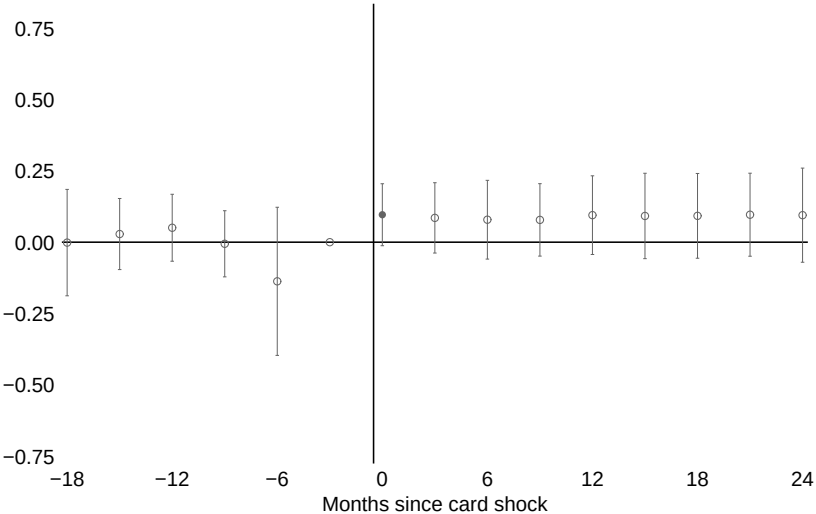
	(1) Municipalities with $<$ 6 month delay in POS response	(2) Municipalities with 6 month–1 year delay in POS response	(3) p-value of difference
First 6 months after card shock	0.102**	−0.020	0.043**
	(0.049)	(0.034)	
Subsequent periods	0.234*	0.124	0.583
	(0.136)	(0.147)	
N (municipality $\times$ 6-month periods)	2,127	288	
Number of municipalities	146	21	
Municipality fixed effects	Yes	Yes	
Time fixed effects	Yes	Yes	

By ATM density

Municipalities with below-median ATMs per person



By ATM density



Prices

Data: High-frequency store by product by week price data, 2002–2014

- Microdata used to construct Mexico's Consumer Price Index
- $\sim$10 million price quotes
- Product codes are barcode-equivalent (e.g., 600ml Coca-Cola bottle)
- Restrict to food, drink, tobacco categories

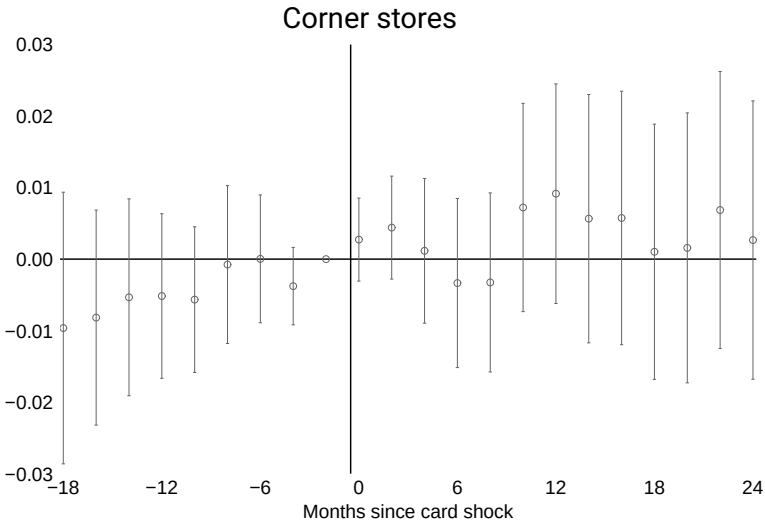
Specification: Event study difference-in-differences

$$\log Price_{gst} = \eta_{gs} + \delta_t + \sum_k \phi_k D^k_{m(s)t} + \varepsilon_{gst}$$

- η_{gs} are barcode-level-good by store fixed effects
- $D^k_{m(s)t} = 1$ if municipality m received the card shock k periods ago
- As before, aggregated to 2-month periods

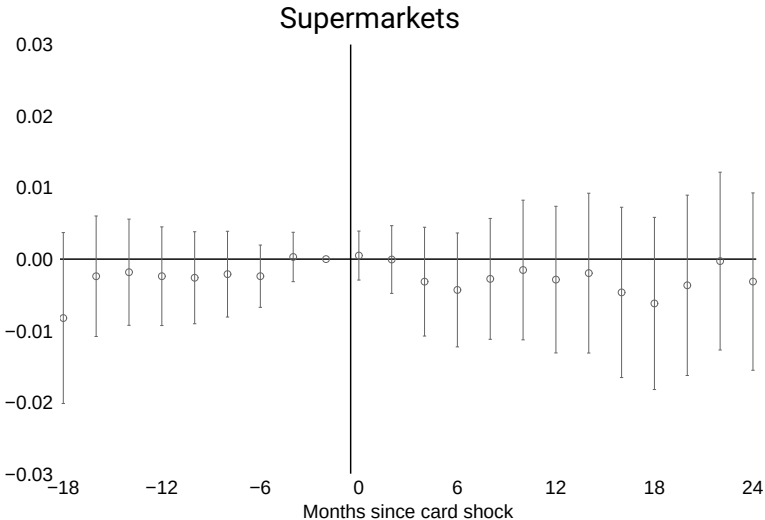
No price effect

$$\log Price_{gst} = \eta_{gs} + \delta_t + \sum_k \phi_k D^k_{m(s)t} + \varepsilon_{gst}$$



No price effect

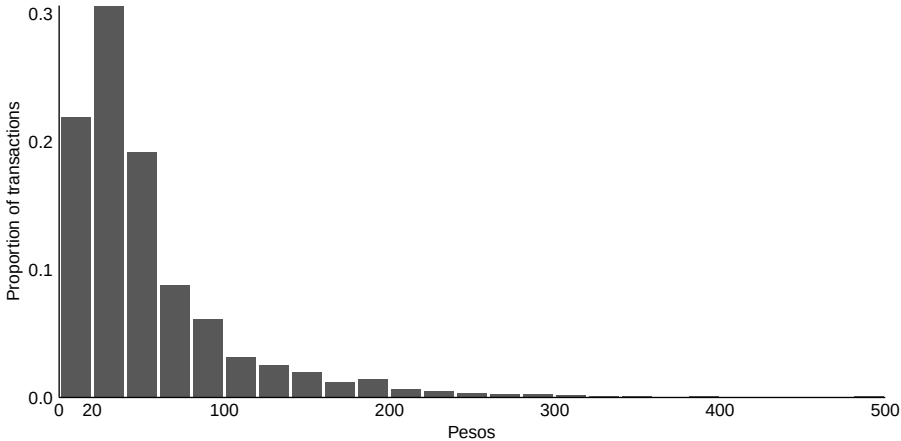
$$\log Price_{gst} = \eta_{gs} + \delta_t + \sum_k \phi_k D^k_{m(s)t} + \varepsilon_{gst}$$



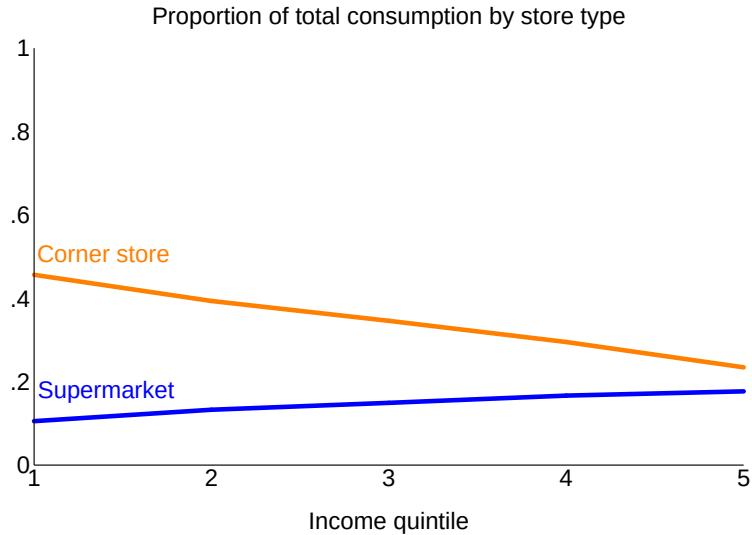
Transaction sizes

Data: universe of transactions at corner stores (by all cardholders)

Result: $>$20% less than US$2, $>$50% less than US$4



Consumption shares by store type (control)



Consumption across stores

$$\log Spending^{s}_{it} = \lambda_{j(i)} + \delta_t + \gamma D_{j(i)t} + \varepsilon_{it}$$

and

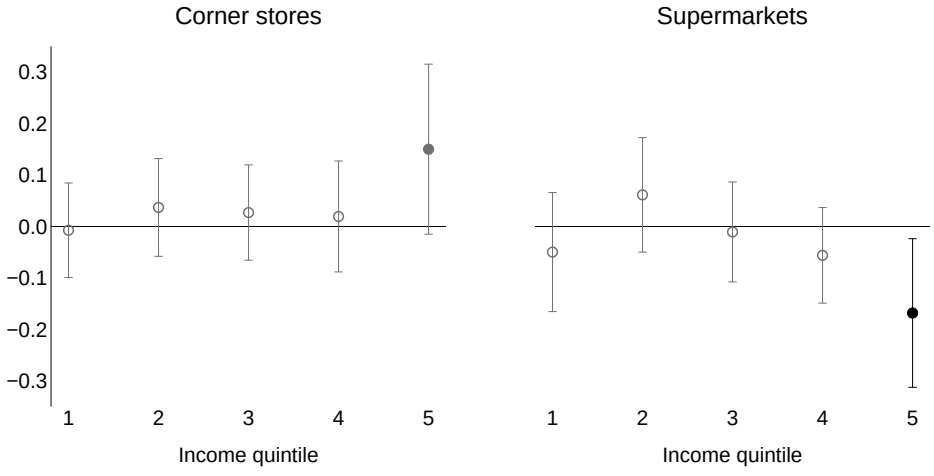
$$\log Spending^{s}_{it} = \xi_{j(i)Card(i)} + \theta_{q(i)Card(i)t} + \delta_t + \gamma D_{j(i)t} + \omega D_{j(i)t} \times \mathbb{I}(Card)_{it} + \varepsilon_{it}$$

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: log spending at…					
	Corner stores		Supermarkets		Total	
Diff-in-diff	0.067**	0.049	−0.018	0.011	0.029	0.031
	(0.032)	(0.033)	(0.043)	(0.047)	(0.030)	(0.030)
Diff-in-diff × has credit card		0.071*		−0.043		0.009
		(0.040)		(0.059)		(0.034)
P-value diff-in-diff + (diff-in-diff × has credit card)		[0.006]***		[0.457]		[0.140]
Number of households	49,810	49,810	49,810	49,810	49,810	49,810
Number of localities	220	220	220	220	220	220
Locality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Locality by credit card fixed effects		Yes		Yes		Yes
Income quintile by credit card by time fixed effects		Yes		Yes		Yes

▸ Consumption ▸ Profits ▸ Quantities

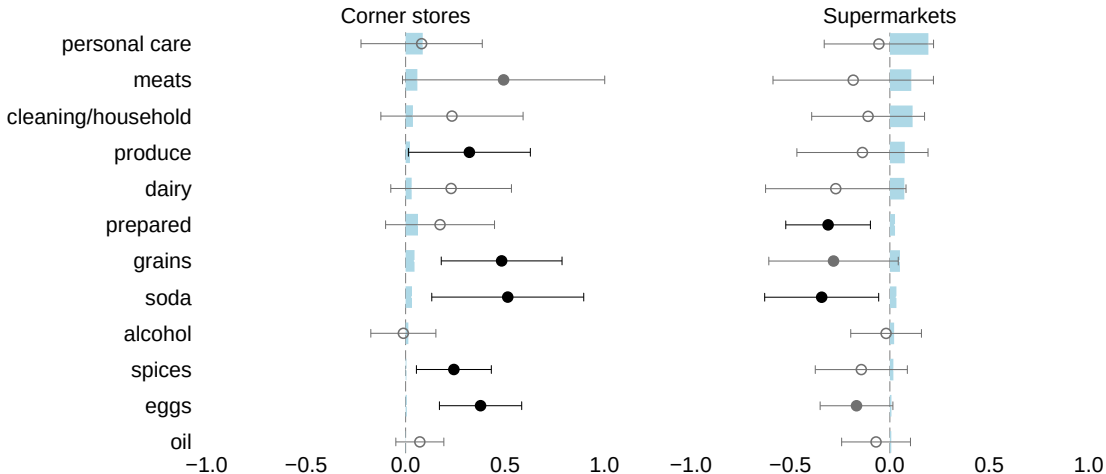
Consumption across stores: quantity of food (kg and liters)

$$\log Quantity^{s}_{it} = \lambda_{j(i)} + \theta_{q(i)t} + \gamma D_{j(i)t} + \sum_{q=2}^{5} \psi_q \mathbb{I}(quintile = q)_{it} \times D_{j(i)t} + \varepsilon_{it}$$



Consumption across stores: by product category

Results for richest quintile



Consumption across stores: quantity of food (kg and liters)

$$\log Quantity^{s}_{it} = \lambda_{j(i)} + \delta_t + \gamma D_{j(i)t} + \varepsilon_{it}$$

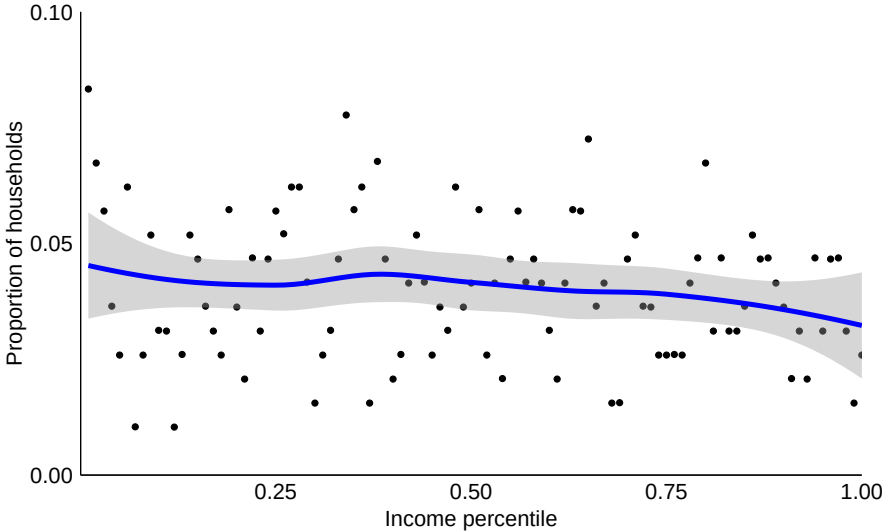
and

$$\log Quantity^{s}_{it} = \xi_{j(i)Card(i)} + \theta_{q(i)Card(i)t} + \delta_t + \gamma D_{j(i)t} + \omega D_{j(i)t} \times \mathbb{I}(Card)_{it} + \varepsilon_{it}$$

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: log quantity purchased at…					
	Corner stores		Supermarkets		Total	
Diff-in-diff	0.048	0.026	−0.046	−0.029	0.030	0.028
	(0.038)	(0.038)	(0.035)	(0.033)	(0.025)	(0.030)
Diff-in-diff × has credit card		0.078		−0.069		−0.003
		(0.053)		(0.066)		(0.042)
P-value diff-in-diff + (diff-in-diff × has credit card)		[0.069]*		[0.110]		[0.529]
Number of households	49,810	49,810	49,810	49,810	49,810	49,810
Number of localities	220	220	220	220	220	220
Locality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Locality by credit card fixed effects		Yes		Yes		Yes
Income quintile by credit card by time fixed effects		Yes		Yes		Yes

▸ Consumption ▸ Profits

Corner store owners evenly distributed by income



▸ Profits

Corner store churn

$$y_{jt} = \lambda_j + \delta_t + \beta D_{jt} + \varepsilon_{jt}$$

	(1)	(2)	(3)	(4)
	Only 2008 stores		All stores	
	Number of Corner Stores	Log Number of Corner Stores	Number of Corner Stores	Log Number of Corner Stores
	−3.056***	−0.048	0.076	0.006
	(1.171)	(0.040)	(0.642)	(0.056)
Number of localities	250	250	250	250
Locality fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes

▸ Profits

POS use

Data: From Mexico's Central Bank:

- Transactions-level data on universe of debit and credit card transactions at POS terminals
  - 2007–2017
  - $\sim$2 million transactions per day on average
  - $\sim$7 billion transactions in total
- For analysis, aggregate to store type $\times$ locality $\times$ 2-month period

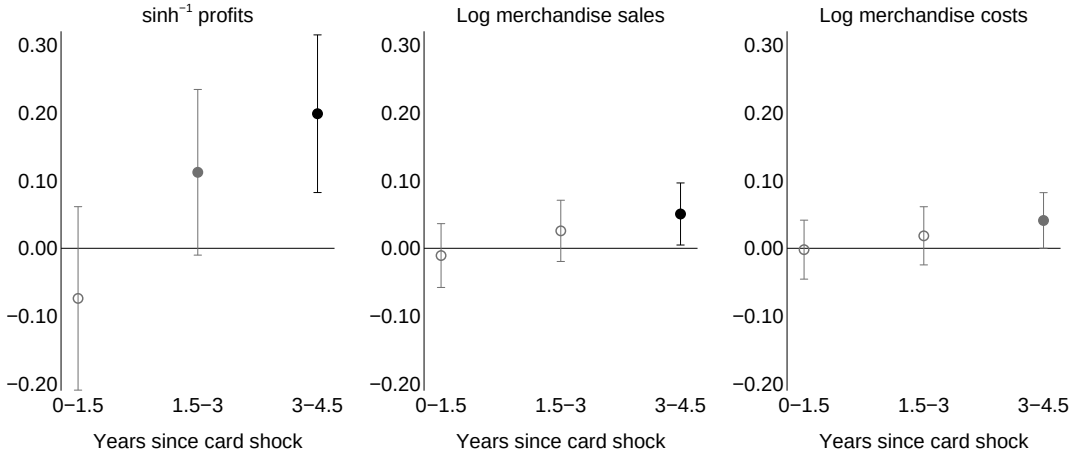
↑ card use at corner stores, ↓ at supermarkets

Diff-in-diff: $y_{jt} = \xi_j + \delta_t + \beta D_{jt} + \varepsilon_{jt}$

	(1) Log # transactions	(2) Log pesos transacted
Corner stores	0.295*	0.472
	(0.179)	(0.301)
Supermarkets	−0.339**	−0.616**
	(0.145)	(0.267)
N (locality by period)	2025	2025
Locality fixed effects	Yes	Yes
2-month period fixed effects	Yes	Yes

Corner store profits increase

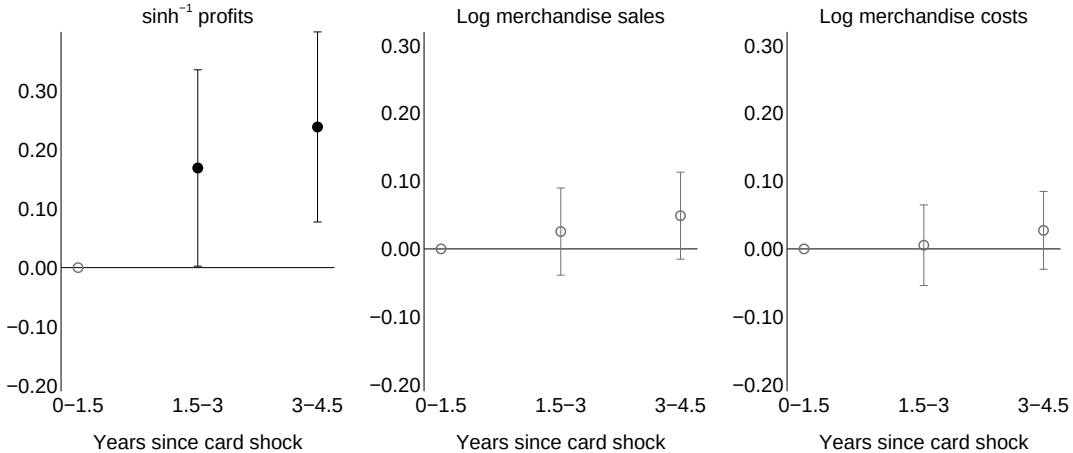
$y_{it} = \gamma_i + \delta_t + \sum_k \gamma_k \mathbb{I}(\text{received cards at } k)_{j(i)} \times D_{j(i)t} + \varepsilon_{it}$ with never-treated



▸ Simple diff-in-diff ▸ Conclusion

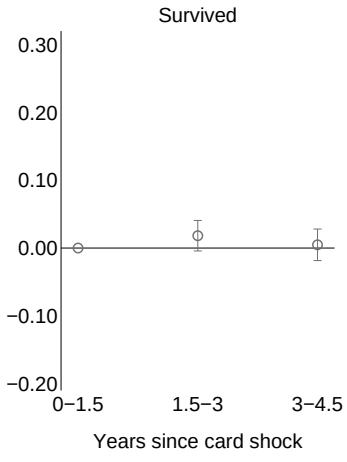
Corner store profits increase

$$y_{it} = \gamma_i + \delta_t + \sum_k \gamma_k \mathbb{I}(\text{received cards at } k)_{j(i)} \times D_{j(i)t} + \varepsilon_{it}$$



Corner store survival

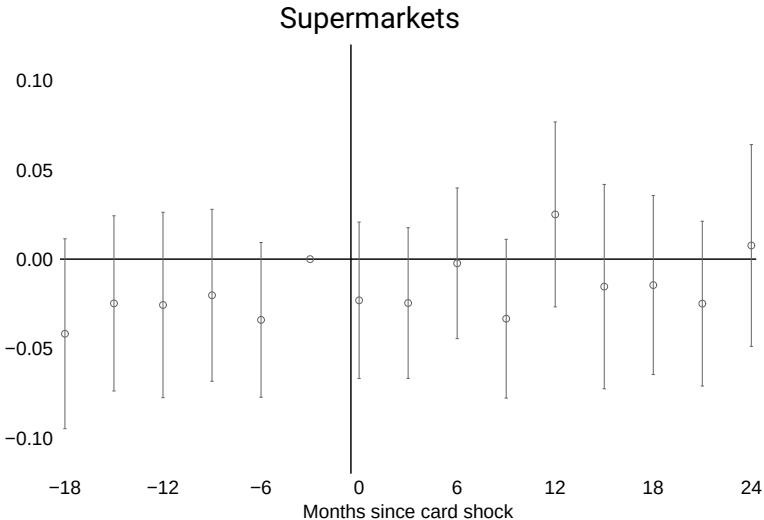
$$y_{it} = \gamma_i + \delta_t + \sum_k \gamma_k \mathbb{I}(\text{received cards at } k)_{j(i)} \times D_{j(i)t} + \varepsilon_{it}$$



▸ Profits ▸ Conclusion

No wage effect

$$\log Wage_{it} = \lambda_{m(i)} + \delta_t + \sum_k \phi_k D^k_{m(i)t} + \varepsilon_{it}$$



▸ Profits

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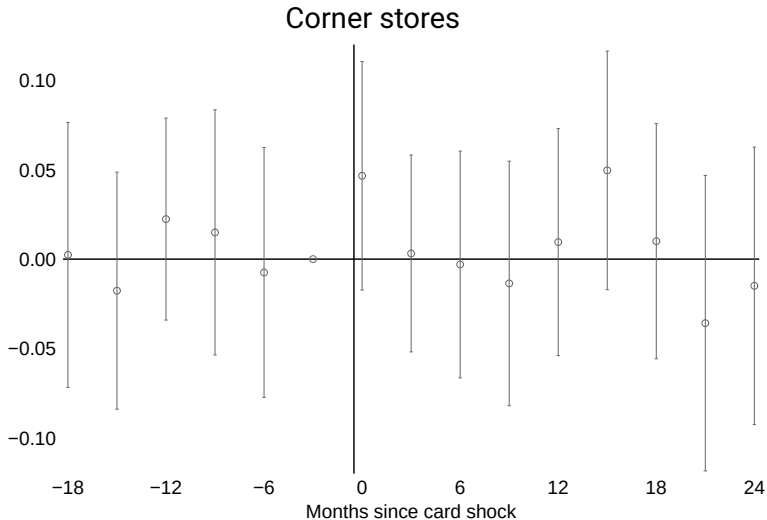
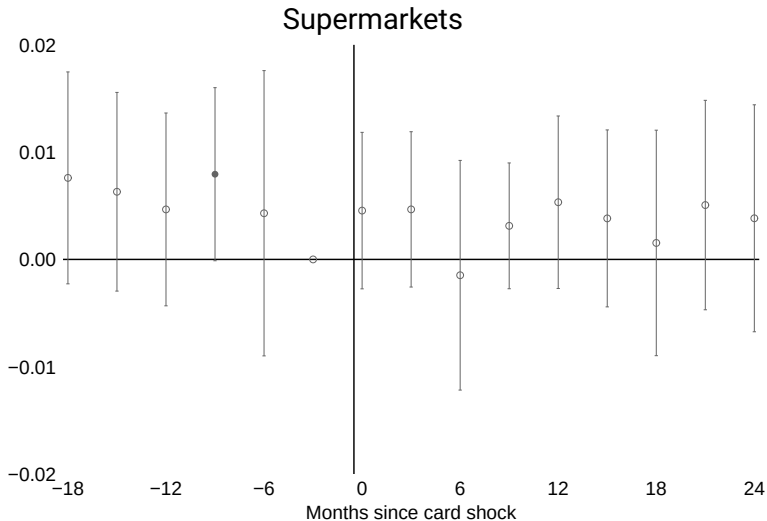


▸ Profits

No effect on probability fired

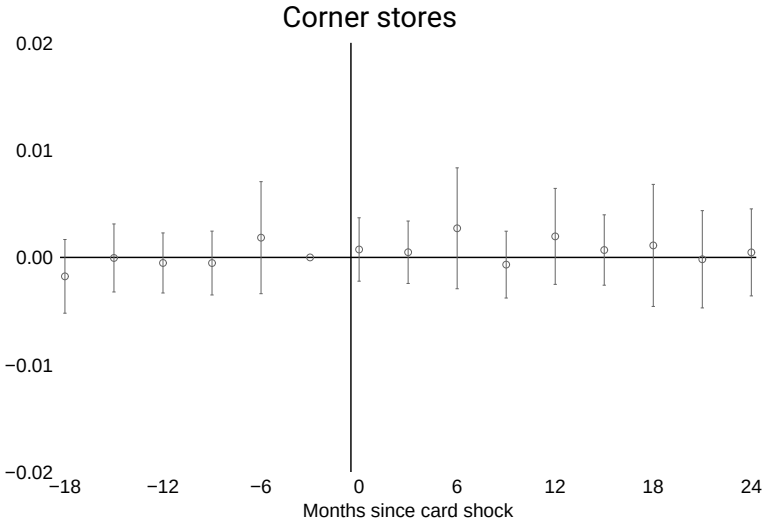
$$\log Fired_{it} = \lambda_{m(i)} + \delta_t + \sum_k \phi_k D^k_{m(i)t} + \varepsilon_{it}$$



▸ Profits

No effect on probability fired

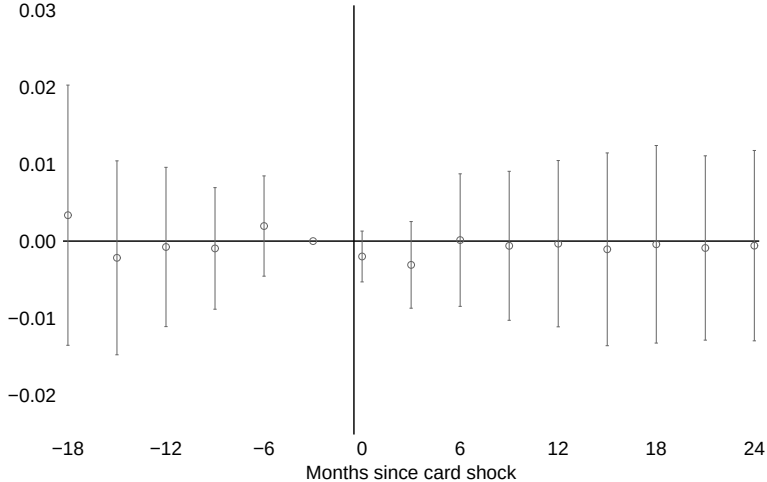
$$\log Fired_{it} = \lambda_{m(i)} + \delta_t + \sum_k \phi_k D^k_{m(i)t} + \varepsilon_{it}$$



▸ Profits

Bank response: No effect on transaction fee

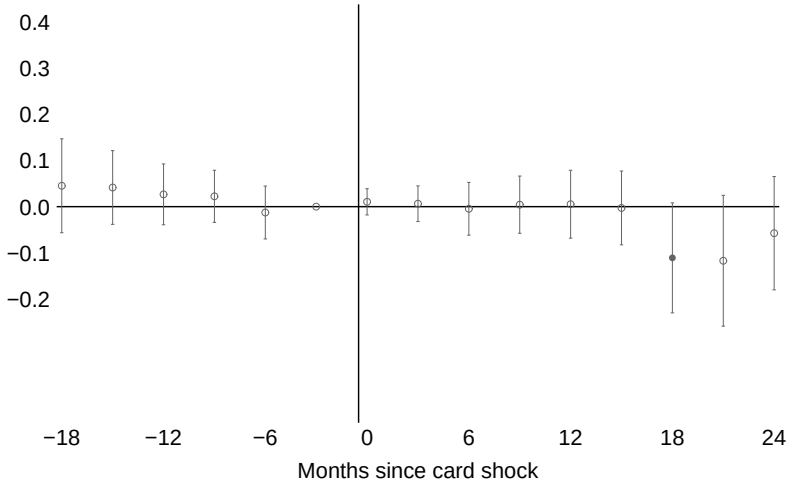
$$\log \overline{Fee}_{mt} = \lambda_m + \delta_t + \sum_k \phi_k D^k_{mt} + \varepsilon_{it}$$



▸ Adoption costs ▸ Profits

Bank response: No change in banking infrastructure

$$\log Branches_{mt} = \lambda_m + \delta_t + \sum_k \phi_k D^k_{mt} + \varepsilon_{it}$$



▸ Profits

Consumer gains from supply-side POS adoption

$-\theta/\alpha$ is price-equivalent value of no stores with POS $\rightarrow$ all stores with POS:

$$-\frac{\theta}{\alpha} = \frac{d \log \phi_{ast} / d\overline{POS}_{ast}}{d \log \phi_{ast} / d \log P_{ast}} = \frac{d \log P_{ast}}{d\overline{POS}_{ast}}$$

$-(\theta/\alpha)\Delta POS_s$ is value to consumers of supply-side response to card shock

- ΔPOS_s is observed change in adoption in response to shock
- $-(\theta/\alpha)\Delta POS_s = -0.015$, i.e. equivalent to 1.5% $\downarrow$ prices

Next: plug in $-\frac{\theta}{\alpha}\Delta POS_s$ for $d \log P_s$ in standard consumer surplus formula

Approximating welfare effects

First-order approximation of compensating variation:

$$CV = e(P^0, U^0) - e(P^1, U^0)$$

First-order Taylor expansion of $e(P^0, U^0)$ around P^1:

$$\approx \left[e(P^1, U^0) + \sum_s \frac{\partial e(P^1, U^0)}{\partial P_s} (P_s^0 - P_s^1) \right] - e(P^1, U^0)$$

Shephard's lemma and duality:

$$\approx -\sum_s x_s^1 (P_s^1 - P_s^0) \approx -\sum_s P_s^1 x_s^1 \left(\frac{P_s^1 - P_s^0}{P_s^1} \right) \approx \sum_s P_s^1 x_s^1 \left(\frac{\theta}{\alpha} \Delta POS_s \right)$$

Proportional Δconsumer surplus $\approx \sum_s \phi_s^1 \, (\theta/\alpha) \, \Delta POS_s$