

ATM pricing and deployment

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Agenda

- ATMs (Automated Teller Machines): an introduction
- Overview
- Literature
- Data
- Reduced-form model and regression results
- Next steps

Overview

- Original motivation: "How sensitive are consumers to surcharges?"
- Panel data set
 - Data from a US ATM network
 - Over 4,000 ATMs
 - Almost three years of daily withdrawal records for each ATM
 - Free and surcharged withdrawals
 - Data set further enhanced to include competitor ATM and bank information
- Reduced-form model takes advantage of rich data set to deal with surcharge endogeneity
 - Surcharges vary between ATMs, over time ATM \rightarrow ATM fixed effects
 - Uniform pricing by banks \rightarrow IV strategy following Fan (AER 2013)
- Results
 - Demand for cash withdrawals is relatively inelastic
 - Average withdrawal value increases with surcharge level

Potential next steps

- Investigate demand for cash by different groups
 - Substantial regional variation in socioeconomic indicators
- Discrete choice demand estimation
 - Motivation: better capture substitution patterns and geospatial competition between ATMs
 - Problem: data set does not capture all ATMs in market
 - Discrete choice models with missing data require consumer-level observations, and rely on very strong simplifying assumptions
- Supply-side model of ATM deployment
 - Impossible (?) to do without demand model that takes into account geospatial competition between ATMs

Literature

- Bolt Jonker van Renselaar (JBF 2010) Incentives at the counter - An empirical analysis of surcharging card payments and payment behavior in the Netherlands
 - Results suggest both the imposition and the actual surcharge level have a significant negative impact on debit card usage
- Ferrari Verboven Degryse (AER 2010) Investment and Usage of New Technologies: Evidence from a Shared ATM Network
 - Paper studies ATM deployment in Belgium
 - Results suggest underinvestment in ATM networks in the absence of user incentives
- Gowrisankaran Krainer (RAND 2011) Entry and pricing in a differentiated products industry: evidence from the ATM market
 - Paper studies impact of surcharging on ATM deployment
 - Results suggest no overinvestment in ATM networks despite surcharges
- Magnac (JBF 2017) ATM foreign fees and cash withdrawals
 - Paper studies impact of foreign fees on cash withdrawals
 - Results confirm that foreign fees shift cash withdrawals from out-of-network ATMs to in-network ATMs and bank branches

Data overview

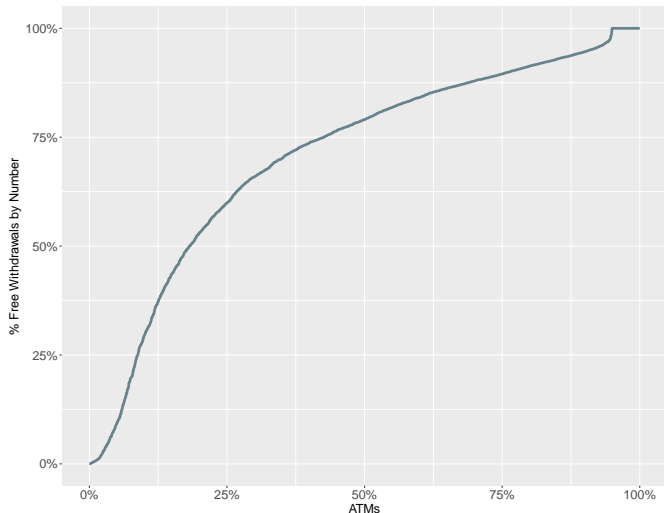
- Panel composition
 - 4391 ATMs
 - November 2014 - June 2017
 - 7.4 million observations (ATM/day/price combination)
 - Relatively little entry or exit
 - Some prolonged ATM outages
- How representative is the data set?
 - Less than 1% of ATMs in the US
 - Around 25% of ATMs in the network's home state

Data overview

- Variables in the data set
 - Number & value of withdrawals
 - Date
 - Surcharge level
 - Address
 - Location type (financial institution, retail store, restaurant etc.)
 - ATM ID
 - Acquirer ID
- Additional data collected
 - Bank name
 - Location of ATMs not operated by the network
- Not observed
 - Customer ID
 - Price and quantity at ATMs not operated by the network

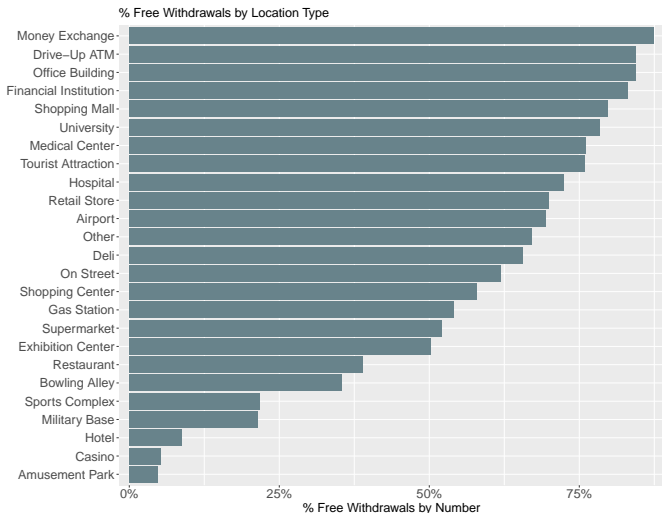
Data overview: summary statistics

- Almost 95% of ATMs have fixed surcharges → our focus
- Proportion of free withdrawals varies greatly across ATMs



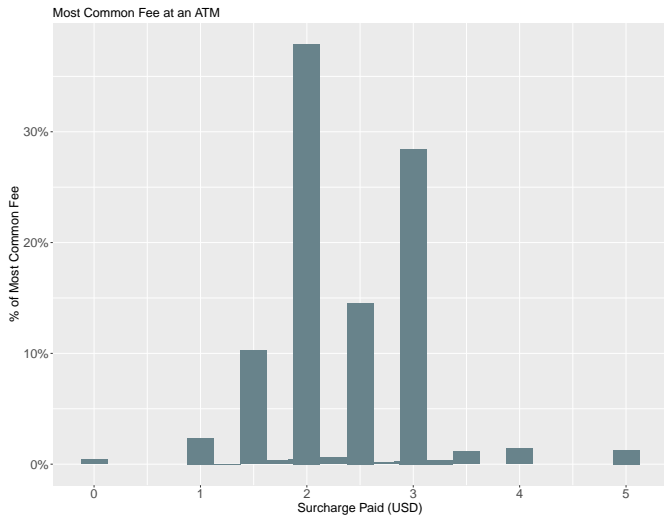
Data overview: summary statistics

- Proportion of free withdrawals varies across *location type*



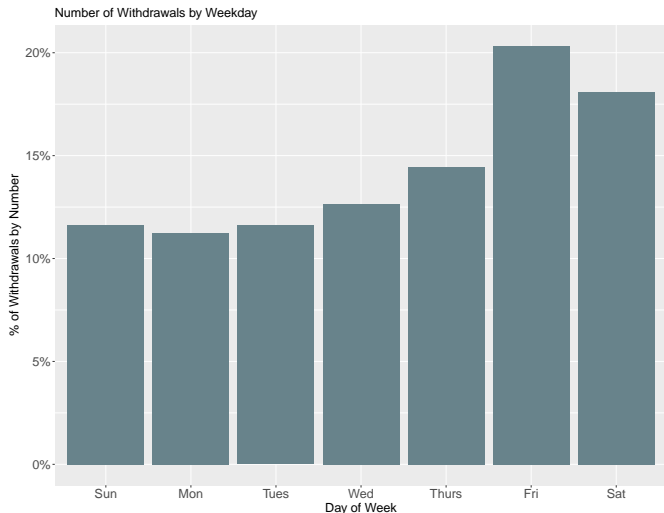
Data overview: summary statistics

- Most common surcharge levels: \$2.00 and \$3.00



Data overview: summary statistics

- Customers withdraw cash more often on Friday and Saturday



Reduced-form: model and data

- Linear model with fixed effects

$$Y_{it} = P_{it}\beta + \alpha_j + \gamma_t + \epsilon_{it} \quad (1)$$

- Data limited to
 - Surcharged withdrawals (at out-of-network ATMs)
 - The ATM network's home state
 - Bank ATMs (in-branch and outdoor)
- Left-hand-side variables Y_{it} :
 - Total daily withdrawals
 - Average daily withdrawal value
- Right-hand-side variables:
 - Surcharge level P_{it}
 - Location fixed effects α_j : *MSA/county* and *location type*, or *ATM*
 - Time fixed effects γ_t : *week & year* and *day of week*

Reduced-form: potential endogeneity of P_{it}

- Concern that P_{it} is correlated with unobserved market characteristics
- Approach #1: ATM fixed effects
 - Sufficient if unobserved market characteristics impacting P_{it} are constant over time
- Approach #2: IV strategy using cost-shifters (no success)
 - Observable bank-level cost variables found not to be informative
 - ATM-level cost variables not observable
- Approach #3: IV strategy using markup-shifters (in progress)
 - Approach follows Fan (AER 2013)
 - Possible because most banks set a uniform surcharge level for their ATMs
 - Idea: surcharge level of an ATM will depend on surcharge level of competing ATMs in the market, which in turn depends on characteristics of other markets competing banks are present in

Reduced-form: results

Table: estimated coefficient on P_{it}

	(1)	(2)	(3)	(4)	(5)
<u>Total withdrawals</u> (mean: 3.82)					
β	-0.23***	-0.17***	-0.62***	-0.68***	
R ²	0.062	0.083	0.233	0.622	
<u>Average withdrawal value</u> (mean: \$131.59)					
β	\$3.46***	\$3.22***	\$2.98***	\$5.30***	
R ²	0.027	0.030	0.047	0.102	
<u>Control variables</u>					
Demographics		X			X
<u>Fixed effects</u>					
Time	X	X	X	X	X
Location Type	X	X	X		X
MSA/county			X		
ATM				X	
<u>Instrumental variables</u>					
Time					X
# observations			405,176		
# ATMs			754		

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