Digital Payments Induce Over-Spending: Evidence from the 2016 Demonetization in India

Sumit Agarwal (NUS)
Pulak Ghosh (IIM Bangalore)
Jing Li (SMU)
Tianyue Ruan (NUS)

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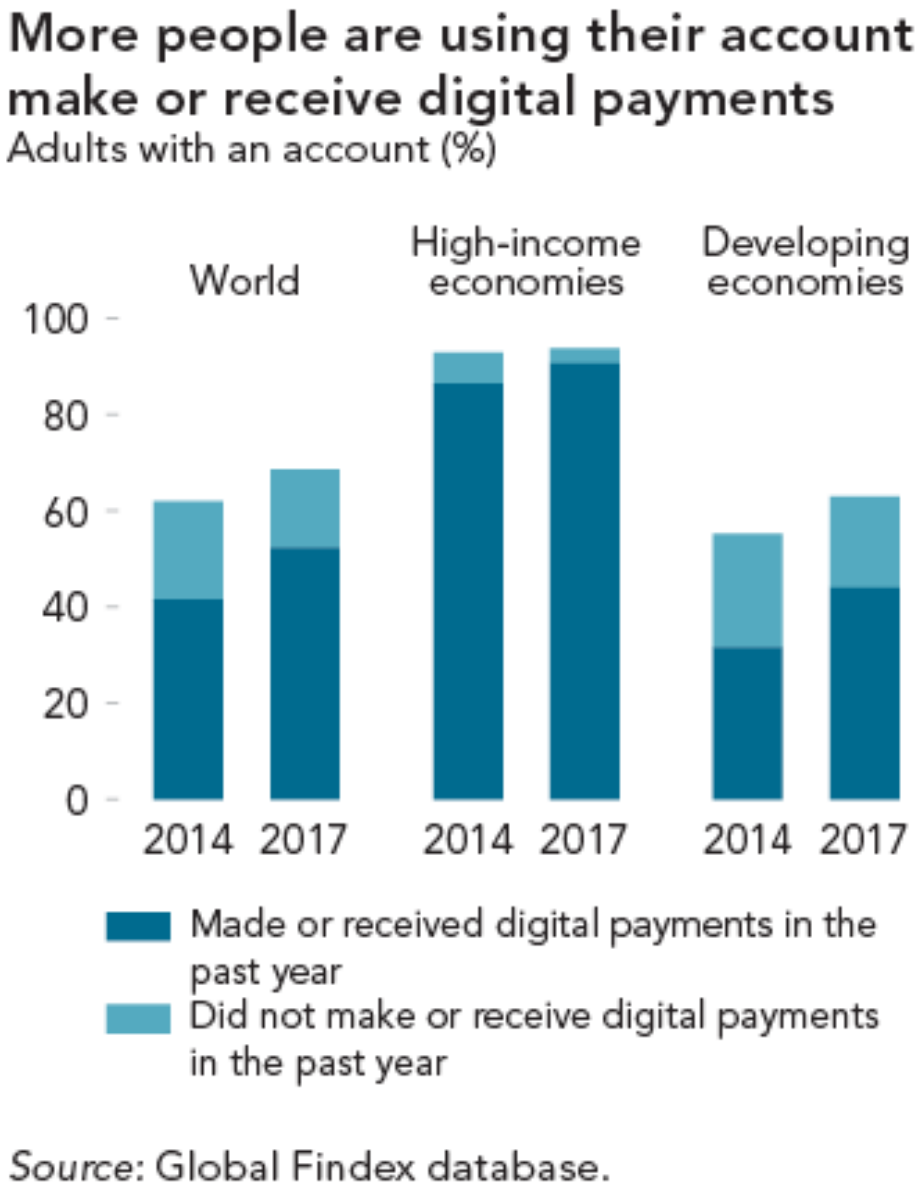
Popularity of digital payments



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

- Prior research highlights the role of credit card usage, largely based on survey evidence: Zinman (2009), Chatterjee and Rose (2012), Runnemark, Hedman, and Xiao (2015); Khan, Belk, and Craig-Lees (2015); Feinberg and Feinberg (2017)

- However, credit cards typically come with a free float, preventing credible conclusion of the role of digital payments

Research question: Do digital payments affect consumption?

- Empirical challenges for studying the impact of digital payments on consumption
  - 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.

- 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

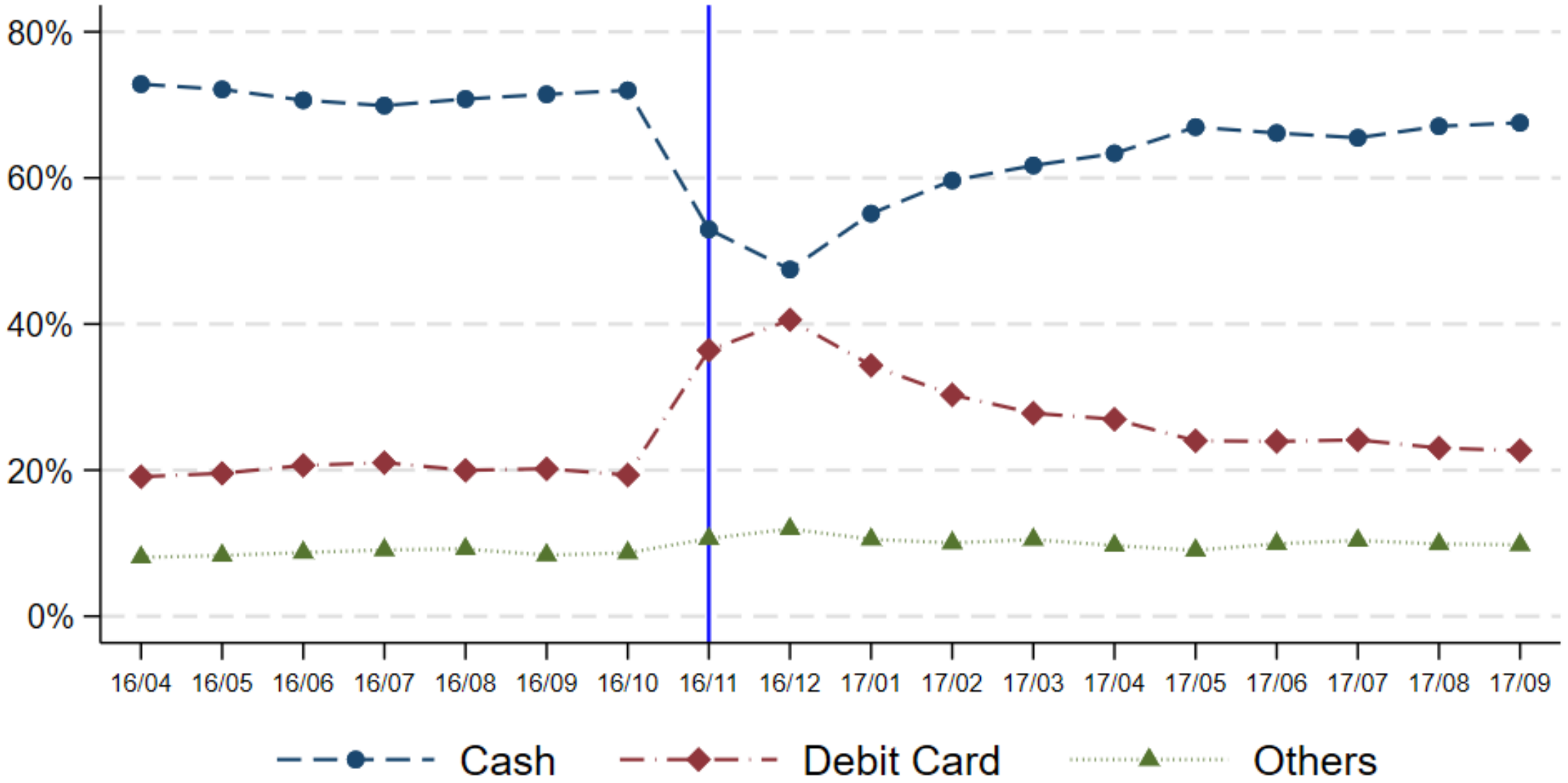
- About 87% of the value of all transactions in 2012 was in cash and it is estimated that the Reserve Bank and commercial banks in India spent equivalently about 3 billion USD in current operation costs annually (Mazzotta et al. 2014).
- Currency in circulation accounts for almost 18% of its GDP (3.5% 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.

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

Variables	Mean	Standard Deviation
Purchase amount per receipt	373.92	969.95
Log(purchase amount per receipt)	4.96	1.65
Indicator for non-cash payment	0.34	0.47
Purchase amount per month	1018.64	24219.97
Log(purchase amount per month)	6.02	1.44
Fraction of non-cash spending per month	0.36	0.45
Fraction of cash spending per month prior to Demonetization	0.70	0.38

Empirical challenges for digital payments → spending

- 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 the exposure to the sudden dry-up of cash due to the Demonetization**

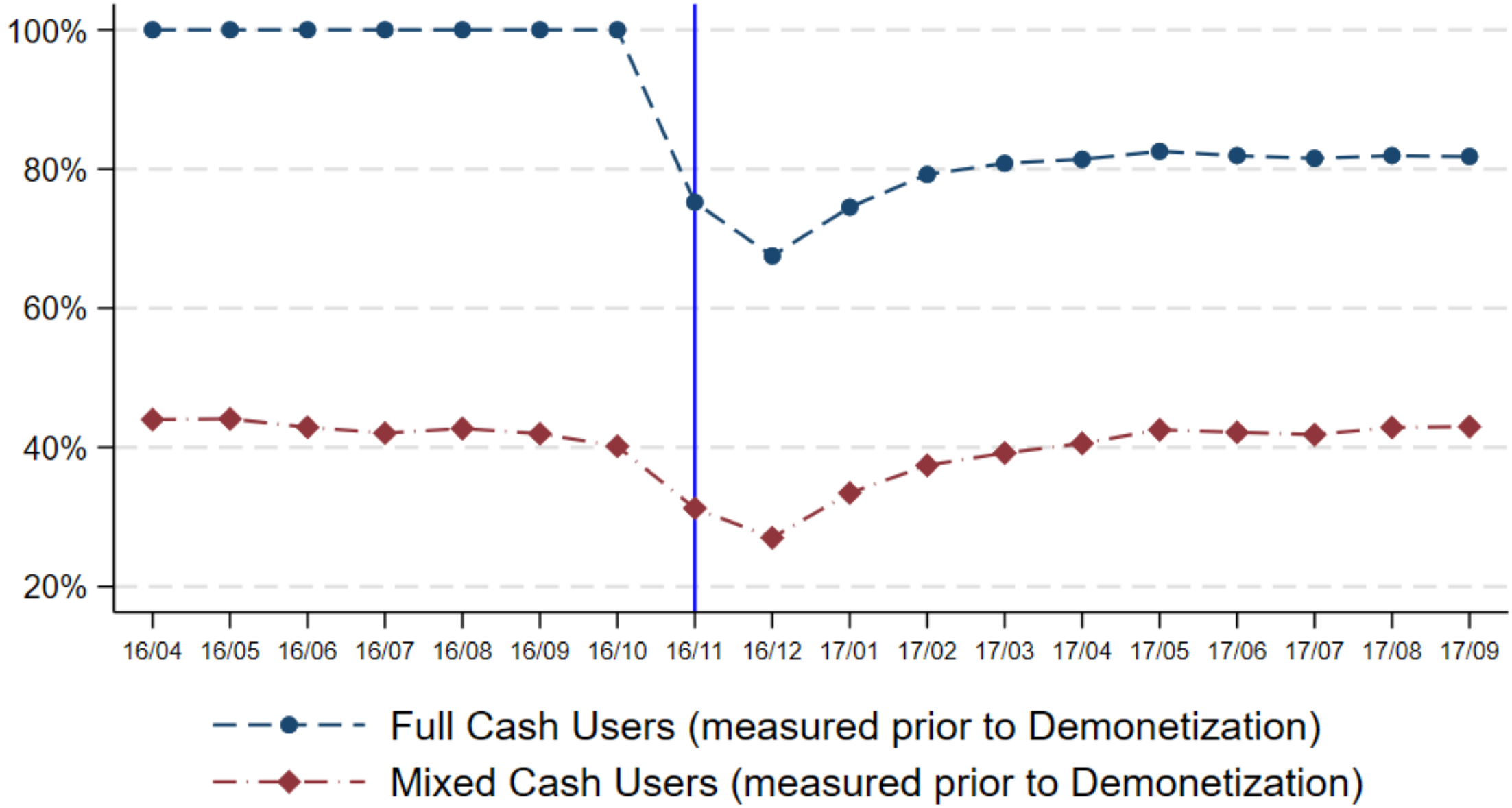
- Difference-in-differences (DiD) framework: compare changes in spending patterns across individuals with varying degree of prior cash dependence.

Difference-in-differences (DiD) specification

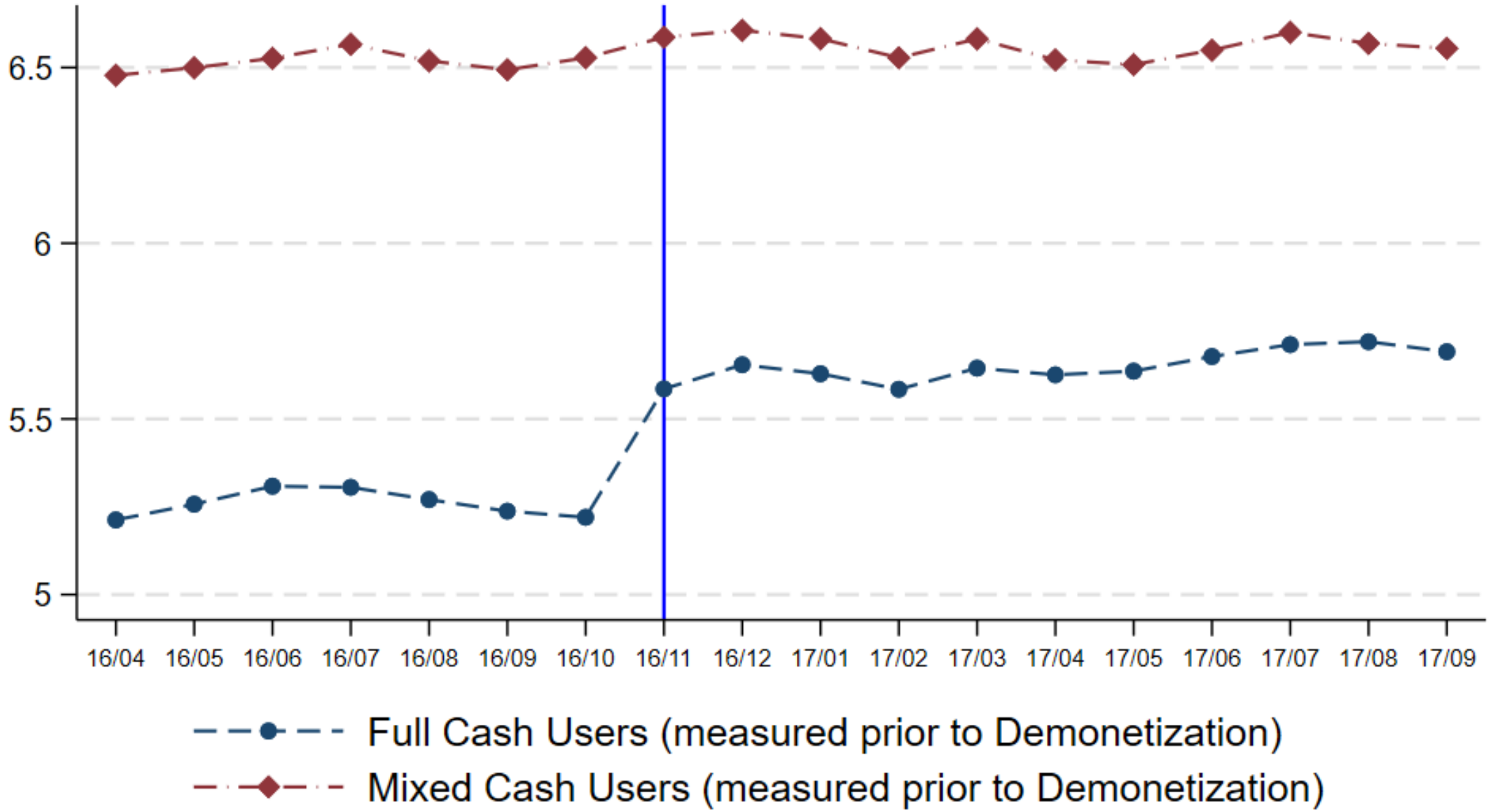
$$\boldsymbol{y_{i,t}} = \mu_i + \tau_t + \beta(Prior\ Cash\ Dependence_i \times Post_t) + \varepsilon_{i,t}$$

- $y_{i,t}$: 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
- Year-month fixed effects: remove aggregate trends and other unobserved time-varying heterogeneity
- 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	Log(spending)
PriorCashDependence × Post	-0.313***	192.661***	0.300***
	[-429.49]	[22.07]	[123.90]
Consumer Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
R-squared	0.626	0.436	0.593
Observations	7644270	7644270	7644270

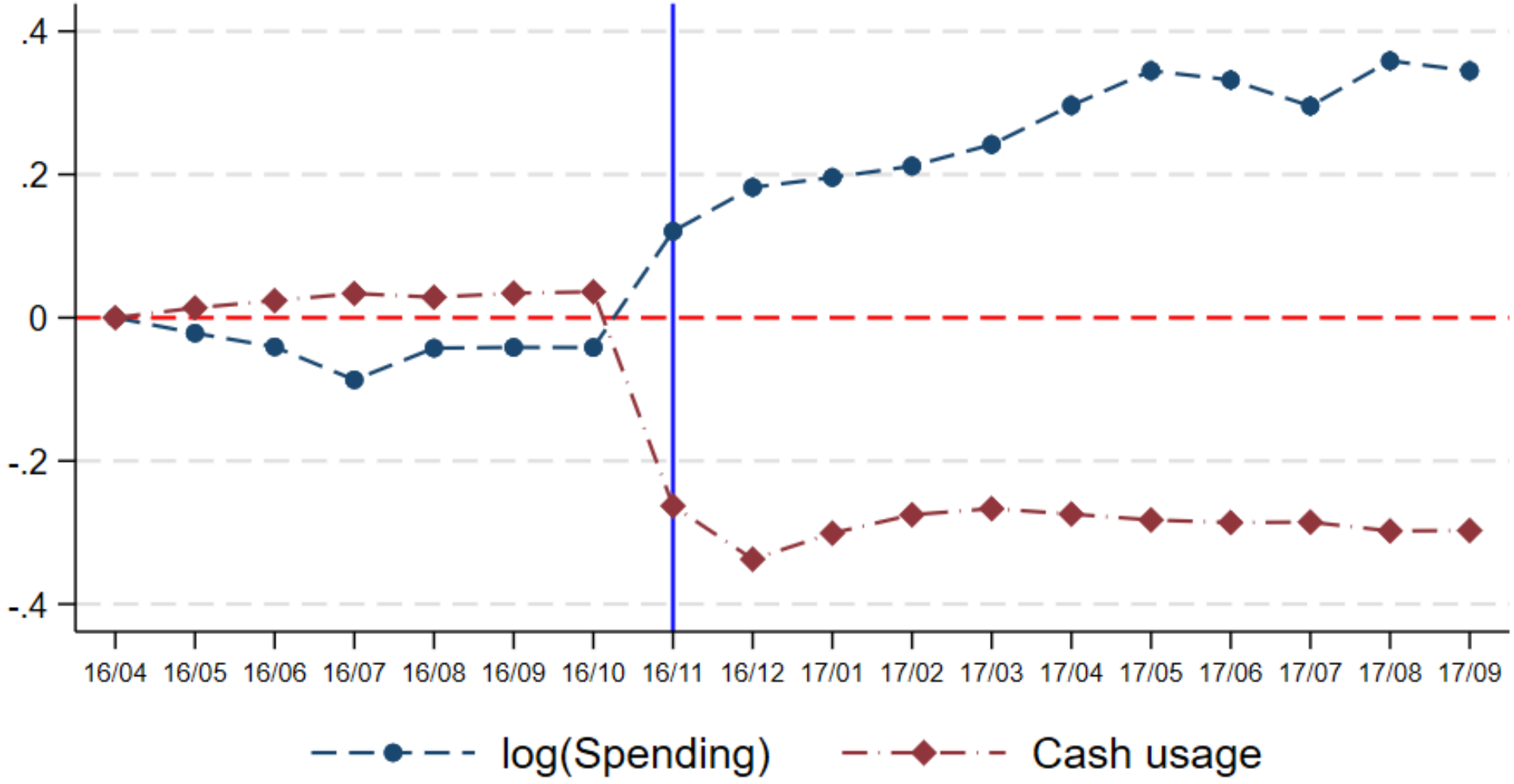
Economic magnitude

- 10 pp increase in prior cash dependence ~ 3.13 pp increase in digital payments adoption, 19.27 rupees increase in monthly spending, 3% increase in monthly spending
- Inter-quartile range of prior cash dependence is 50% ~ 96.35 rupees increase or 15% increase in monthly spending

Heterogeneous forced switch to digital payments

	Cash usage	Debit usage	Mobile usage	Credit usage
PriorCashDependence × Post	-0.313***	0.268***	0.001***	-0.024***
	[-429.49]	[311.06]	[6.71]	[-55.26]
Consumer Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.626	0.568	0.359	0.368
Observations	7644270	7644270	7644270	7644270

Dynamic effects of digital payments on spending



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

Results in the sample excluding Nov 2016 to Jan 2017

	Cash usage	Spending	Log(spending)
PriorCashDependence × Post	-0.305***	225.099***	0.337***
	[-367.81]	[24.99]	[122.43]
Consumer Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
R-squared	0.640	0.447	0.603
Observations	6509979	6509979	6509979

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 & use promotions less

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

$$y_{i,c,t} = \mu_{i,c} + \tau_{c,t} + \beta(Prior\ Cash\ Dependence_i \times Post_t) + \varepsilon_{i,c,t}$$

	Amount		Quantity		Unit Price		Use Offer	
PriorCashDependence × Post	10.828***	19.255*	0.084*	0.281	1.932***	1.616***	-0.002***	-0.004***
	[2.86]	[1.84]	[1.69]	[1.56]	[23.30]	[21.13]	[-4.87]	[-9.72]
Consumer Fixed Effects	Yes	No	Yes	No	Yes	No	Yes	No
Consumer-Category Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Category-Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.111	0.432	0.139	0.434	0.558	0.682	0.407	0.649
Observations	47182408	47182408	47182408	47182408	47182408	47182408	47182408	47182408

Payment method and spending: Role of salience

1) **Decision point at purchase**
   - A payment mechanism that is effortful and involves some transaction costs/constraints can serve as a decision point for consumers to evaluate their expenses. However, plastic mechanisms (debit or credit cards) remove those decision points and hence make spending easier.
2) **Memorability of past expenses** and hence the accuracy of the mental accounting
   - People who use debit or credit cards tend to underestimate their past expenses in a given month, overestimate their available funds, and hence spend more.
3) **Pain of paying or payment transparency** (Prelec and Loewenstein, 1998; Zellermayer, 1996; Soman, 2003; Raghubir and Srivastava, 2008)
   - Cash payment is painful because the consumer has to physically endure the act of parting with their hard-earned money.
   - Payment by plastic mechanisms is simpler and shorter as no money actually exchanges hands.

Payment method and spending: Role of salience

4) **Transaction decoupling** (Gourville and Soman, 1998; Soman and Gourville, 2001; Thaler, 1999)
   - In the case of advance purchases using credit cards, consumers gradually adapt to the pain of the payment over time, such that when the time to pay finally arrives, the payment is no longer aversive and the good appears to be a free good.
   - Prospect theory (Kahneman and Tversky, 1979) also predicts that the payment will not sting as much in the bundled credit card condition, because it is integrated with other losses.
5) **Feedback on behavior** (Hogarth, Gibbs, McKenzie, and Marquis, 1991)
   - The provision of feedback allows consumers to learn and hence update their behaviour.
   - Feedback arrives in the form of credit card statements that are neither timely nor consistent with household budgeting cycles.

Summary: Salience of payment modes

	Mode of Payment			
Mechanism	Cash	Debit Cards	Mobile Payments	Credit Cards
Decision Point at Purchase	High	Low	Very Low	Low
Memorability	High	Low	Low	Low
Pain of Payment	High	Low	Low	Low
Degree of Coupling	High	Medium	Medium or Low	Low
Quality of Feedback	High	Medium	Low	Low
Level of Salience	High	Medium	Low	Low

Source: Soman, Cheema, and Chan (2011).

Addressing identification challenges

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

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.

Conclusion

- Focus: Do digital payments affect spending?

- 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.

Additional slides

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

Slow comeback of cash

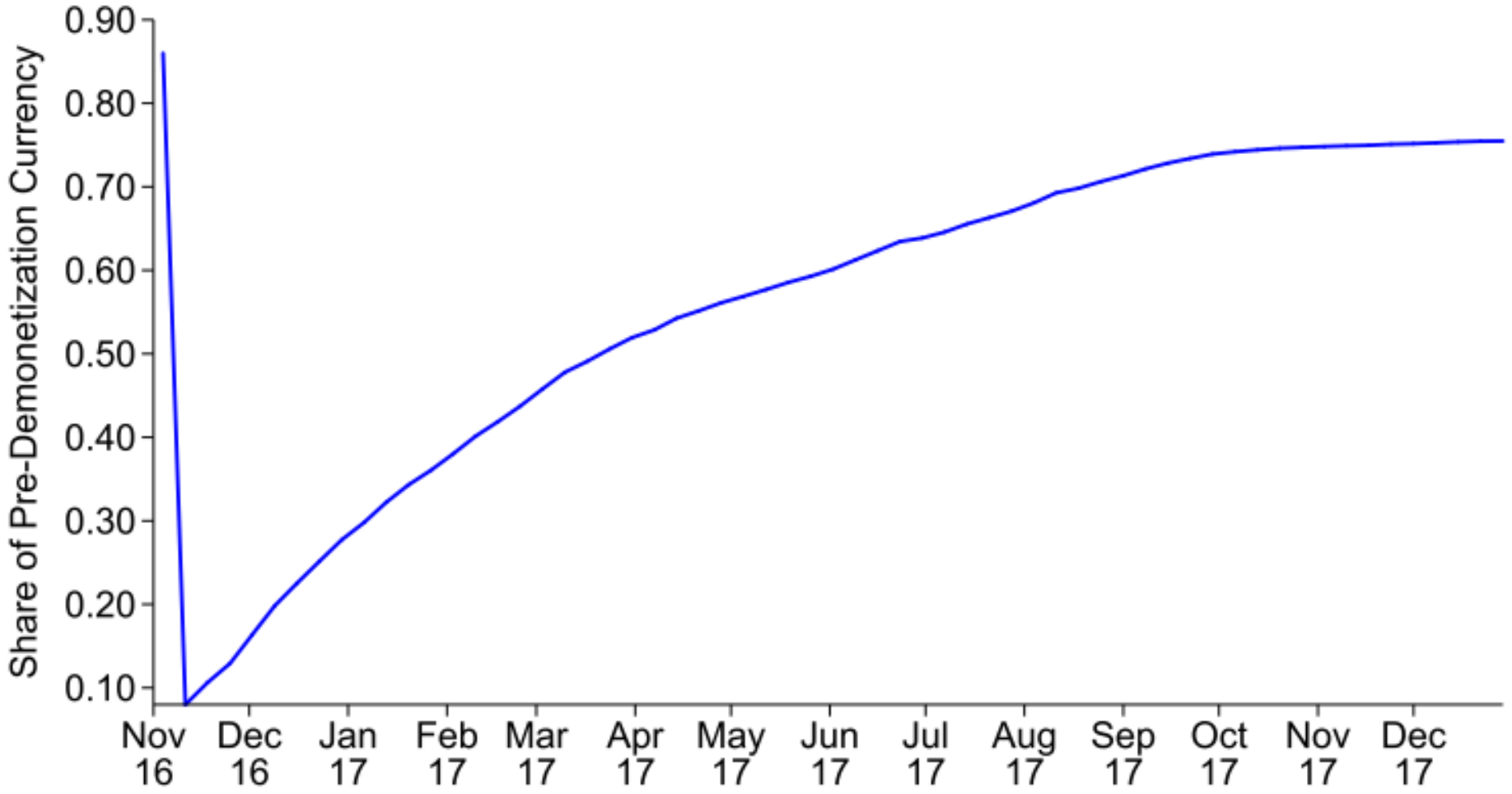
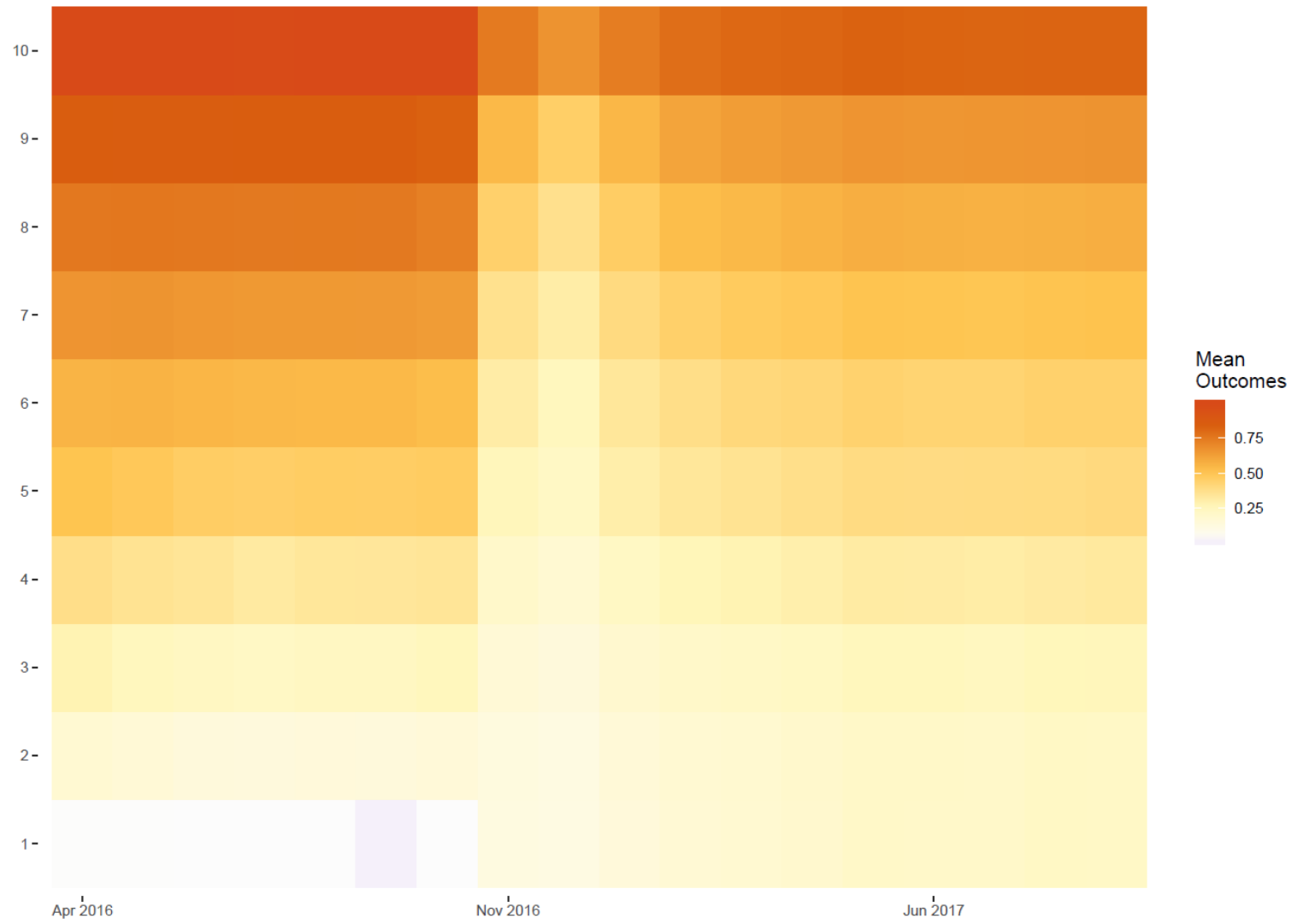
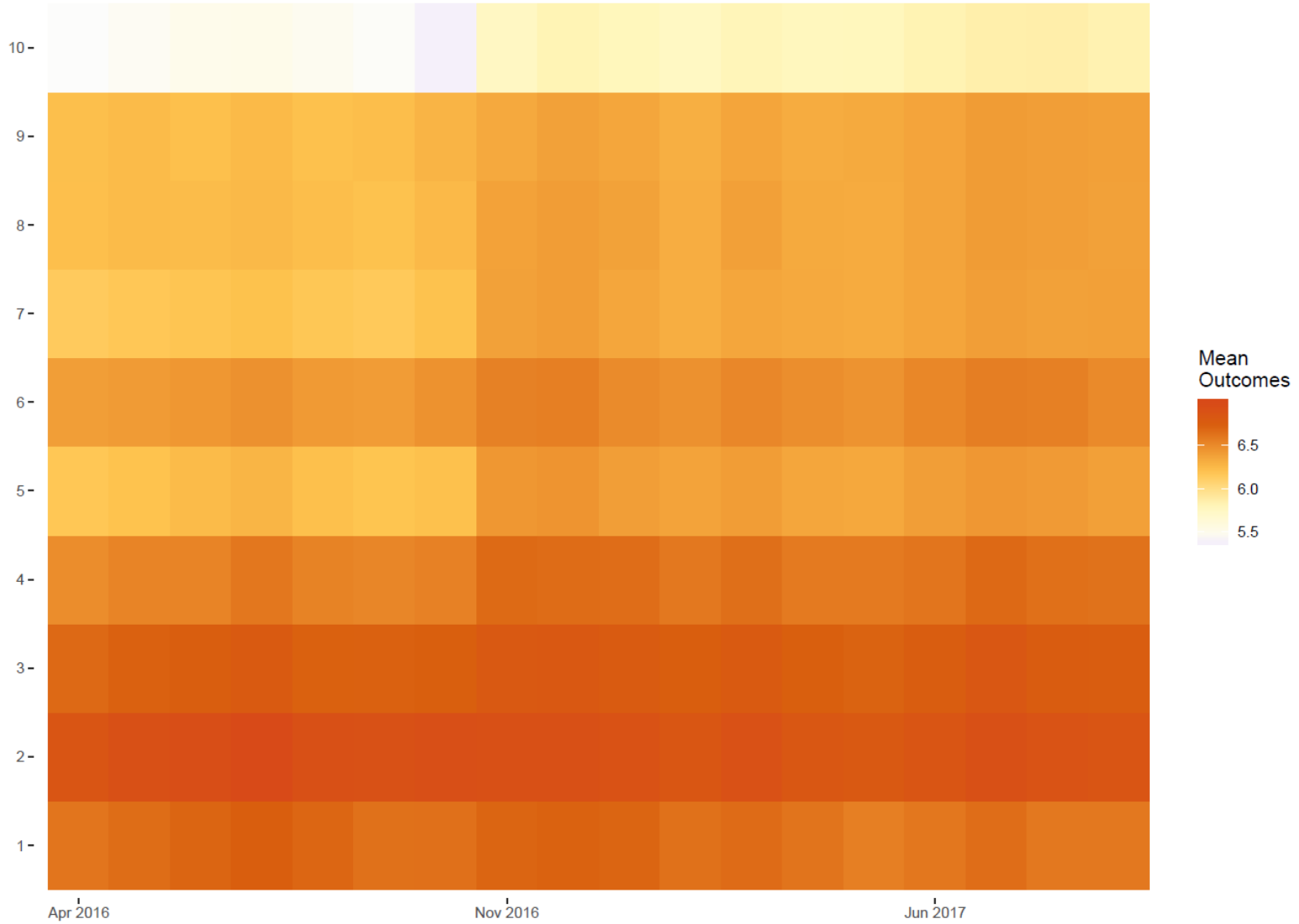


Figure 1 of Chodorow-Reich et al. (2018)

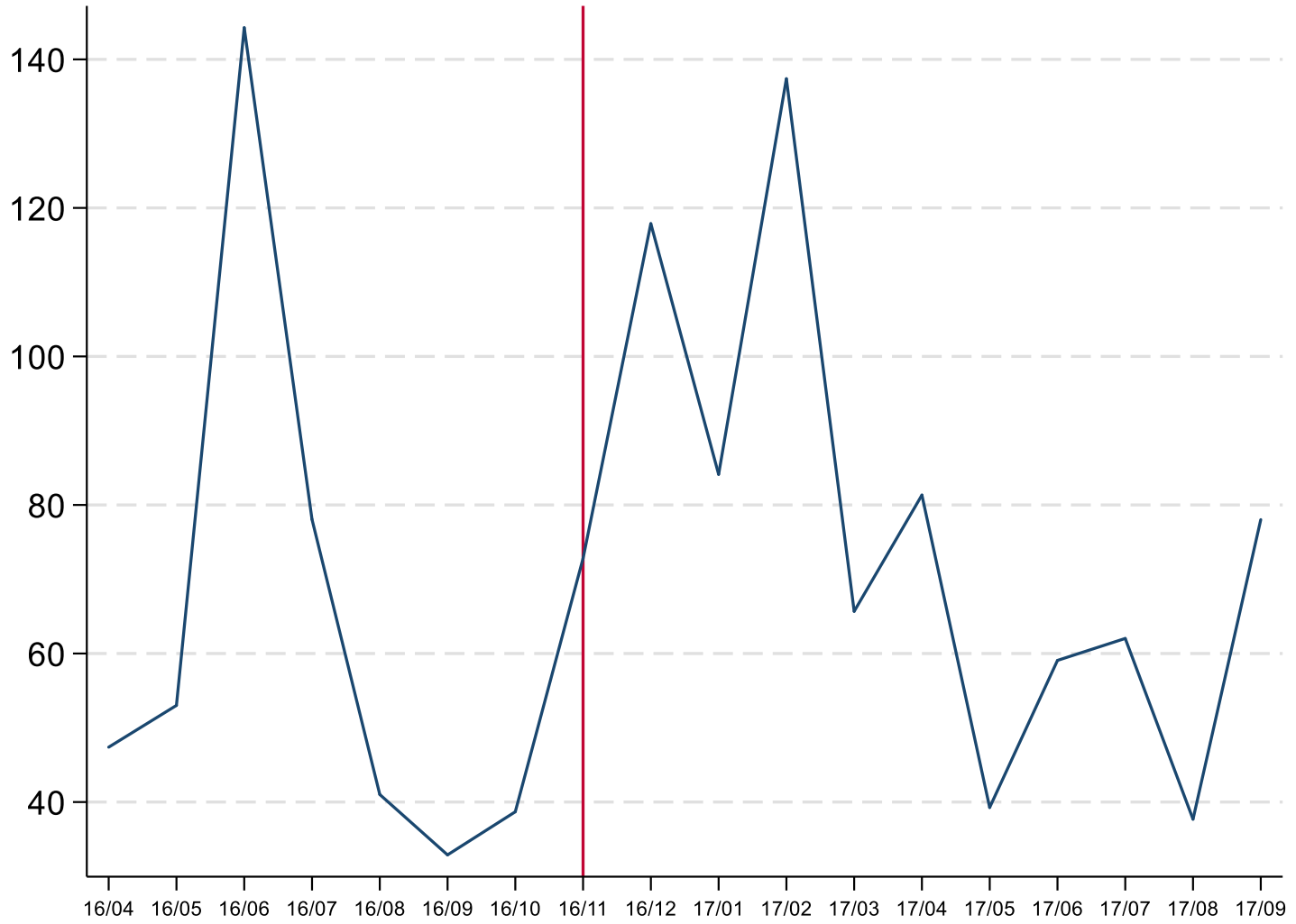
Multi-group DiD heatmap: Cash usage decreases



Multi-group DiD heatmap: Spending increases



Economic Policy Uncertainty in India



Results from the sample excluding full cash users

	Cash usage	Debit usage	Mobile usage	Credit usage	Spending	Log(spending)
PriorCashDependence × Post	-0.392***	0.335***	0.003***	-0.014***	297.295*	0.169***
	[-315.87]	[252.71]	[11.22]	[-21.95]	[1.77]	[47.04]
Consumer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.509	0.518	0.363	0.373	0.435	0.538
Observations	4001967	4001967	4001967	4001967	4001967	4001967

Heterogeneous forced switch to digital payments (level)

	Cash		Debit		Mobile		Credit	
	Level	IHS	Level	IHS	Level	IHS	Level	IHS
PriorCashDependence × Post	-181.005***	-1.244***	305.013***	2.205***	3.183***	0.000	-47.767***	-0.213***
	[-57.32]	[-210.92]	[96.09]	[318.08]	[6.47]	[0.08]	[-37.94]	[-50.63]
Consumer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.426	0.522	0.418	0.580	0.360	0.350	0.401	0.407
Observations	7644270	7644270	7644270	7644270	7644270	7644270	7644270	7644270

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	Log(spending)	Cash usage	Spending	Log(spending)
PriorCashDependence × Post	-0.333***	234.521***	0.516***	-0.215***	162.003*	0.030***
	[-403.10]	[67.87]	[182.27]	[-137.24]	[1.76]	[6.24]
Consumer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.663	0.595	0.574	0.547	0.435	0.485
Observations	4836072	4836072	4836072	2808198	2808198	2808198

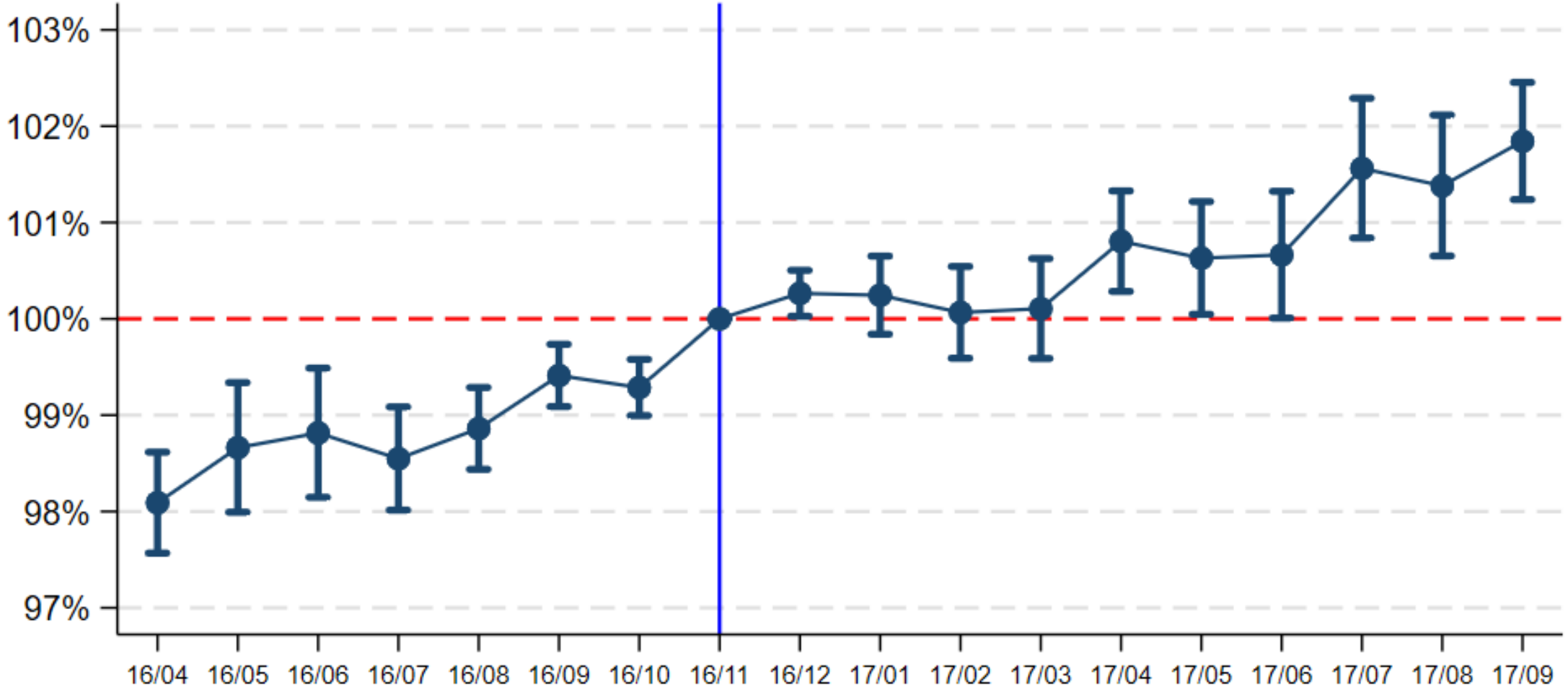
Credit supply (concern 2) does not fully explain findings

- 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

	Full	Existing users		New users	Non-users
PriorCashDependence × Post	0.300^{***}	0.230^{***}	0.247^{***}	0.410^{***}	0.295^{***}
	[123.90]	[13.40]	[13.49]	[49.19]	[113.02]
PriorCreditDependence × Post			0.066^{***}		
			[2.74]		
Consumer Fixed Effects	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.593	0.523	0.523	0.504	0.586
Observations	7644270	249668	249668	551031	5770361

Supplier's pricing response (concern 3) is modest

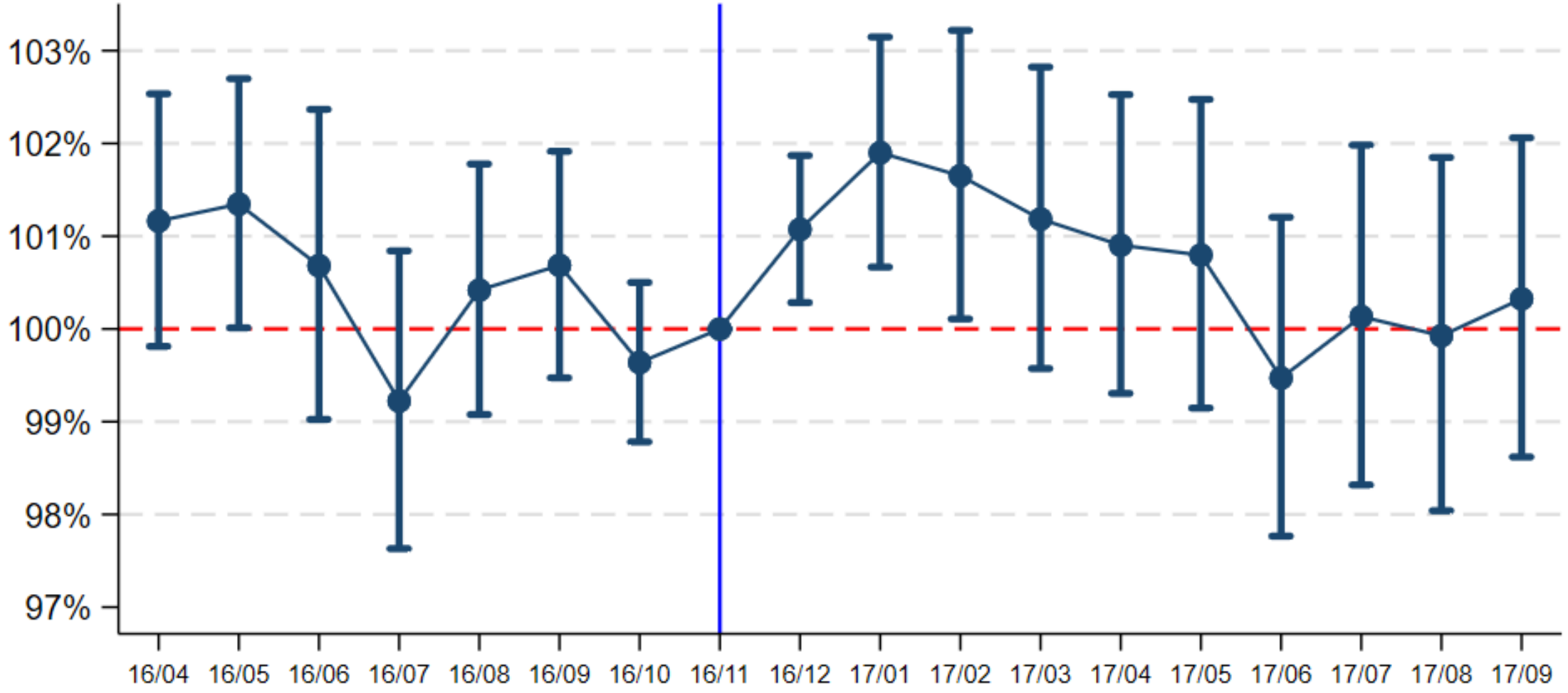
Overall price level in this supermarket chain (controlling for items and stores)



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

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.

	Previous grocery spending $\leq 95\%$				Previous grocery spending $> 95\%$			
	Cash usage	Total spending	Grocery spending	Non-grocery spending	Cash usage	Total spending	Grocery spending	Non-grocery spending
PriorCashDependence × Post	-0.350***	0.232***	0.357***	-0.088***	-0.309***	0.301***	0.294***	0.134***
	[-195.44]	[41.12]	[43.19]	[-6.95]	[-381.75]	[114.53]	[107.98]	[31.53]
Consumer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.608	0.569	0.533	0.422	0.626	0.603	0.588	0.411
Observations	1191000	1191000	1190994	1190994	6453260	6453270	6453253	6453253