Digital Payments and Consumption: Evidence from the 2016 Demonetization in India

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Capital Market Development: China and Asia

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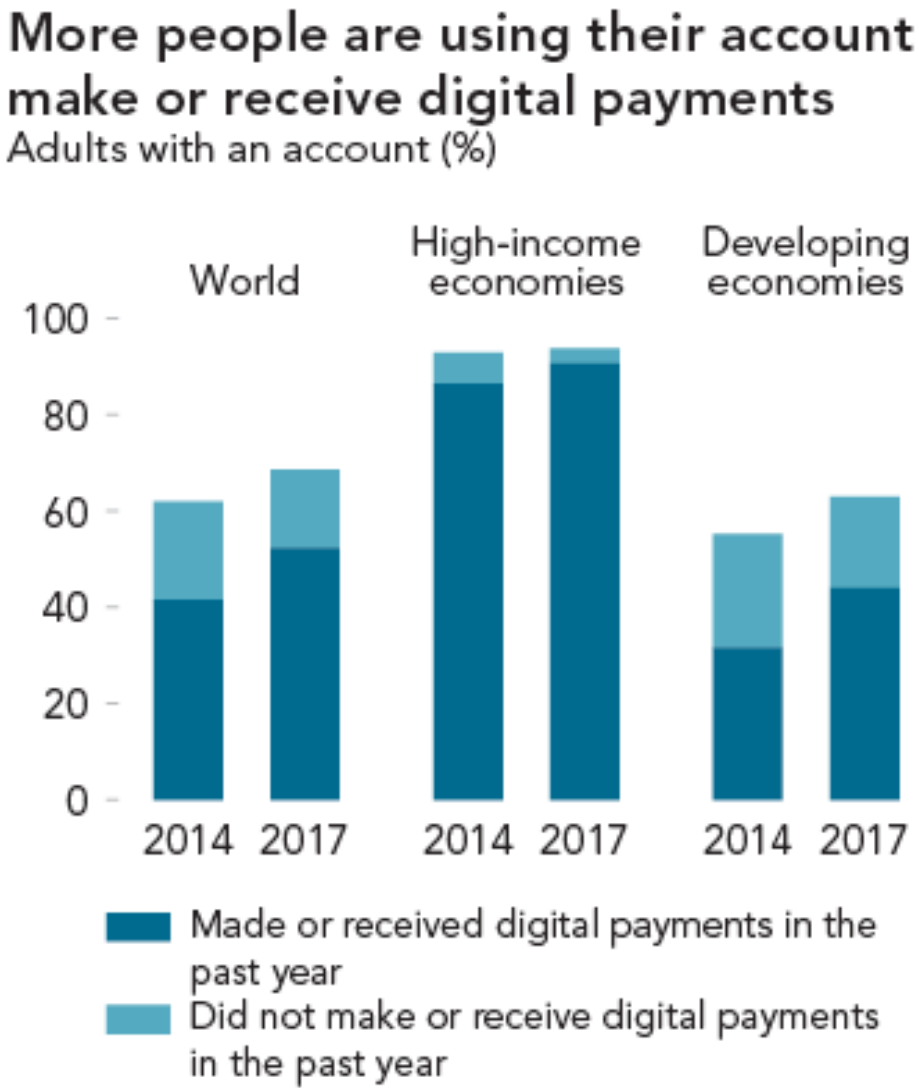
Popularity of digital payments



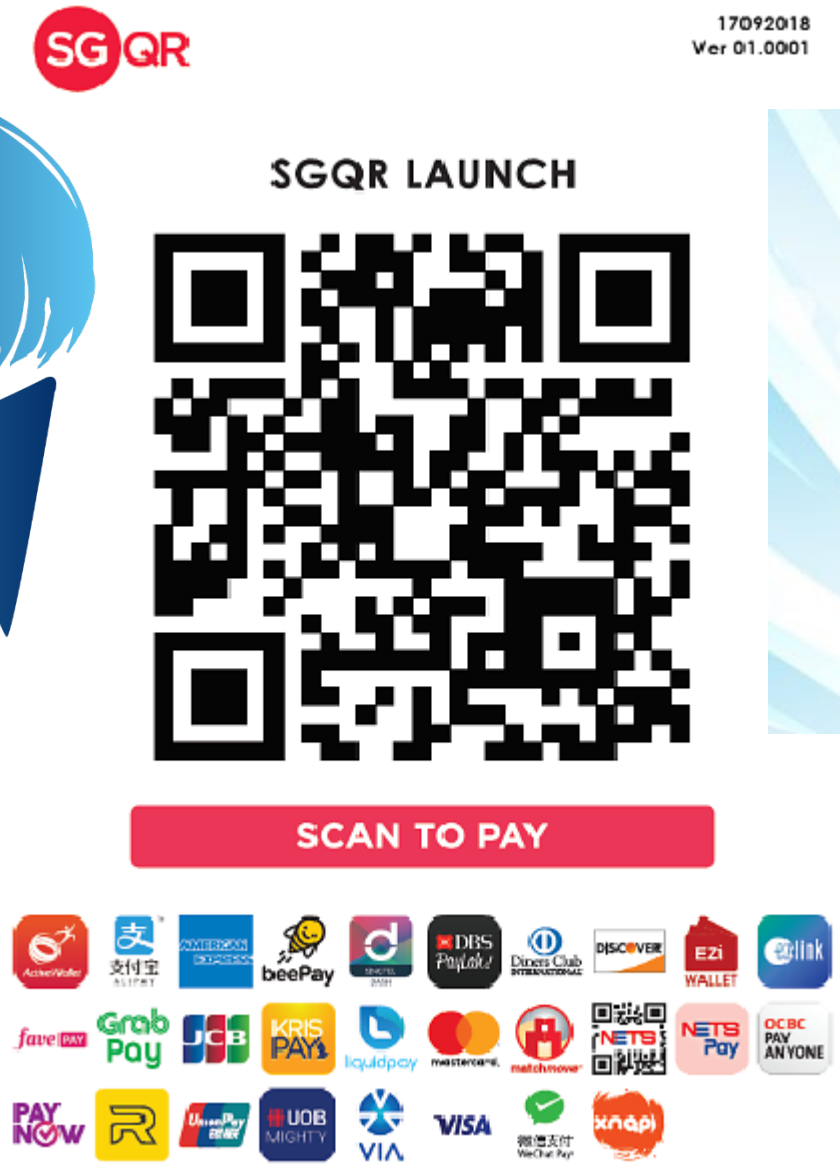
Source: Global Findex database.

Digital payments can help improve financial inclusion (Demirguc-Kunt et al., 2015)

- Improve efficiency of making payments
- Enhance security
- Increase transparency
- Provide first entry point into formal financial system

Cash puts a floor on nominal interest rate and facilitates illegal activity and tax evasion (Rogoff, 2017). Digital payments can overcome these costs.

Governments around the world promote digital payments



Research question: Do digital payments affect consumption?

- Why would digital payments affect consumption?
  - Transaction costs
  - Salience

- Empirical challenges for studying this question in observational data
  - Consumers do not have equal access to digital payments (Borzekowski and Kiser, 2008).
  - Merchants are not uniformly willing to accept digital payments.
  - Even in a setting where merchants have equal acceptance of digital payments and consumers have equal access, consumers can often choose to pay a small receipt with cash and switch to digital payments for a larger receipt.

Research question: Do digital payments affect consumption?

- Experimental evidence of debit cards (Runnemark, Hedman, and Xiao, 2015) / credit cards (Feinberg, 1986; Prelec and Simester, 2001) increase willingness-to-pay: limited generalizability and quantitative relevance

- How do we address these challenges?
  - Unique and unexpected Demonetization in India exogenously altered choice of payment mode
  - We use a large administrative data set to track consumption behaviors of individuals before and after the Demonetization to identify the consumption response

November 2016 Demonetization in India

- On 8th November 2016, the Indian Prime Minister Narendra Modi announced a demonetization scheme in an unscheduled live television address: notes of INR 500 and INR 1,000 would be invalid post midnight.
- Stated purposes: to flush out black money and to combat tax evasion, counterfeiting, and terrorism.
- New notes were available only months later.

November 2016 Demonetization in India

- About **87%** of the value of all transactions in 2012 was in cash and it is estimated that the Reserve Bank and commercial banks in India spent equivalently about **3 billion USD** in current operation costs annually (Mazzotta et al. 2014).
- Currency in circulation accounts for almost **18%** of its GDP (3.5% to 8% in USA, UK)
- The INR 500 and INR 1,000 notes, at the time of scrapping, were the most circulated currency in India, accounting for as much as **86%** of paper money.

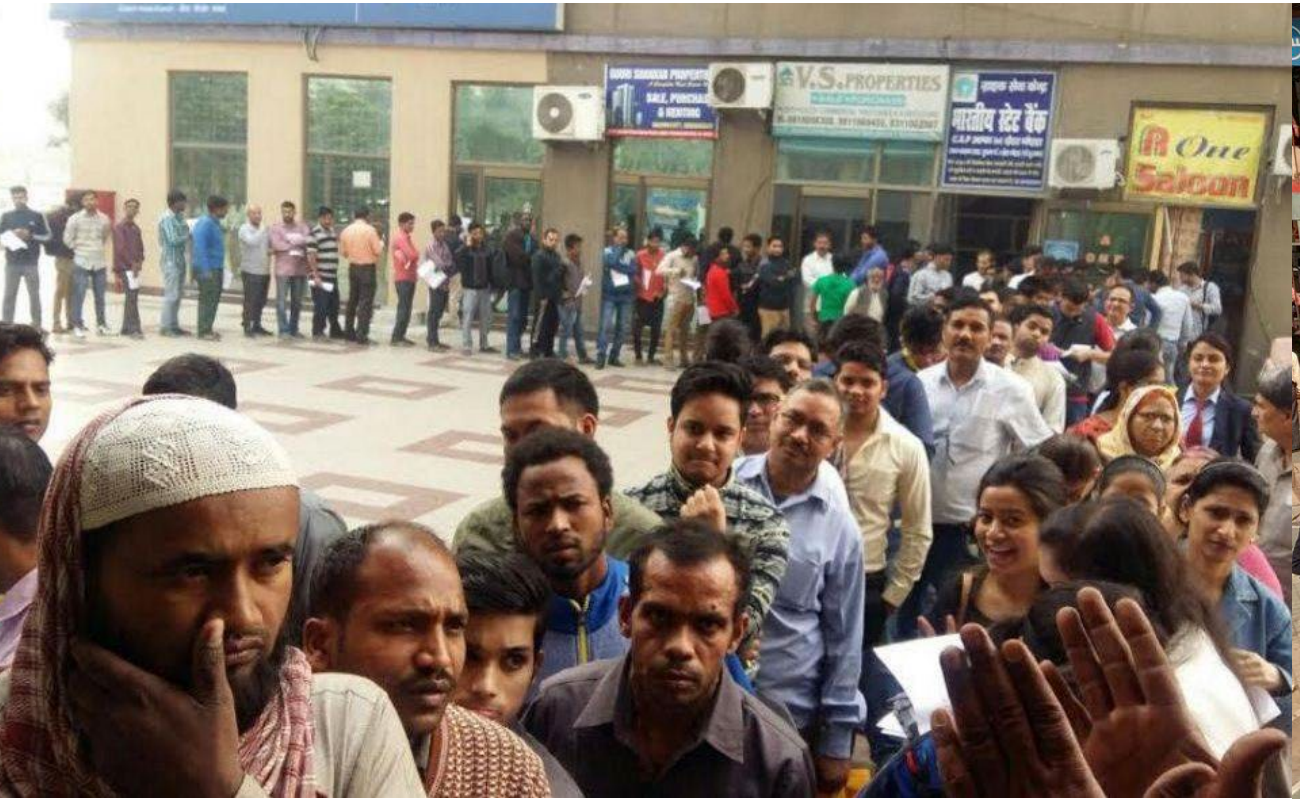
Comparisons with historical demonetization episodes

- Several other countries have embraced demonetization in the past, including United Kingdom in 1971, Ghana in 1982, Nigeria in 1984, Australia in 1996, Zimbabwe in 2015, and Pakistan in 2016.
- Demonetization has been implemented in India twice in prior history.
  - In 1946, the currency notes of INR 1,000 and INR 10,000 were removed from circulation.
  - In 1978, the currency notes of INR 1,000, INR 5,000 and INR 10,000 were removed from circulation.
- What is **special** about the Demonetization in November 2016?
  - Larger scope
  - Suddenness of the announcement
  - Prolonged unavailability of new notes

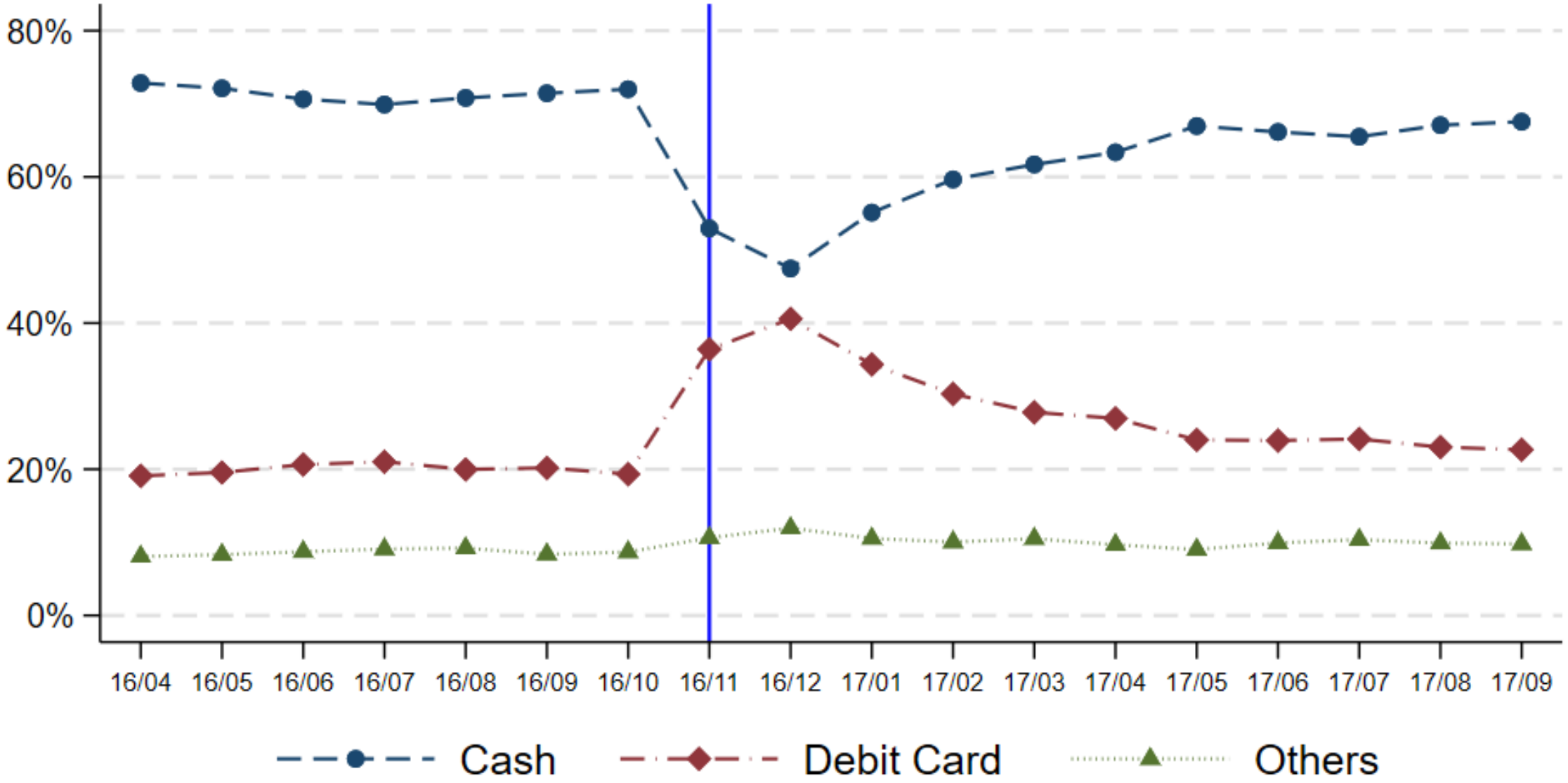
Sudden dry-up in cash due to Demonetization

"The implementation process faced technical disruptions, leading to severe cash shortages, and the overall poor preparation of the policy led the country into chaos for more than three months."

-- The Conversation



Demonetization and payment mode



Data

- Customer receipt-level administrative transaction data from a large supermarket chain store in India
  - Fourth largest supermarket chain
  - Third largest private sector business group
  - 530 stores across the country (171 in our data)
  - More than INR 35 billion (~USD 525 million) in revenue
- Sample period: April 2016 to September 2017
- Information available:
  - Receipt amount
  - Payment mode
  - Details of items purchased

Summary statistics

	Mean	Std. Dev.	Median
Cash payment fraction (2016:04--2016:10)	0.72	0.39	1
Cash payment fraction (2016:11--2017:09)	0.60	0.40	0.71
Debit cards fraction (2016:04--2016:10)	0.22	0.35	0
Debit cards fraction (2016:11--2017:09)	0.32	0.37	0.12
Mobile payment fraction (2016:04--2016:10)	0.0021	0.036	0
Mobile payment fraction (2016:11--2017:09)	0.0045	0.048	0
Credit cards fraction (2016:04--2016:10)	0.0069	0.061	0
Credit cards fraction (2016:11--2017:09)	0.030	0.13	0
Monthly supermarket spending (2016:04--2016:10)	830.7	12515.7	400
Number of individuals	924,753		

Empirical challenges for digital payments → consumption

- Omitted variable from the consumer side: Socio-economic status affects consumers' access to digital payments as well as spending (Borzekowski and Kiser, 2008).

- Omitted variable from the merchant side: Some merchants may not accept digital payments. This supermarket chain accepts digital payments in all its stores.

- Reverse causality: Even in a setting where merchants have equal acceptance of digital payments and consumers have equal access, consumers can often choose to pay a small receipt with cash and switch to digital payments for a larger receipt.

Identification strategy

- The Demonetization drained the currency in circulation and affected individuals' ability to use cash in transactions, therefore forcing cash-dependent individuals to switch to digital payments

- Identification relies on the **variation in dependence on cash – the exposure to the sudden dry-up of cash due to the Demonetization**

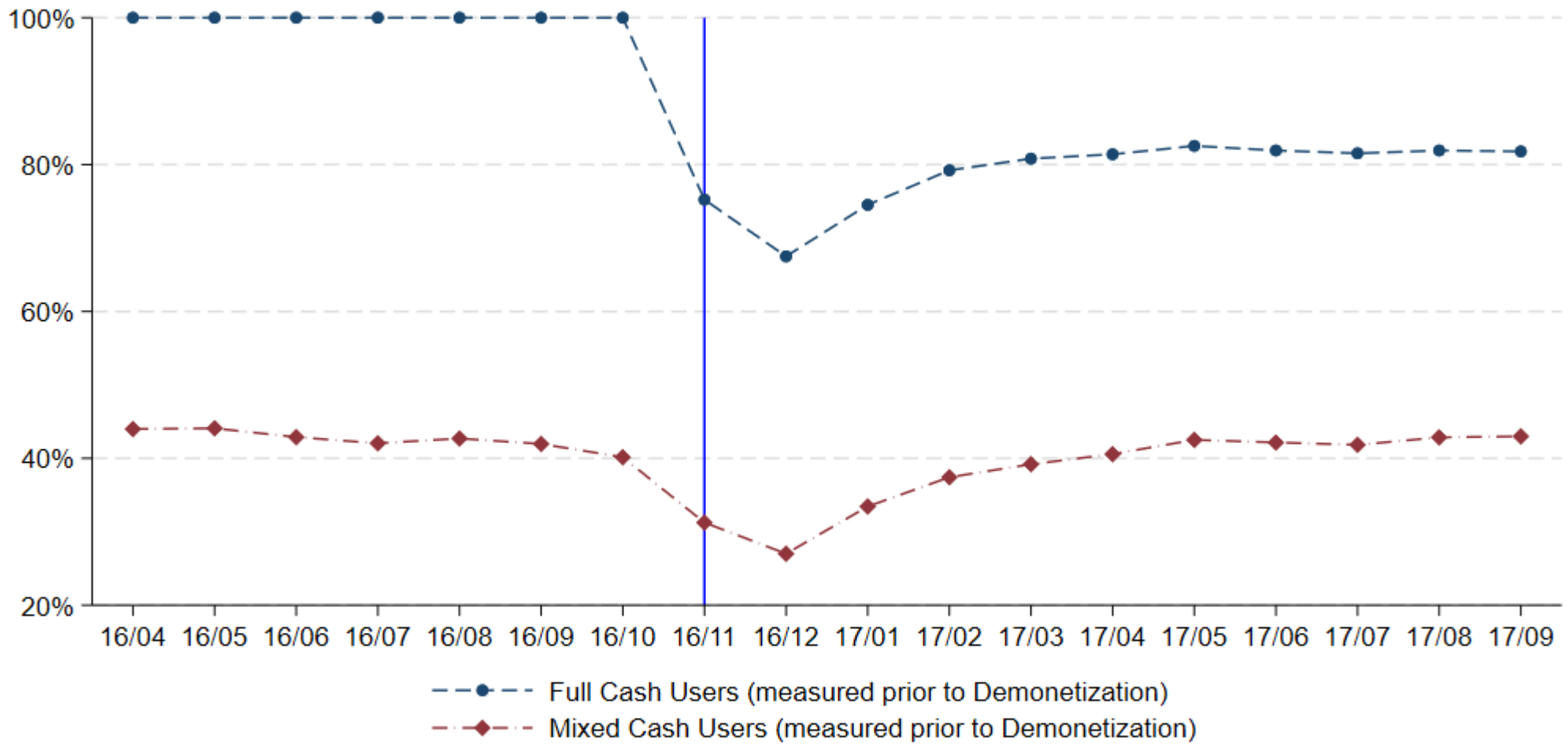
- Difference-in-differences (DiD) framework: compare changes in spending patterns across individuals with varying degree of prior cash dependence.

Difference-in-differences (DiD) specification

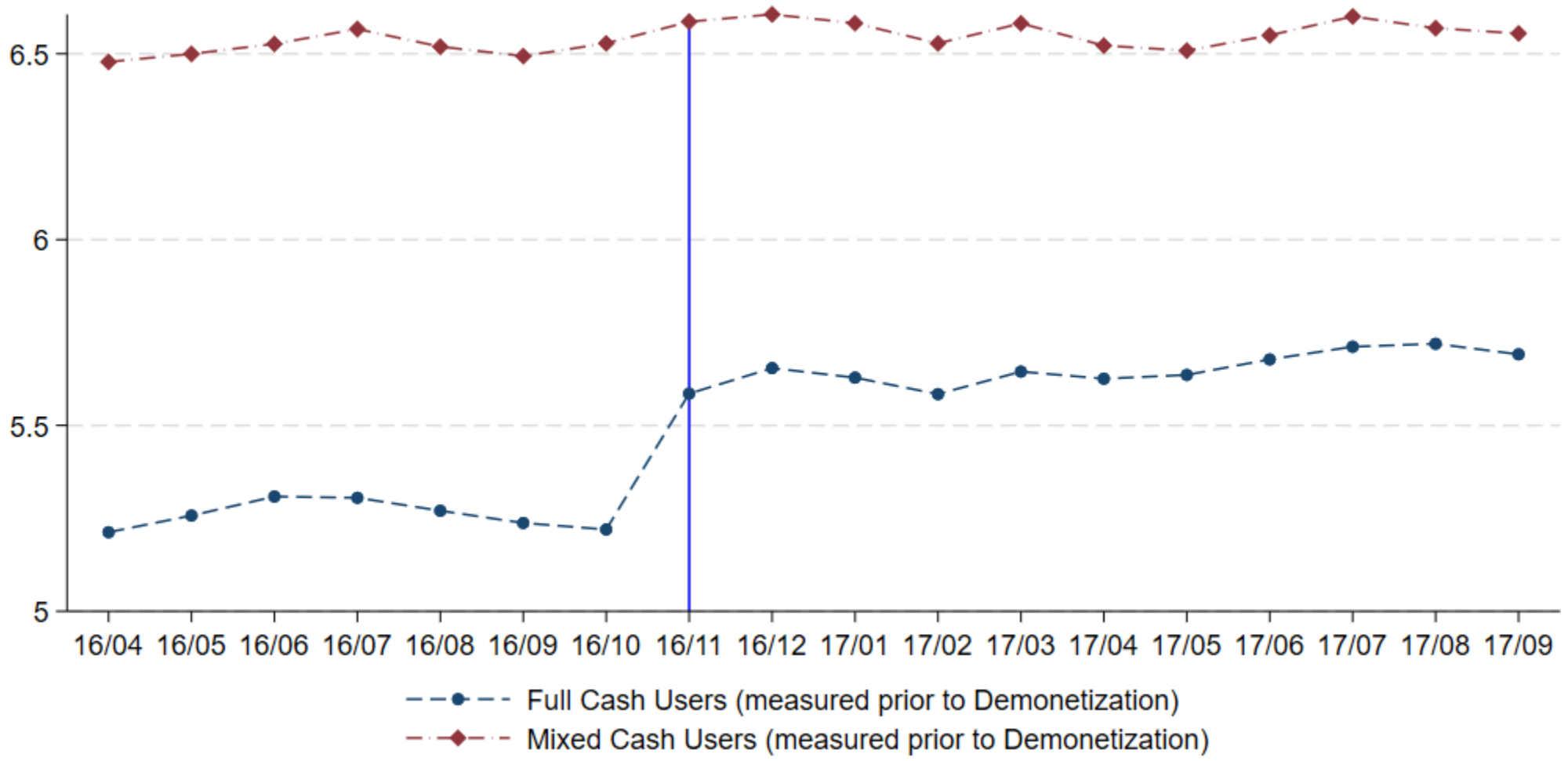
$$y_{i,t} = \mu_i + \pi_{d,t} + \beta(Prior\ Cash\ Dependence_i \times Post_t) + \varepsilon_{i,t}$$

- $y_{i,t}$: Consumption behavior (spending amount, payment pattern)
- Prior Cash Dependence: fraction of cash usage from April to October 2016, continuous in [0,1]
- Post = 1 for November 2016 to September 2017, 0 for April to October 2016
- β measures the impact of the forced switch to digital payments
- Consumer fixed effects: remove unobserved time-invariant individual heterogeneity
- District-specific time fixed effects: remove common trends and other unobserved time-varying heterogeneity, e.g., district-level differential availability of new bills (Chodorow-Reich et al., 2019)
- Standard errors: robust, clustered at the consumer level

DiD illustration: Cash % in monthly spending decreases



DiD illustration: Previous cash users increase spending



Forced switch to digital payments & effect on spending

	Cash usage	Spending (level)	Spending (log)
PriorCashDependence × Post	-0.338***	239.322***	0.307***
	[-39.20]	[3.11]	[12.61]
Individual FEs	Yes	Yes	Yes
District × Time FEs	Yes	Yes	Yes
R-squared	0.622	0.436	0.586
Observations	6,561,580	6,561,580	6,561,580

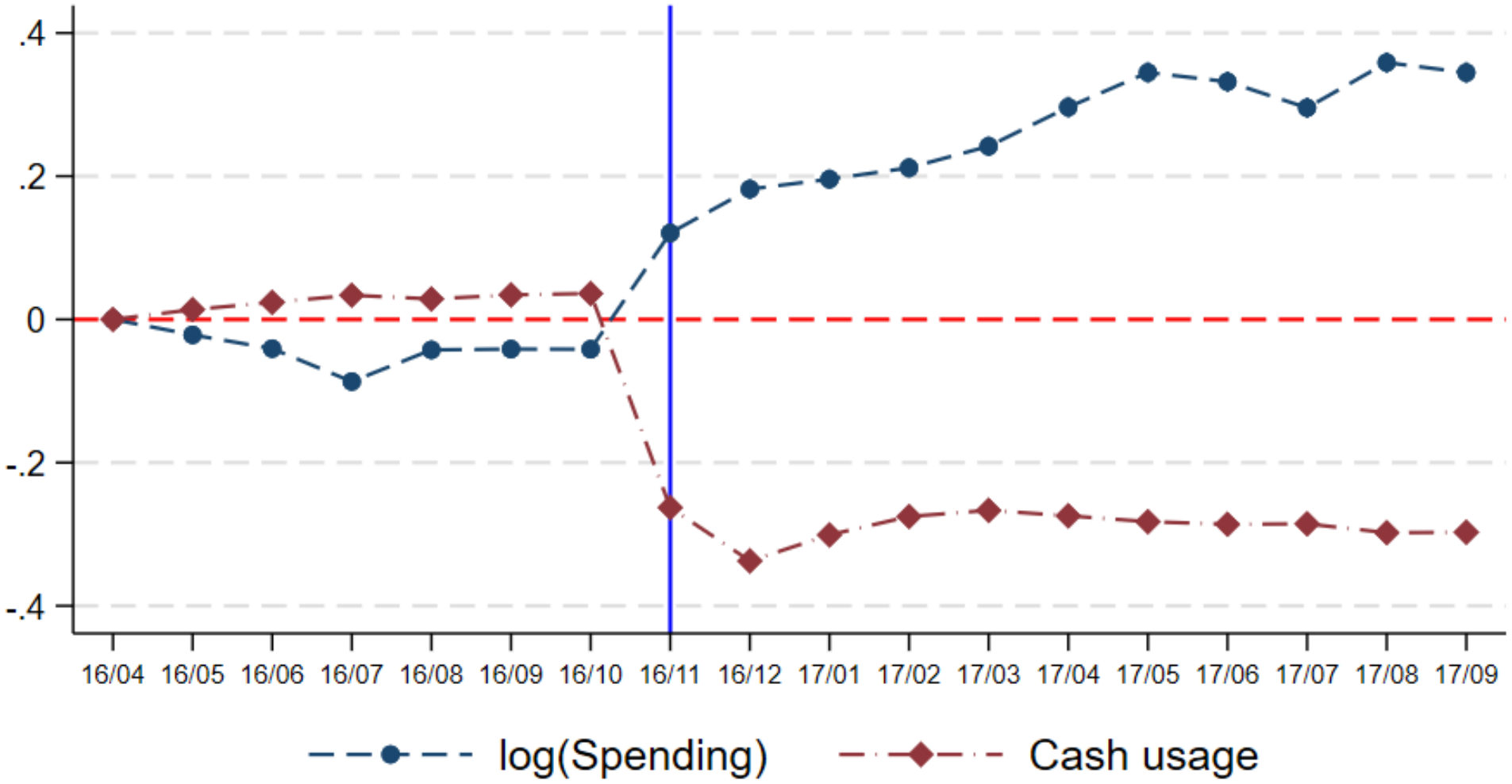
Economic magnitude

- 10 pp increase in prior cash dependence ~ 3.38 pp increase in digital payments adoption, 23.93 rupees increase in monthly spending, 3% increase in monthly spending
- Inter-quartile range of prior cash dependence is 50% ~ 119.65 rupees increase or 14% increase in monthly spending

Heterogeneous forced switch to digital payments

	Cash usage	Debit card usage	Mobile payment usage	Credit card usage
PriorCashDependence × Post	-0.338***	0.296***	0.001**	-0.019***
	[-39.20]	[42.01]	[2.27]	[-3.30]
Individual FEs	Yes	Yes	Yes	Yes
District × Time FEs	Yes	Yes	Yes	Yes
R-squared	0.622	0.566	0.350	0.403
Observations	6,561,580	6,561,580	6,561,580	6,561,580

Dynamic effects of digital payments on spending



$$y_{i,t} = \mu_i + \pi_{d,t} + \sum_t \beta_t(Prior\ Cash\ Dependence_i \times \mathbb{I}_t) + \varepsilon_{i,t}$$

Results in the sample excluding Nov 2016 to Jan 2017

	Excluding full cash users			Excluding Nov 2016 to Jan 2017		
	Cash usage	Spending (level)	Log (spending)	Cash usage	Spending (level)	Log (spending)
PriorCashDependence × Post	-0.413***	375.665	0.177***	-0.330***	289.047***	0.345***
	[-36.67]	[1.38]	[9.23]	[-43.20]	[3.11]	[17.55]
Individual FEs	Yes	Yes	Yes	Yes	Yes	Yes
District × Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.518	0.436	0.539	0.636	0.447	0.596
Observations	3,720,539	3,720,539	3,720,539	5,427,290	5,427,290	5,427,290

Treated individuals increase non-food & durable spending

	Differentiate food & non-food spending			Differentiate durable & durable spending		
	Food spending > 0	Non-food spending > 0	Non-food spending share	Durable spending > 0	Non-durable spending > 0	Durable spending share
PriorCashDependence × Post	0.006***	0.063***	0.018***	0.013***	0.000	0.001***
	[4.65]	[16.85]	[9.12]	[8.59]	[1.54]	[5.76]
Individual FEs	Yes	Yes	Yes	Yes	Yes	Yes
District × Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.345	0.443	0.437	0.243	0.251	0.277
Observations	6,561,580	6,561,580	6,561,580	6,561,580	6,561,580	6,561,580

Treated individuals increase shopping variety

	Product variety	Broad category variety	Category variety	Shop variety	No. of trips
PriorCashDependence × Post	2.002***	0.212***	0.975***	0.002*	0.027
	[7.11]	[14.39]	[11.99]	[2.07]	[0.85]
Individual FEs	Yes	Yes	Yes	Yes	Yes
District × Time FEs	Yes	Yes	Yes	Yes	Yes
R-squared	0.650	0.531	0.634	0.523	0.594
Observations	6,561,580	6,561,580	6,561,580	6,561,580	6,561,580

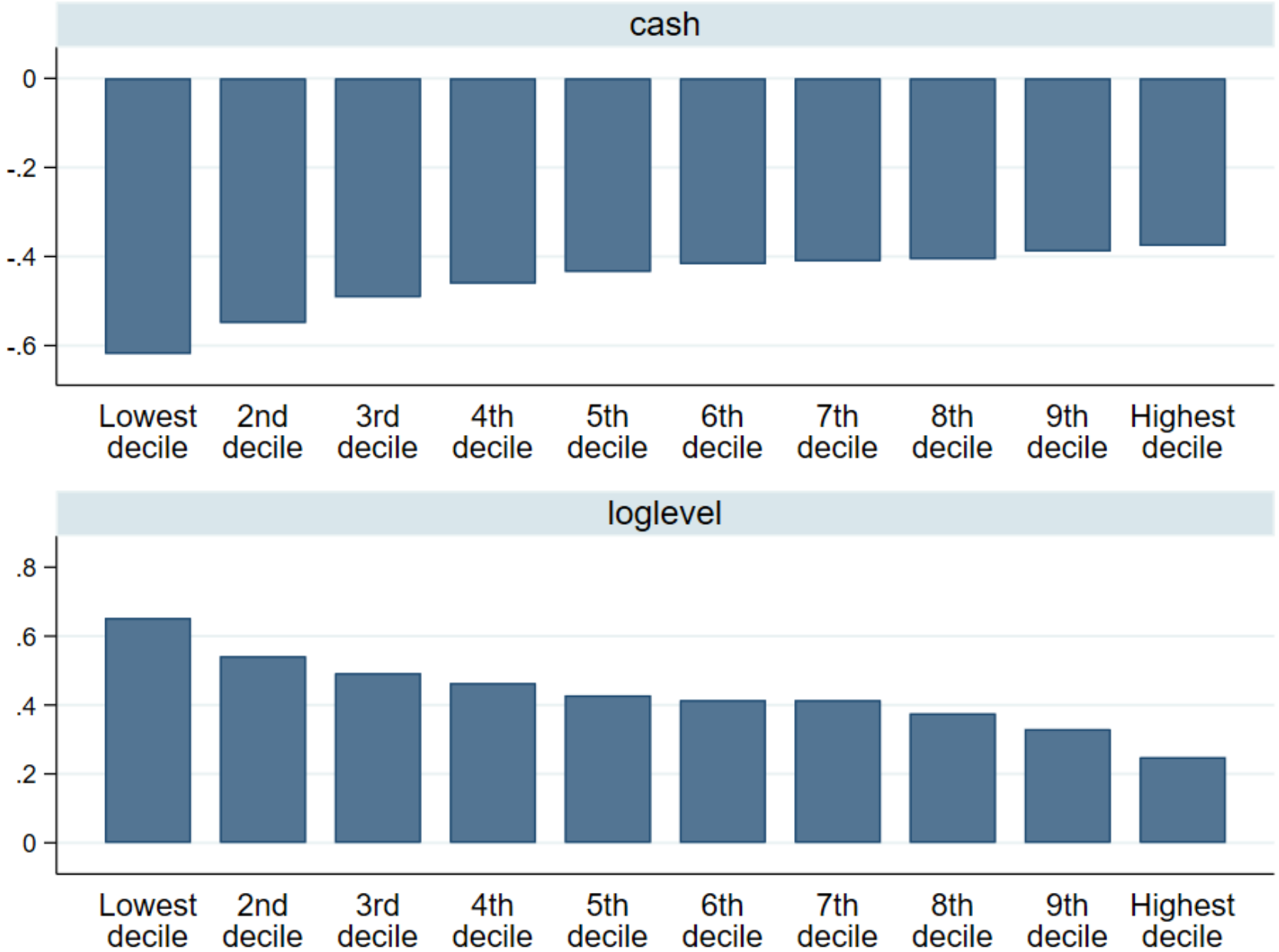
Spending by category analysis: Examples of categories

Item	Category
more. Value/Daily Chana Dal 1 Kg	Cereals - Pulses and Flours
more. Value/Daily Sugar 1 Kg	Salt and Sugar
more. Veg Sandwich 150 Gm	Starters
more. White Bread 400 Gm	Bread
more. White Nappies Without Plastic PO12 White	Infant Underwear & Night Wear
more. for you Mustard Big 100 Gm	Spices and Dehydrated Foods
more. freshness Baby Corn Peeled	Processed Products
more. freshness Basil	Vegetables
more. freshness Rambutan Pkd	Fruits
more. freshness Sprout Chana White	Vegetables
parle hide & seek mint 93.75 Gm	Biscuit
pro nature 100% organic urad white 500 gm	Organics
sai shantD- Ring binder A4	Office Stationery and Corres
sh gold cloth clip	Clothes Upkeep
usha Halogen Oven INFINITICOOK 3514i 1300W . nos Box	Cooking Appliances

Treated consumers buy more expensive items within granular product categories

	Amount	Quantity	Unit Price
PriorCashDependence × Post	20.372	0.367	0.829***
	[1.25]	[1.16]	[8.28]
Individual × Category FEs	Yes	Yes	Yes
District × Category × Time FEs	Yes	Yes	Yes
R-squared	0.399	0.385	0.771
Observations	54,603,502	54,603,502	54,603,502

Heterogeneous spending response



Alternative explanations

1. Income shock
2. Credit supply
3. Supplier’s pricing response
4. Moving purchases to the formal market

Income shock (concern 1) goes against us finding result

- First, overall income probably dropped in 2016Q4.
- A more subtle argument: re-allocation of relative income
- We proxy for black market income with the behavior of paying large receipts with cash prior to the Demonetization

	Did not use cash for large bills pre-Demonetization			Used cash for large bills pre-Demonetization		
	Cash usage	Spending (level)	Spending (log)	Cash usage	Spending (level)	Spending (log)
PriorCashDependence × Post	-0.356***	240.412***	0.537***	-0.240***	243.569**	0.015
	[-46.44]	[9.90]	[18.57]	[-21.54]	[2.89]	[0.55]
Individual FEs	Yes	Yes	Yes	Yes	Yes	Yes
District × Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.659	0.593	0.566	0.546	0.437	0.486
Observations	3,950,372	3,950,372	3,950,372	2,611,208	2,611,208	2,611,208

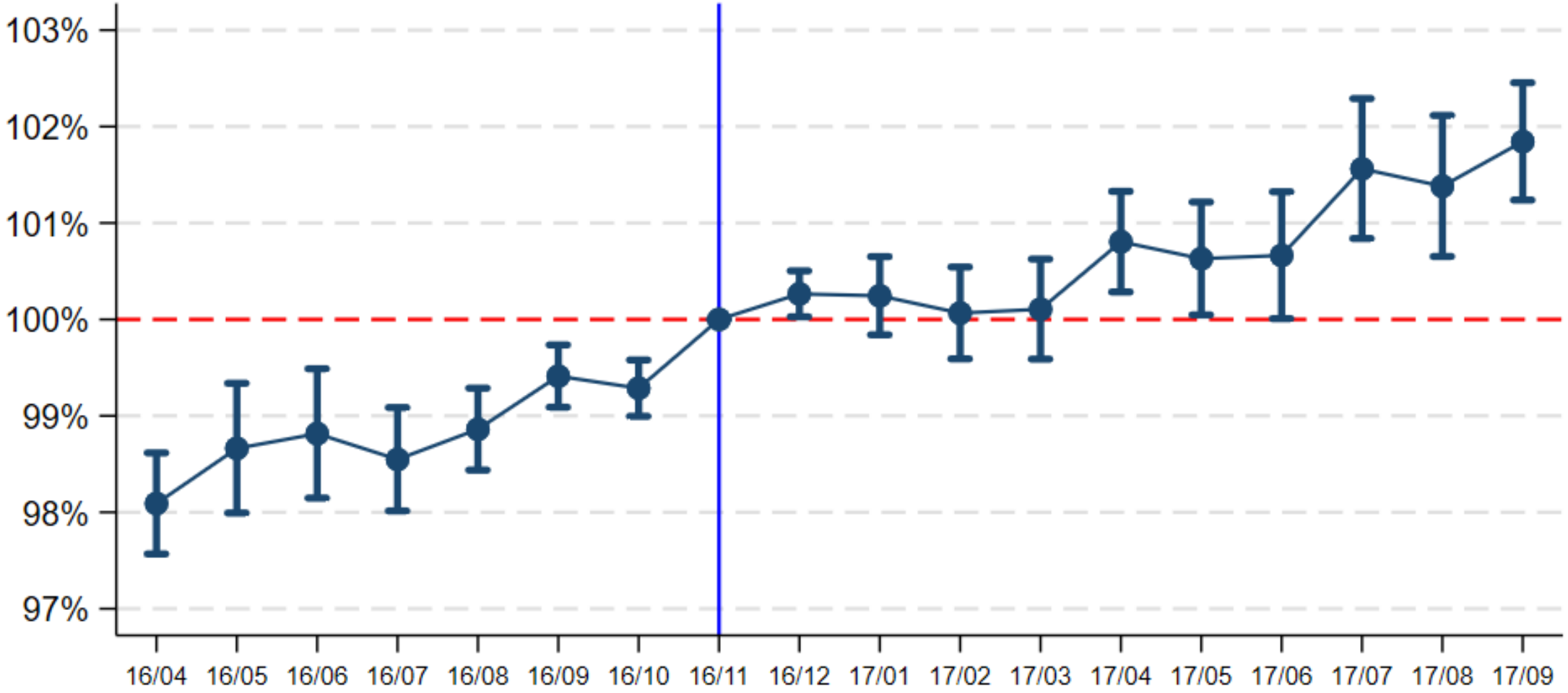
Credit supply (concern 2) does not fully explain findings

- Uptick of digital payments concentrated on debit card, credit card usage declined slightly
- A credit supply shift, if exists, should affect existing credit card holders more
- We analyze three sub-samples: existing users, new users, and non-users

	Outcome variable: Spending (log)				
	Full	Existing users		New users	Non-users
PriorCashDependence × Post	0.307***	0.241***	0.260***	0.448***	0.311***
	[12.61]	[8.71]	[8.75]	[18.06]	[12.44]
PriorCreditDependence × Post			0.074**		
			[2.37]		
Individual FEs	Yes	Yes	Yes	Yes	Yes
District × Time FEs	Yes	Yes	Yes	Yes	Yes
R-squared	0.586	0.520	0.520	0.505	0.587
Observations	6,561,580	240,191	240,191	551,031	5,770,358

Supplier's pricing response (concern 3) is modest

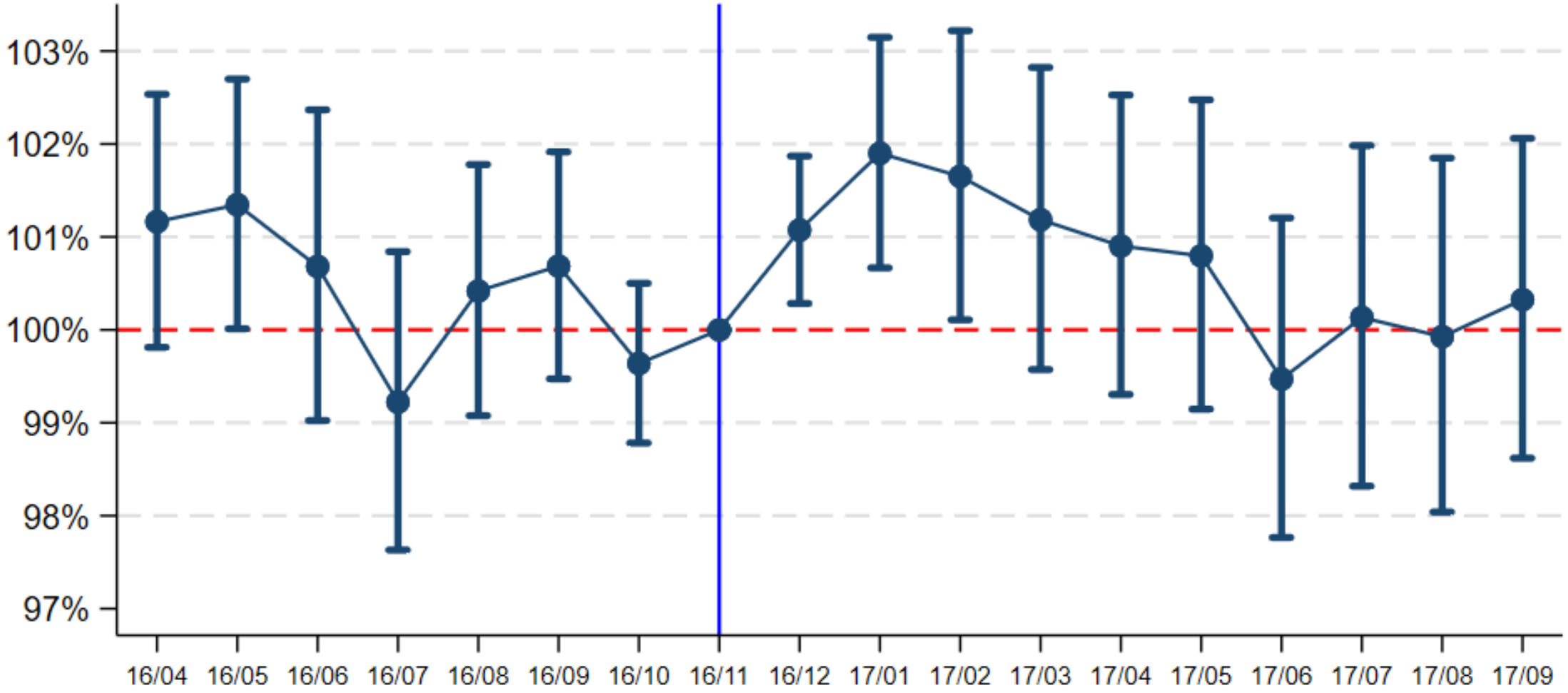
Overall price level in this supermarket chain (controlling for items and stores)



$$log\left(Mean\ Price_{item,store,t}\right) = \mu_{item} + \gamma_{store} + \sum \boldsymbol{\beta_j} \mathbb{I}_t + \varepsilon_{item,store,t}$$

No differential pricing by exposure to prior-cash-dependent consumers

Price level of high exposure products relative to low exposure products



$$log\left(Mean\ Price_{item,store,t}\right) = \mu_{item} + \gamma_{store} + \sum \beta_j \mathbb{I}_t + \sum \boldsymbol{\gamma_j}\left(\mathbb{I}_t \times \mathbb{I}(HighExposure_{item})\right) + \varepsilon_{item,store,t}$$

Moving purchases to the formal market (concern 4)

- Newly arrived consumers do not contribute to our estimation.
- Consumers who were likely to go to informal markets for grocery shopping experienced a lower spending response.

	Pre-Demonetization food spending share is below median (88%)			Pre-Demonetization food spending share is above median (88%)		
	Cash usage	Spending (log)	Food spending share	Cash usage	Spending (log)	Food spending share
PriorCashDependence × Post	-0.354***	0.207***	0.043***	-0.332***	0.349***	-0.019***
	[-35.58]	[10.08]	[13.36]	[-39.80]	[13.46]	[-19.43]
Individual FEs	Yes	Yes	Yes	Yes	Yes	Yes
District × Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.608	0.564	0.366	0.629	0.562	0.322
Observations	3,635,392	3,635,392	3,635,392	2,926,188	2,926,188	2,926,188

Summary: How do we address these challenges

1. **Income shock**: The difficulties imposed on black market activities implies that a re-allocation of relative income exists, if exists, goes against us finding result. We find potential black market earners experienced a lower spending response.
2. **Credit supply**: Analysis on existing credit card users shows some evidence for credit supply shift but such channel does not explain our main results – uptick of digital payments concentrated on debit card and credit card usage experienced a small decline; most consumers still did not have a credit card post Demonetization.
3. **Supplier's pricing response**: The overall price level exhibits a smooth low inflation throughout the sample period. In the cross section, pricing of products highly exposed to prior-cash-dependent consumers was not elevated.
4. **Moving purchases to the formal market**: Newly arrived consumers do not contribute to our estimation. Consumers who were likely to go to informal markets for grocery shopping experienced a lower spending response.

Mechanisms

- Physical transaction costs
  - Costs associated with storing, transporting, and counting paper bills and coins
  - Time costs of traveling to a bank branch or an ATM to withdraw cash (Bachas et al., 2018)
  - Risk of cash theft (Economides and Jeziorski, 2017; Rogoff, 2014).
- Psychological transaction costs/salience
  - Decision point at purchase
  - Pain of paying or payment transparency (Prelec and Loewenstein, 1998; Zellermayer, 1996; Soman, 2003; Raghubir and Srivastava, 2008)

Analyzing online grocery spending to tease out mechanism

- Cash on delivery for online purchases involves no exchange of money between hands at the time of purchase decision → lower psychological transaction costs/salience
- Physical transaction costs apply equally to online and offline shopping.
- Differences in estimates reflect the effect of the salience:

	Supermarket spending		Online grocery spending	
	Cash usage	Spending (log)	Cash usage	Spending (log)
PriorCashDependence × Post	-0.338***	0.307***	-0.522***	0.041***
	[-39.20]	[12.61]	[-33.97]	[3.30]
Individual FEs	Yes	Yes	Yes	Yes
District × Time FEs	Yes	Yes	Yes	Yes
R-squared	0.622	0.586	0.651	0.559
Observations	6,561,580	6,561,580	209,391	209,391

Conclusion

- Focus: Do digital payments affect consumption?

- Findings:
  - Consumers who are forced to switch to digital payments by the 2016 Indian Demonetization increase spending.
  - They buy higher unit price products and are less likely to use offers.
  - Alternative explanations such as income shock, credit supply, supplier's pricing response, and moving to the formal market do not explain our results.
  - Psychological transaction costs/salience drive our resultss

Additional slides

Slow comeback of cash

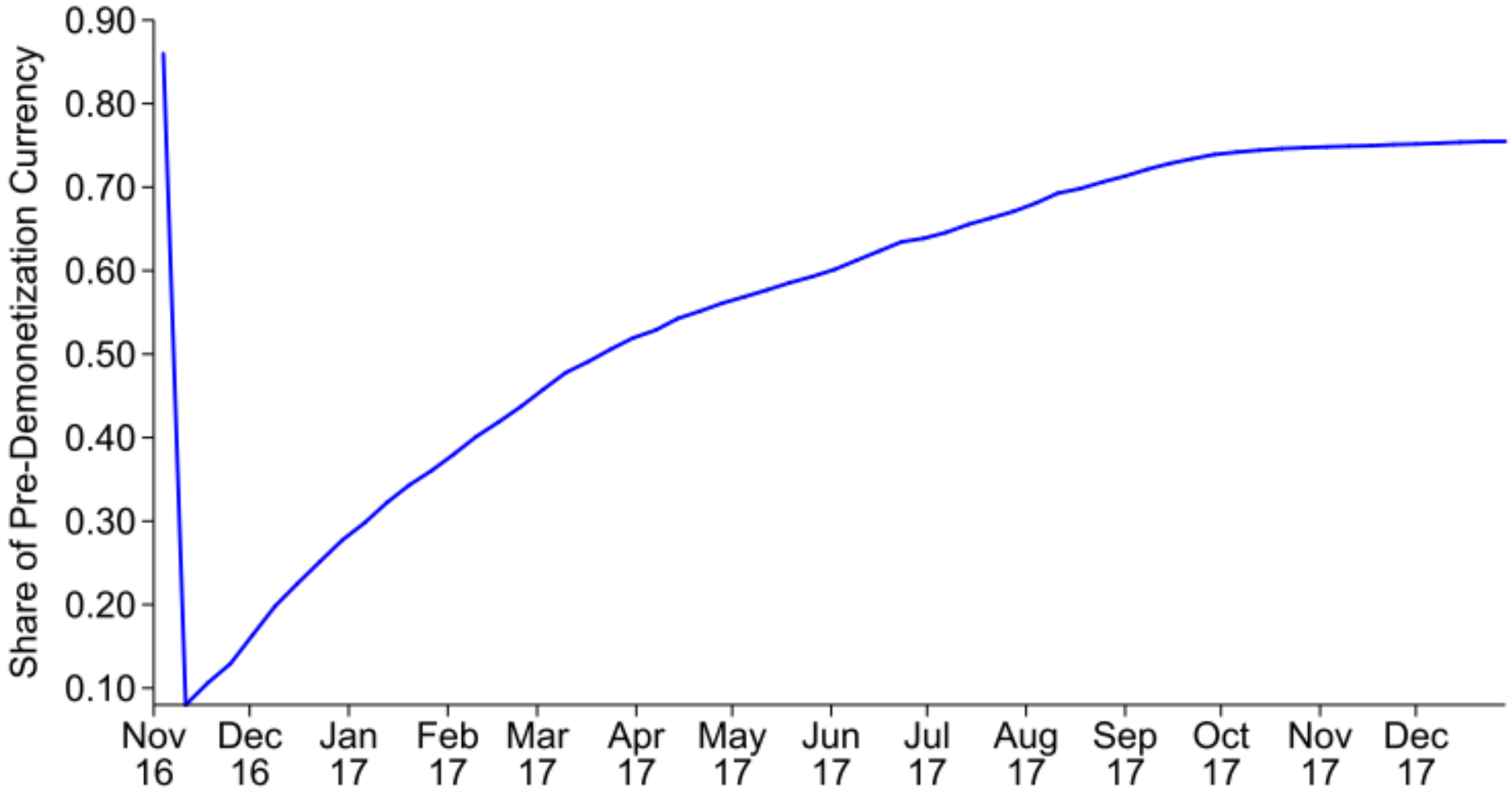
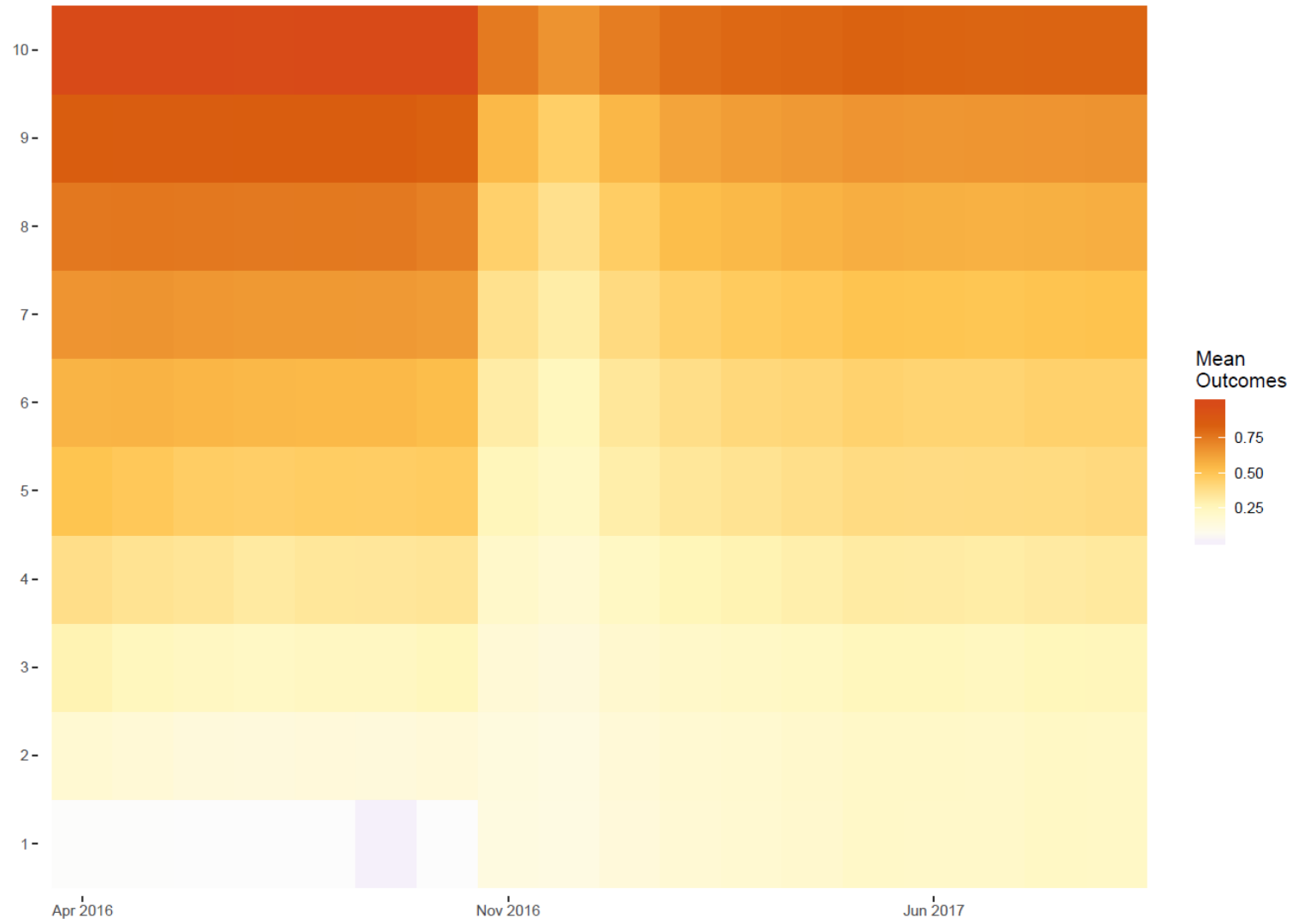
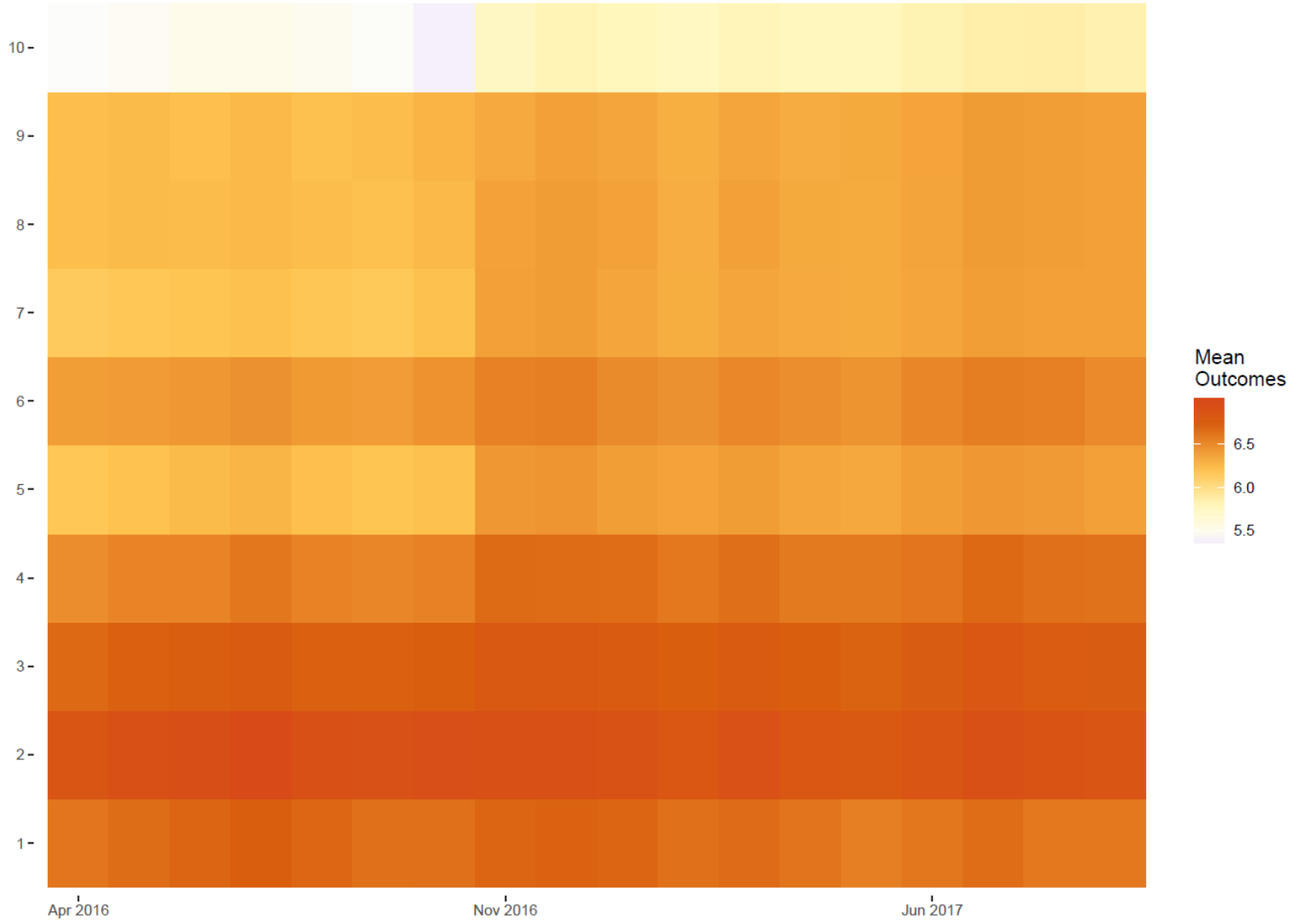


Figure 1 of Chodorow-Reich et al. (2019)

Multi-group DiD heatmap: Cash usage decreases



Multi-group DiD heatmap: Spending increases



Economic Policy Uncertainty in India