Towards a Cashless Economy? Evidence from the Elasticity of Cash Deposits of Mexican Firms

Pierre Bachas (World Bank Research)
Sean Higgins (Northwestern Kellogg)
Anders Jensen (Harvard Kennedy School, NBER)

November 3, 2020

Motivation

Economies are increasingly becoming cashless

- Worldwide from 2014 to 2017: (Demirgüç-Kunt et al. 2018)
  - Wage earners paid in cash 42% ↘ 31%
  - Government transfer recipients paid in cash 29% ↘ 14%
  - Paid utility bills in cash 42% ↘ 30%
  - Used digital payments 41% ↗ 52%

Countries around the world have actively sought to encourage this trend

- Reduce tax evasion, money laundering, criminal activity (Rogoff 2016)

However, policies that constrain cash as a mode of payment can have negative economic impacts (Chodorow-Reich et al. 2020)

Motivation

Extent to which governments should encourage digital transition depends on firms' elasticity of cash use with respect to relative price of cash

Two main ways governments can encourage the shift away from cash

1. Subsidize adoption of electronic payment technologies
   - On supply side (Brockmeyer & Sáenz Somarriba 2020)
   - On demand side, with spillovers to supply side (Higgins 2020)
2. Increase the cost of using cash
   - Eliminating bank notes as in India's 2016 demonetization (Chodorow-Reich et al. 2020, Crouzet, Gupta, Mezzanotti 2020)
   - Taxing cash when deposited and/or withdrawn from a bank (Coelho, Ebrill, Summers 2001)

Contribution

Little credibly-identified evidence on policies that impact cash

- Lack of firm-level data distinguishing between cash and other payment technologies
- Uniform national policies implemented at a single point in time

Leverage confidential microdata at the firm bank account level from large Mexican bank

Exploit a policy which sought to combat informal cash economy through tax on cash deposits

- 3% tax on monthly sum of cash deposits above 15,000 pesos ($1200)
- Implemented in 2008, modified in 2010, repealed in 2014

Identification strategy: use firm-level variation in exposure to the tax based on firm's pre-tax intensity of cash usage and exemption threshold

Key results

Cash deposits increase by 34% immediately after tax repealed

Firms react strongly to the tax

- Sharply bunch at monthly threshold after tax is implemented (2008)
- Firms respond to change in bunching threshold (2010)
- Bunching disappears when tax repealed (2014)

Highly elastic to tax: 1pp $\downarrow$ in tax on cash deposits $\Rightarrow$ 158% $\uparrow$ in cash deposits

- In short term (year after repeal): partly driven by shift from electronic payment technologies
- In longer term, driven almost entirely by depositing cash otherwise held outside of banking sector

Context

Cash and informality in Mexico

Large informal sector: 57% of workers are informal (INEGI)

Largely cash-based economy

- 37% of adults have bank account (compared to 72% worldwide)
- 32% made a digital payment in the last year (52% worldwide) (Demirgüç-Kunt et al. 2018)
- 32% of retailers in urban areas had adopted point of sale terminals in 2009 (Higgins 2020)

Several policies to encourage the transition away from cash

- Bank accounts to cash transfer recipients in 2005; debit cards in 2009 (Bachas Gertler Higgins Seira 2020)
- National Chamber of Commerce subsidized POS terminals in 2015
- Central Bank launched digital payments platform in 2019

Impuesto a los Depositos en Efectivo (IDE)

Tax introduced in 2008 to discourage and track cash usage ▸ Details

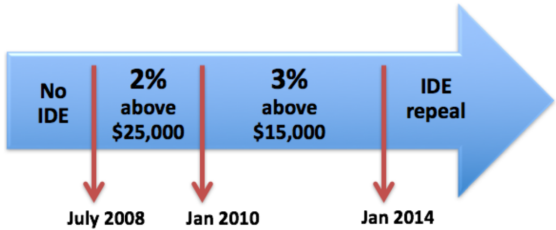
- Tax applied to **monthly cash deposits** above a threshold
  - Summed across all cash deposits in all bank accounts of a firm
- Other deposit methods are not tax liable

Financial institutions remit and inform clients

Note: Deductible for corporations but not for small firms

- Hence we focus on micro, small, and medium enterprises (MSMEs)
- MSMEs had a simplified tax regime and IDE was not deductible

Timeline of tax on cash deposits



Prior to July 2008, no tax

July 2008: implemented tax at 2% rate on monthly cash deposits above 25,000 pesos

January 2010: changed threshold and rate (3% above 15,000 pesos)

January 2014: repealed

Data

Data

Firm bank account level microdata from a large Mexican commercial bank

- Monthly amount and number of deposits and withdrawals by type of transaction
- Geographic location and industry of firm
- Random sample of micro, small, and medium enterprises

Continuous monthly panel between April 2011 and December 2018

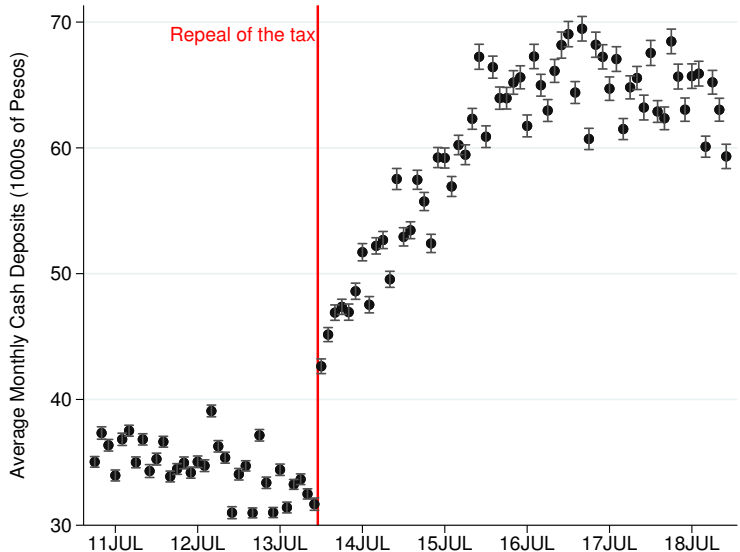
- Thus, focus on repeal of the tax

Complemented with data for December in 2006, 2008, 2009, 2010

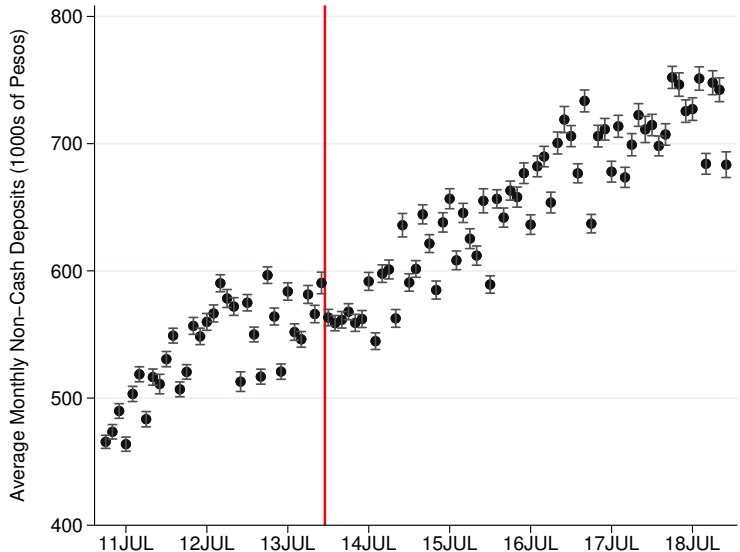
Balanced sample consists of 73,192 firms

Descriptive Results

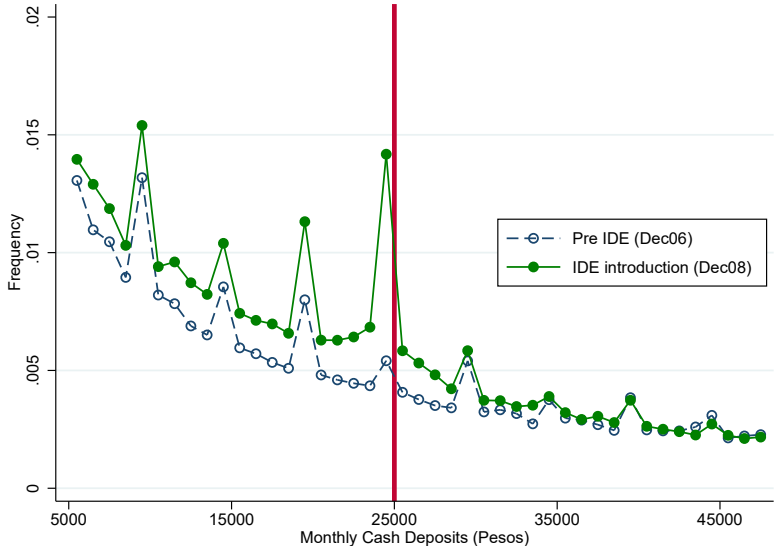
Time series of cash deposits (average across firms)



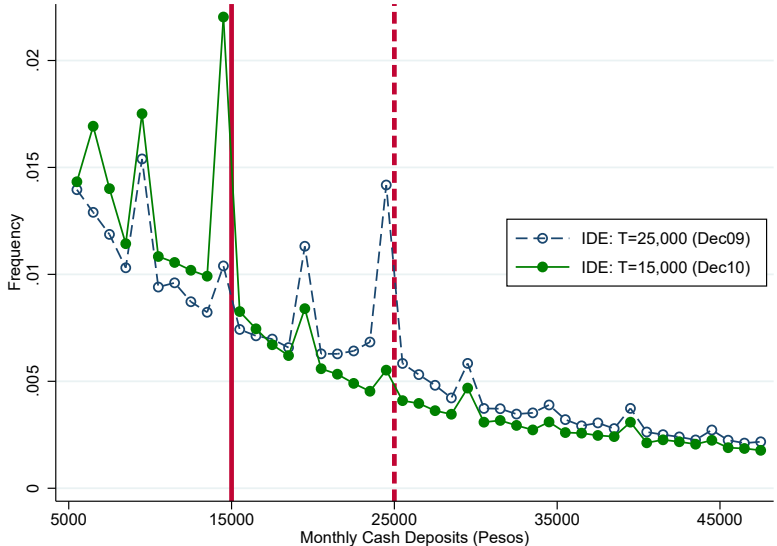
Time series of non-cash deposits (average across firms)



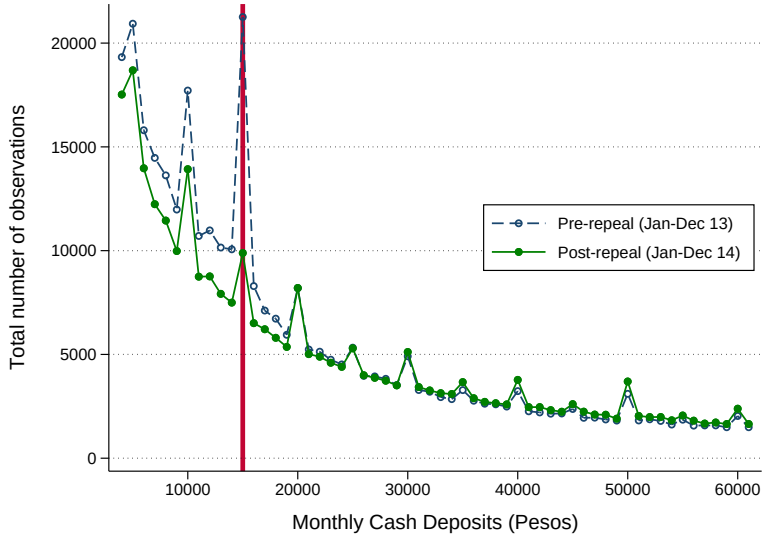
Firms bunch at threshold when tax implemented



Firms shift bunching to new threshold when threshold changed



Firms stop bunching when tax repealed



Identification Strategy

Intuition of identification strategy

Use variation in the tax rate as a function of the exemption threshold and pre-tax cash deposits

- Following public finance literature (Gruber & Saez 2002)

Conditional on total deposits, imagine two types of firms

- Some rarely deposit cash in excess of tax's threshold even in 2006
  - $\Rightarrow$ low average tax on cash deposits in absence of behavioral response
- Others deposit large amounts of cash in 2006
  - $\Rightarrow$ high average tax on cash deposits in absence of behavioral response

Example: two firms deposit 50,000 pesos in total per month

- One deposits 10,000 cash pre-tax $\Rightarrow$ average tax rate on cash = 0%
- Other deposits 30,000 cash pre-tax $\Rightarrow$ average tax rate on cash = 1.5%

Identification strategy

Challenge: analysis at firm level prone to mean reversion (Weber 2014, Kopczuk 2019)

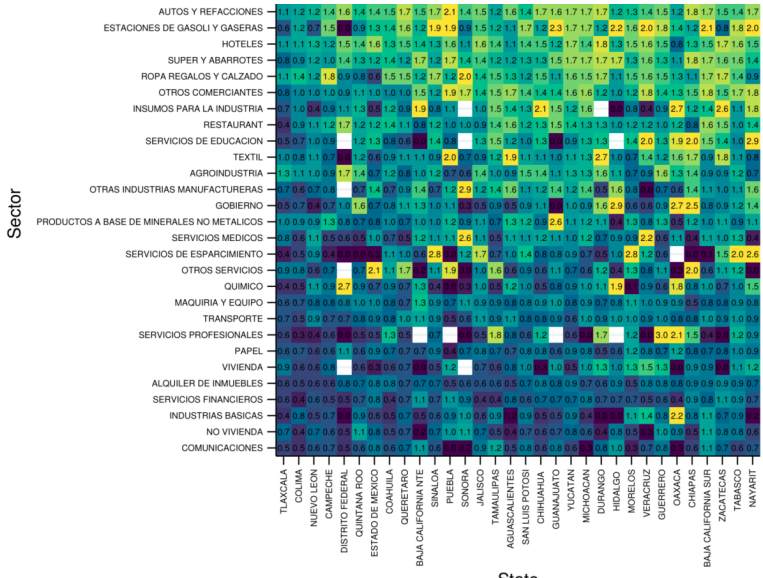
For example, observe firm with low cash deposits pre-tax because of idiosyncratic negative shock

- Expect firm to revert to mean even in the absence of tax
- Firm-level regression will incorrectly attribute this mean reversion to an effect of the tax

Solution: group firms at industry-state level and average within industry-state

- Averages out idiosyncratic pre-tax shocks if they are mean-zero and not correlated within industry-state

Identifying variation



Estimation

Following public finance literature, interested in

$$\log(y_{gt}^{d}) = \beta \cdot \log(1 - \tau_{gt}) + \gamma_g + \gamma_t + e_{gt},$$

where

- y_{gt}^{d} is average log deposits of firms in industry-state group g in year t for deposit type d
- $\log(1 - \tau_{gt})$ is the log of the average net of tax rate with

$$\tau_{gt} = \frac{1}{N_g} \sum_{i \in g} \frac{\text{tax rate}_t \cdot (y_{it}^{\text{cash}} - \text{threshold}_t)}{y_{it}^{\text{cash}}}$$

Problem: τ_{gt} endogenous (mechanically changes when y_{gt}^{d} changes)
Solution: Instrument with simulated tax rate using 2006 cash deposits

$$\tilde{\tau}_{gt} = \frac{1}{N_g} \sum_{i \in g} \frac{\text{tax rate}_t \cdot (y_{i,2006}^{\text{cash}} - \text{threshold}_t)}{y_{i,2006}^{\text{cash}}}$$

Cash highly elastic, shifted from cash held outside bank

	Cash deposit (log)		Non-cash deposit (log)		Total deposit (log)		Share Cash	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	158.5	158.2	-8.0	11.9	8.0	7.0	12.2	9.1
	(14.0)	(14.8)	(8.0)	(6.9)	(3.1)	(3.3)	(1.6)	(1.6)
Controlling for scale		X		X		X		X
First Stage	0.56	0.50	0.56	0.50	0.56	0.50	0.56	0.50
Baseline Mean (Year $\leq$ 2013)	10.6	10.6	14.2	14.2	14.7	14.7	19.2	19.2
# industry x state group	358	358	358	358	358	358	358	358
# observations	2864	2864	2864	2864	2864	2864	2864	2864
# of firms	63802	63802	63802	63802	63802	63802	63802	63802

Elasticity of cash deposits to net-of-tax rate of 158

- Benchmark: elasticity of 135 for tax on financial transactions in France and Italy (Coelho, 2016)

Dynamics over time

	Cash deposit (log)		Non-cash deposit (log)		Total deposit (log)		Share Cash	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2011–2012	-1.7	6.1	6.4	6.9	1.5	1.2	-1.7	-2.2
	(8.4)	(10.0)	(4.9)	(5.3)	(1.9)	(2.2)	(0.5)	(0.5)
2012–2013	-12.0	-13.3	1.7	7.2	0.2	1.6	-1.6	-2.5
	(10.3)	(12.1)	(4.6)	(5.4)	(1.7)	(1.9)	(0.4)	(0.5)
2013–2014	**116.9**	**127.6**	**-13.8**	**-15.0**	**3.8**	**2.0**	**11.8**	**12.6**
	(13.5)	**(15.9)**	**(6.2)**	**(6.4)**	**(2.6)**	**(2.6)**	**(1.3)**	**(1.4)**
2014–2015	30.4	24.5	-3.4	3.8	3.2	1.9	3.0	2.2
	(9.2)	(11.5)	(4.7)	(4.4)	(1.7)	(2.0)	(0.5)	(0.6)
2015–2016	29.3	22.3	2.4	17.0	-0.0	-0.7	1.2	-1.7
	(9.5)	(11.2)	(4.3)	(5.1)	(1.8)	(2.1)	(0.6)	(0.7)
2016–2017	34.0	28.2	5.2	11.2	3.5	5.7	-0.7	-2.0
	(10.1)	(12.5)	(3.8)	(4.2)	(1.8)	(2.1)	(0.6)	(0.6)
2017–2018	10.0	3.5	6.9	13.5	0.2	2.6	-1.6	-3.1
	(9.0)	(11.0)	(4.1)	(4.9)	(2.1)	(2.4)	(0.5)	(0.5)
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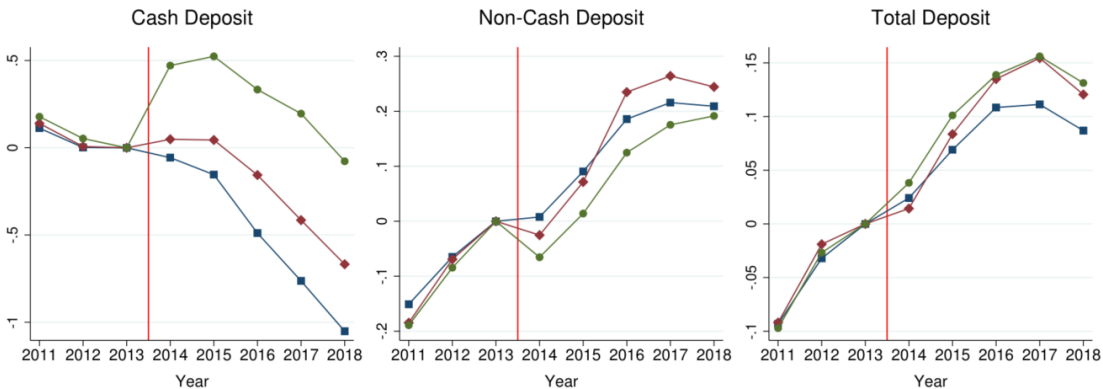
Dynamics over time



Conclusions

Firms respond to tax on cash deposits by:

- Bunching below tax threshold
- Substituting away from cash deposits, but to holding cash rather than electronic payments

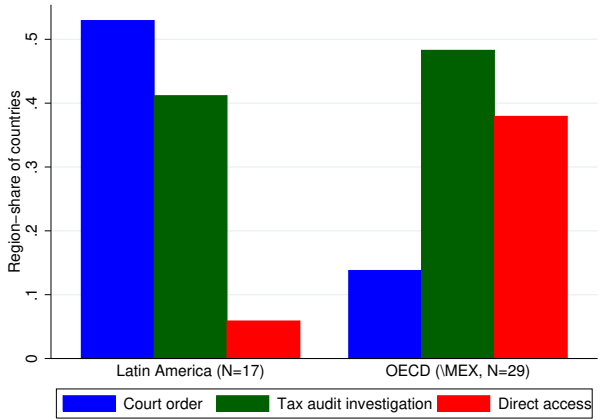
If governments want to encourage digital transition, need to think not just about cost of cash for firms

- For example, subsidize cost of non-cash adoption by consumers
- Could start feedback loop of use of electronic and digital payments between consumers and firms (Higgins 2020)

Appendix

Tracking cash

Government ability to view bank activity of firms:



Source: (CIAT, 2012) (OECD, 2004)

▸ Context

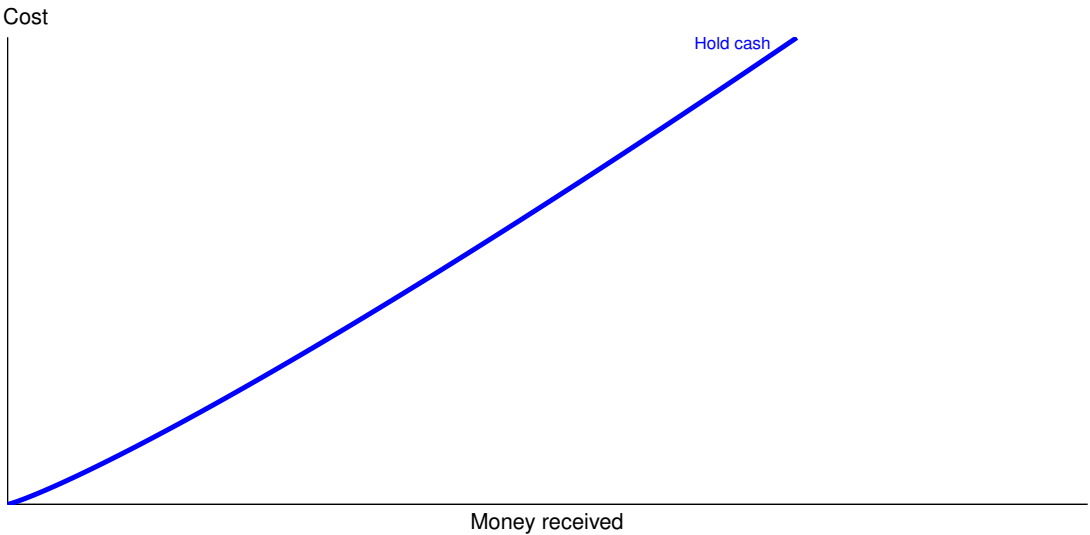
Toy model

Relative costs of technologies during IDE

Cost curve of holding cash

- e.g. risk of theft (Rogoff, 2016)
- May be non-linear (e.g. risk convex in cash holdings)
- Intercept at 0 (no fixed cost like trip to bank)

Relative costs of technologies during IDE



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Cost curve of bank cash deposits

- Intercept > 0: fixed cost (e.g., trip to bank)
- Slope small and positive below tax threshold
  - due to e.g. risk of theft on way to bank
- Steeper slope above tax threshold due to the tax

Relative costs of technologies during IDE

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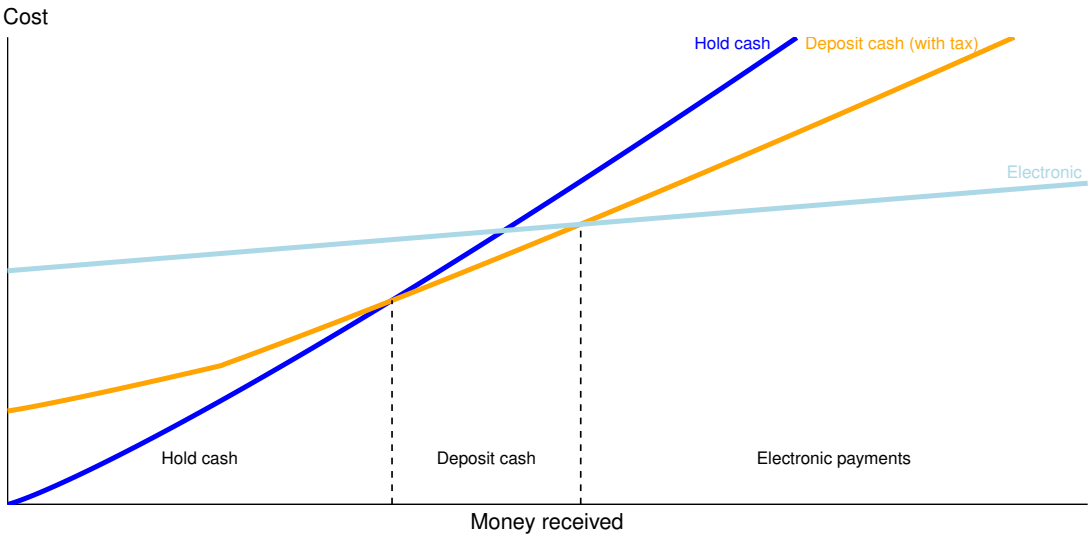
Cost of non-cash deposits

- Intercept $>$ intercept for cash deposits (e.g., fixed cost of technology adoption)
- Slope: marginal cost of technology (e.g., transaction fee for POS)

Relative costs of technologies during IDE

Relative costs of technologies during IDE



Repeal of IDE: new cost curve for cash deposits

Changes cost of bank cash deposits

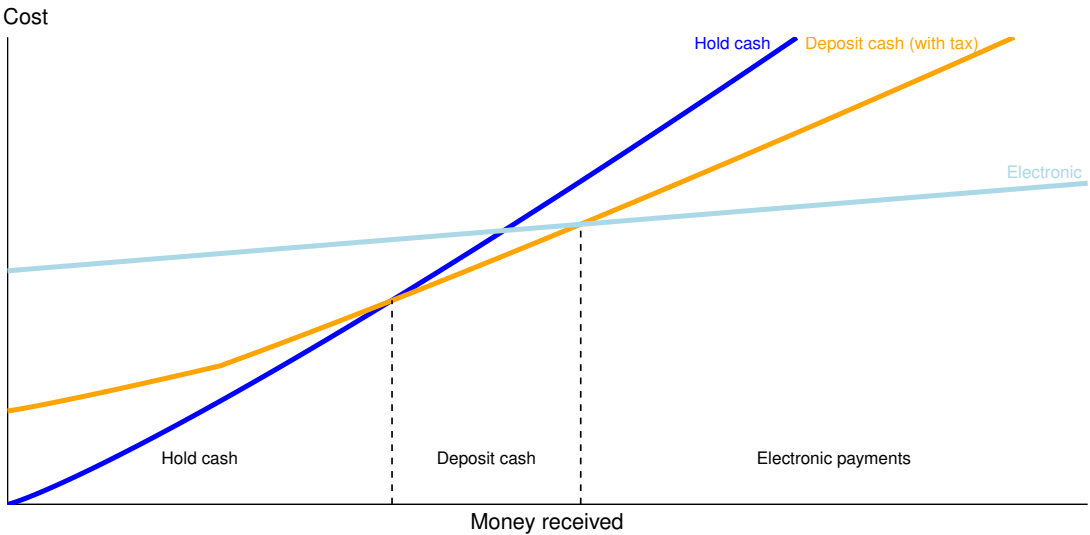
- Higher slope above threshold disappears

$\Rightarrow$ Kink at threshold disappears

No change to:

- Cost of holding cash
- Cost of taking electronic payments

Repeal of IDE: new cost curve for cash deposits



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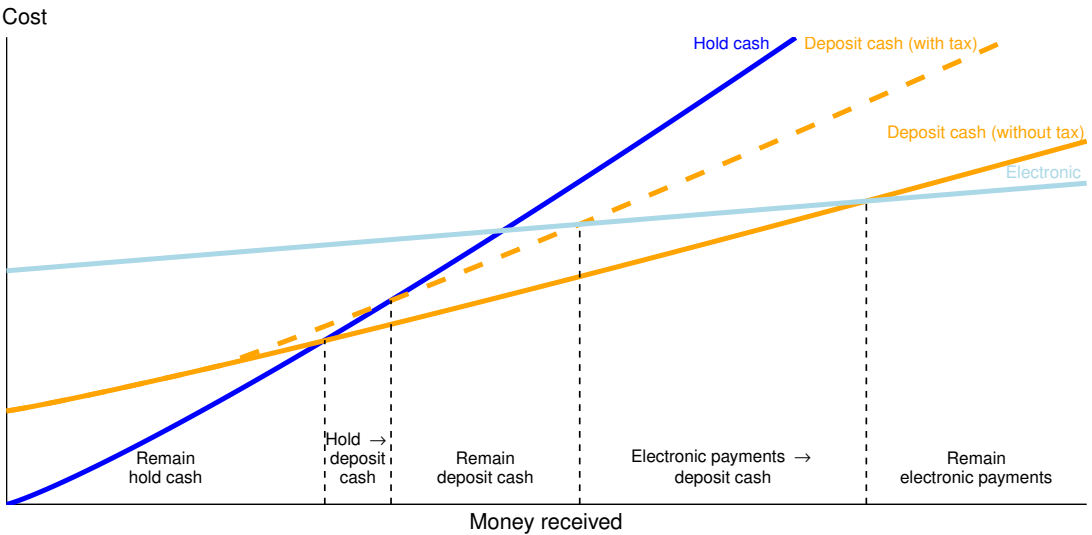
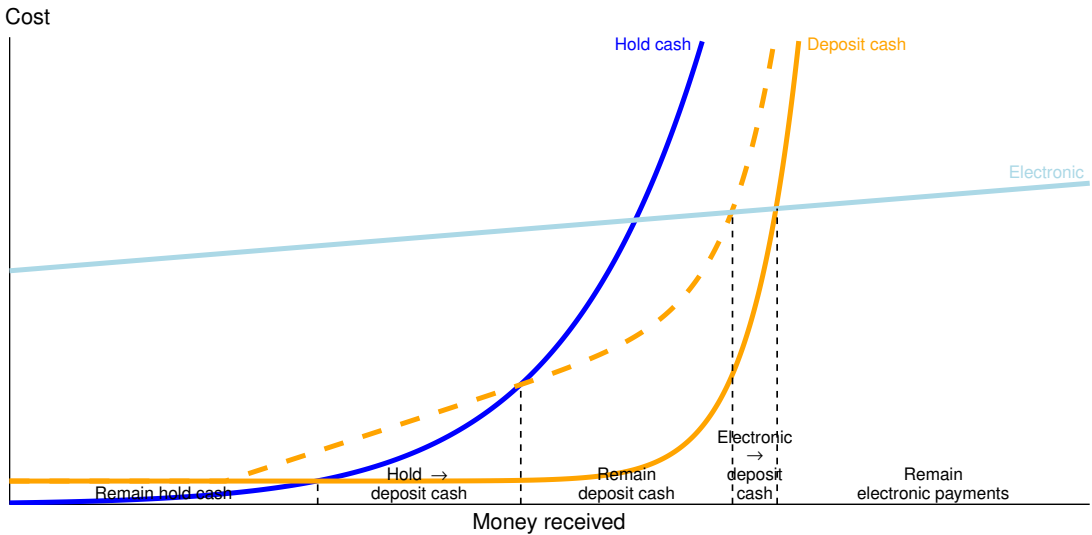
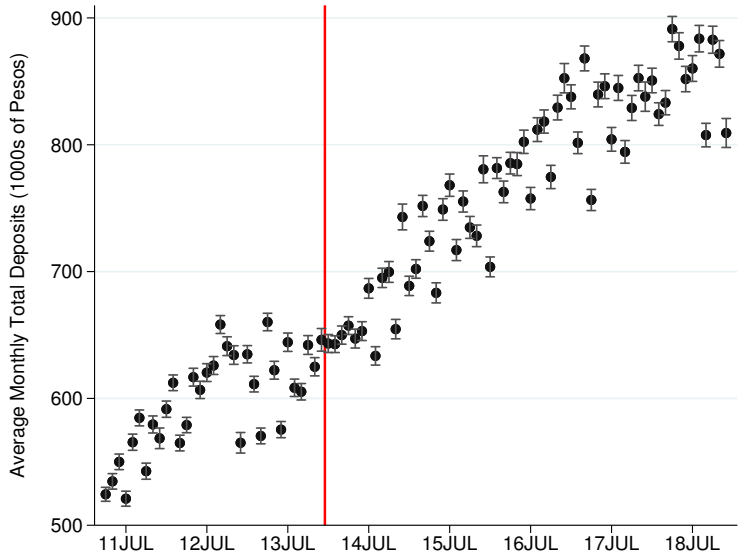


With alternative cost curves, response margin changes



Additional Results

Time series of total deposits (average across firms)



Time series of share of deposits in cash (average across firms)

Illustration of IV: cash deposits by simulated tax rate

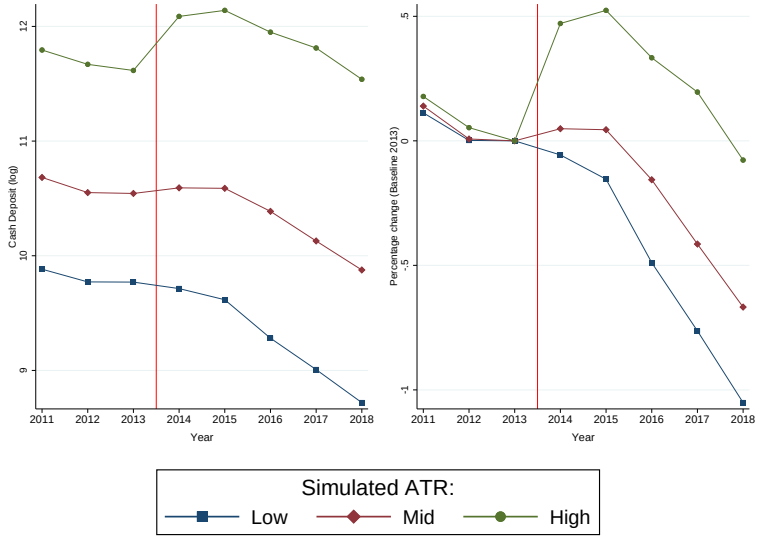
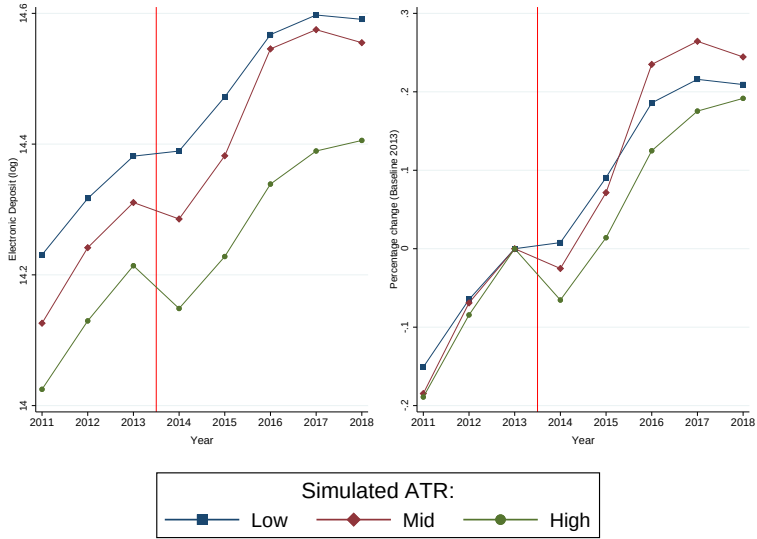


Illustration of IV: non-cash deposits by simulated tax rate



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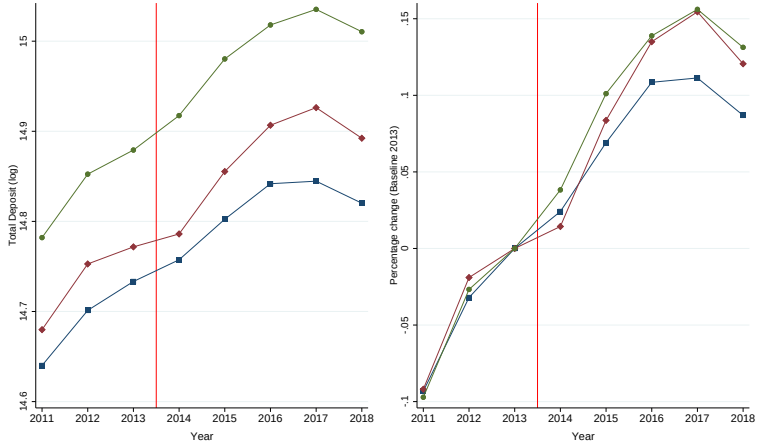


Elasticity between cash and POS

Exploit notch in POS fee structure

The commercial bank we are working with has the following fee structure for POS terminals:

- Up-front istallation cost: 300 pesos ($15)
- Monthly fee: 359 pesos ($19) **if** POS transactions by the firm are under 25,000 pesos that month
- Marginal transaction cost: 1.75% in retail sector

This creates a notch in the fee structure and incentivizes firms below 25,000 pesos to substitute to electronic transactions

- Incentive fairly large: represents 1.4% of electronic sales at the threshold, so nearly as large as the marginal fee

In focus groups, MSMEs knew POS fee structure

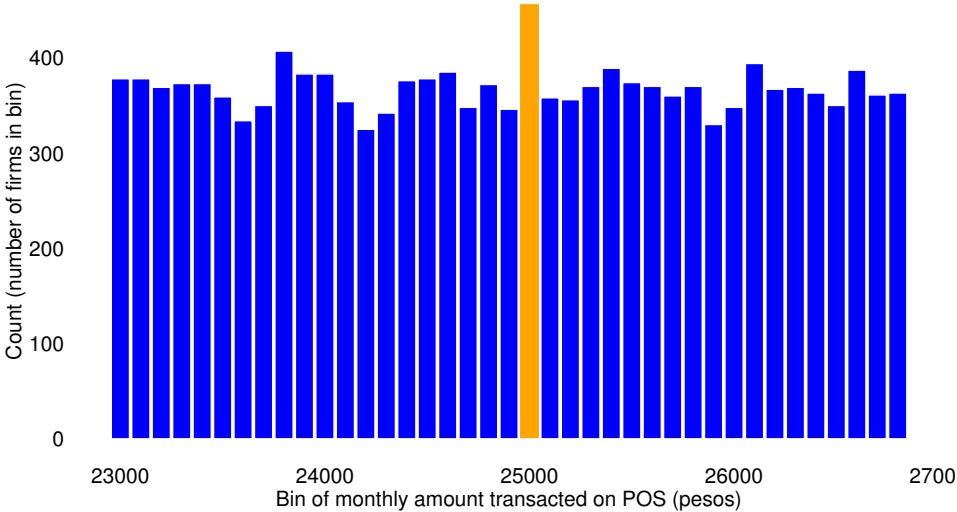
Data

Universe of POS transactions by merchants with a point of sale terminal from a particular large commmercial bank

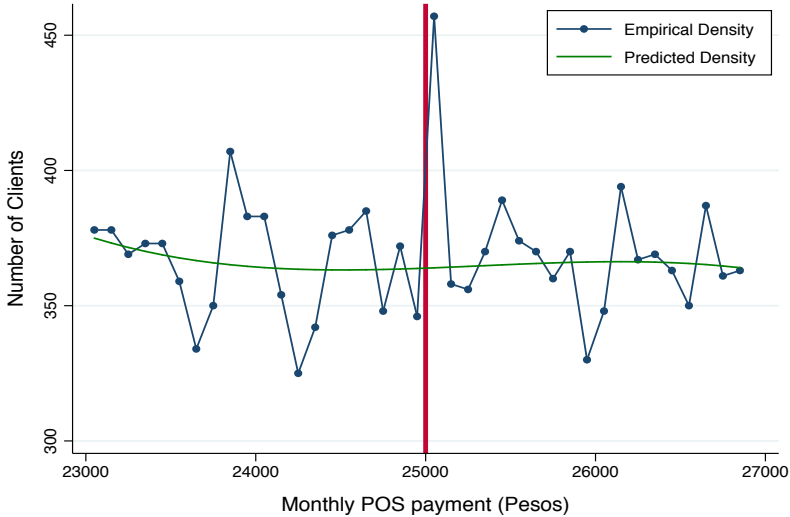
- 2017–2019
- 3.5 billion transactions from 1.7 million firms

Use transaction-level data to create firm-by-month data with total volume POS transactions to look at density of firms near threshold

Bunching above threshold



Estimating elasticity from excess mass at threshold



Estimating elasticity from excess mass at threshold

Caveat: treat variation as a kink (rather than notch) $\Rightarrow$ obtain upper bound on ϵ

Excess Mass $\approx$ 25%. That 25% more mass needs to come from left part of distribution

Since the bins are 100 pesos wide, this corresponds to 25 pesos of missing mass relative to the 25,000 peso threshold

The size of the tax change at the threshold is $-359/25000 = -0.014$.

$$\epsilon_{z,1-t} = \frac{dz/z}{d(1-t)/(1-t)} = \frac{dz/z}{-dt/(1-t)} = \frac{25/25000}{0.014/1} \approx 0.07$$

Consistent with IDE results, very small elasticity of electronic payments to its price