Liquidity Shocks and Firm Exports: Evidence from Cash Shortages During India's Demonetization*

Ritam Chaurey† Johns Hopkins University

Ryan Kim‡ Johns Hopkins University

Pravin Krishna§ Johns Hopkins University and NBER

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Abstract

This paper examines how liquidity shocks caused by currency shortages impact exports. We explore this in the context of India's 2016 currency demonetization, a sudden government policy announcement that led to 86% of the country's currency in circulation being rendered illegal within hours. Our analysis uses novel data, including high-frequency customs transaction records matched with exporting firms and their balance sheets, as well as with inter-district domestic trade. While the cash shortages do not directly affect exporting firms, we find a significant and immediate decline in real exports for firms whose domestic customers experience liquidity shocks.

Keywords: Demonetization, liquidity, supply chain, exports, customs transactions data, cash

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†rchaurey@jhu.edu

‡rkim59@jhu.edu

§pravin_krishna@jhu.edu

1 Introduction

A vast literature has studied the relationship between liquidity constraints and international trade, largely focusing on the consequences of disruptions in capital and foreign exchange markets on trade flows.[1] However, the role of cash (typically an economy's most liquid asset) itself in affecting exports has remained understudied. This is perhaps because it is widely believed that currency in circulation should not directly affect exporters since they are less likely to use domestic currency in their transactions (Gopinath et al., 2020).[2] However, particularly in developing countries, domestic firms and workers can be heavily reliant on cash (Breza et al., 2024); exporters linked to the domestic economy through domestic supply chains (Dhyne et al., 2021)[3] can, therefore, be indirectly affected by shocks to currency in circulation.

This paper studies how liquidity constraints caused by currency shortages affect firm-level exports. To do so, we leverage the quasi-experimental variation in cash shortages generated by an unanticipated policy announcement in India: the 2016 "Demonetization" episode when the Government of India, in a surprise announcement, mandated that large currency bills – accounting for 86 percent of currency in circulation in India – would be rendered illegal tender within hours. Following this event, the economy was characterized by widespread currency shortages, which were especially problematic in India due to its high dependence on currency notes as the medium of exchange. It was widely feared that the demonetization would impact firms negatively, both in the short run during re-monetization and in the long run, if fragile supply chain linkages meant that work stoppages, loss of output, and firm bankruptcies in one part of the economy had cascading effects throughout the whole system.

[1] See, for example, survey papers about trade and finance (Foley and Manova, 2015), distortions in trade and development (Atkin and Khandelwal, 2020), and global banking (Buch and Goldberg, 2020).

[2] Also, there is no role of "cash" in textbook models of monetary economics (Woodford, 2003; Gali and Monacelli, 2005).

[3] For example, in our sample, an average exporter generates 65% of their total revenues through domestic sales.

The effects of demonetization were also expected to be heterogeneous; depending on liquidity needs, firms faced varying levels of exposure to the policy shock.

To study the consequences of liquidity shocks on firm export performance, we construct a novel data set with dis-aggregated, high-frequency data on firm-level exports (customs transactions), matched with annual balance sheet information on firms, as well as inter-district domestic trade data. We use these data to explore the direct effects of demonetization-induced cash shortages on exporters that occur due to the exporters' own cash dependence and also study indirect effects arising from the fact that exporters are embedded in domestic supply chains with other cash-dependent domestic firms. The annual firm balance sheets and the inter-district domestic trade data allow us to construct two interrelated measures capturing the intensity of demonetization that also reflect the importance of domestic supply chains for exporters – one varying spatially, at the district level, and the other at the firm level. The customs transactions data, available at a temporally granular level, allows us to focus solely on the liquidity constraints generated by currency shortages while controlling for the broader macroeconomic environment and for other channels that could work, for instance, through the foreign exchange market.[4] Specifically, using this data and difference-in-differences specification, we compare the evolution of the outcomes for exporters before and after demonetization in districts and firms that were differentially affected by policy-induced cash shortages. Note that our focus on firm exports enables us to cleanly identify the effect of cash shortages in the domestic economy, while keeping the demand for firms' exported products unchanged, as it is unlikely that international customers were affected by demonetization.

We study first the causal impact of cash shortages on firm exports along the spatial dimension (by exploring variation in impact across firms in different districts). To do this, we utilize district-level measures of the demonetization shocks constructed by Crouzet et

[4]Importantly, in practice, while demonetization decreased currency in circulation, it did so without changing the policy rate or exchange rate. Appendix B.1 visually depicts exchange rate movements during the demonetization episode. Exchange rates during this period were stable, consistent with the stable money supply (Crouzet et al., 2023) and interest rates (Gopinath et al., 2020) documented in previous studies.

al. (2023)[5] and Chodorow-Reich et al. (2019).[6] We then explore both the direct effects on exporting firms due to currency shortages and indirect effects through domestic supply chains using the following approach. We construct a measure of the total sales from one district to other *destination* districts and the total purchases of that district from other *source* districts. Then, for each exporting firm headquartered in a particular district, we define (i) own shock – the shock for that district, (ii) destination shock – the sales-weighted average shock across destination districts, and (iii) source shock – the purchase-weighted average shock across source districts.[7]

Using these two sets of complementary measures, we find that firm exports significantly decline in response to destination district shocks. In contrast, exports remain statistically unchanged in response to own-district or source-district shocks. These results suggest that exporters are not directly affected by the cash shortages since they most likely use electronic payment for their input purchases. However, they indicate that currency shortages negatively affect firm exports only indirectly through domestic supply chains, especially when there are shocks in destination districts, i.e., in districts where their domestic customers are located. In essence, we find that when domestic customer firms get negatively affected by cash shortages, it indirectly affects exporters connected to them.

Having established the importance of the supply chain network in the transmission of the cash shortages, we use a more direct, firm-level measure capturing an exporting firm's exposure to demonetization-induced cash shortages of their domestic customer firms: the average of a firm's pre-demonetization (2013-15) accounts receivable to sales (AR/S) ratio.[8]

[5]This measure exploits district-level differences in the relative importance of chest banks (banks with a currency chest) in the local banking market.

[6]This measure uses Reserve Bank of India (RBI) data on the variation in the replacement rate of demonetized notes across districts.

[7]Ideally, we would have used pre-demonetization firm-to-firm linkages matched to exporters in the customs-transactions data set. For example, Lucie et al. (2019); Khanna et al. (2022); Castro-Vincenzi et al. (2024); Panigrahi (2021), use firm-to-firm transaction data for one or more states in India. However, such data cannot be matched to exporters in the customs-transactions data using the firm identifiers provided.

[8]See Appendix B.2 for an illustration of this logic and Petersen and Rajan (1997) for a comprehensive discussion of trade credit. Accounts receivable to sales is a standard index of trade credit reliance, as discussed

The underlying rationale for this is as follows. Accounts receivable refer to the money a company's customers owe for goods or services they have received but not yet paid for. They are a part of the firm's current assets and are used to satisfy working capital needs, such as input purchases and wage payments. Firms with high accounts receivable to sales are therefore more dependent on payments from prior sales to domestic buyers. Following the sudden demonetization announcement, these firms' working capital was affected when domestic buyers could not pay for their previous purchases due to the currency shortages. Importantly, a firm's pre-demonetization AR/S is plausibly exogenous in this context as it is largely explained by domestic buyers' characteristics associated with the need to make their payments with credit (Petersen and Rajan 1997; McMillan and Woodruff 1999; Klapper et al. 2012) and is unlikely to be correlated with the other factors affecting firm exports following demonetization. To corroborate our main results obtained using the (AR/S) measure, we also use the average pre-demonetization accounts payable to expenditures (AP/E) ratio of the domestically sold products, which is the exporter's exposure to cash shortage shocks in the domestic supply chain and essentially measures the effect of demonetization on domestic customers' ability to pay exporters.

We also use various initial firm characteristics that are likely to be correlated with firms' own cash usage: cash holdings, accounts payable, interest payment, banking borrowing, firm age, total assets, accounting profit, and capital. Adding these covariates allows us to test whether exporters were affected by demonetization because of their reliance on currency notes for payments. For example, if exporters use domestic currency notes (instead of electronic payments), those exporters with more extensive initial cash holdings would likely be more affected by demonetization. As another example, since old firms are more likely to use domestic currency notes than young firms that likely use more electronic payment, assuming that exporters use domestic currency notes for their transactions, the negative effect of demonetization on exporters would be more substantial for old firms.

in Love et al. (2007); Levchenko et al. (2011).

Using our primary firm-level measure of exposure to domestic buyers' cash shortages, our main results are as follows. We first find an adverse effect of demonetization on firm-level exports. Specifically, our estimates suggest that exports of firms with ten percentage points higher accounts receivable to sales declined by 4 percent relative to their counterparts immediately following demonetization in November of 2016. Comparing the firms that were most exposed to the policy to those minimally exposed (90th vs. 10th percentiles), we find a 13% differential drop in exports in the first month immediately following the demonetization. We also find that this negative effect on exports through domestic buyers was short-lived and dissipated over time: by December 2017, there were no statistically significant differences in exports across differentially exposed firms. In Appendix D.7, using our estimates, a back-of-the-envelope calculation suggests that the overall exports declined by 14.13 billion USD (5.34% of total 2015 Indian exports) due to the demonetization.[9] On the other hand, using various initial firm characteristics, we do not find evidence that exporters suffer from demonetization because they use domestic currency notes for their own transactions, echoing the results exploiting the spatial dimension of the data.

Our analysis points to a causal relationship between liquidity constraints and exports that arise due to their linkages to domestic supply chains. Specifically, when the economy faces currency shortages, exporters can encounter liquidity issues due to delayed payments by domestic buyers, which then inhibits their ability to cover input costs and forces them to reduce output and exports.[10] Three additional empirical findings underscore the relevance of this mechanism. First, our estimated effect of demonetization is on real, not nominal, exports. Separately considering export prices and export quantities in our analysis, we find that export quantities declined immediately following the announcement of demonetization, whereas the effect on export prices was largely muted both before and after the episode. Indeed,

[9]We note that this paper focuses on continuing firms, and we do not evaluate the entry or exit margin or other broader general equilibrium effects resulting from demonetization.

[10]Appendix B.4 illustrates this mechanism when AR/S is used.

we observe that the quantitative adjustment occurred through the number of products and destinations. Second, we show evidence that firms with greater exposure to demonetization decreased their use of inputs in production. Specifically, we find that more exposed firms lowered employee compensation, material expenses, and inventory stock, implying lower output.[11] Finally, we find that the effect of demonetization is more substantial when exporters rely more on domestic markets and domestic buyers who are more likely to use cash.

To the best of our knowledge, our paper is the first to suggest a causal link between domestic currency notes in circulation and firm exports. While it might seem unexpected given that many exporters are large entities (Bernard et al., 2009), deal in foreign currencies (Gopinath et al., 2020), and often use electronic payments, our research underscores the counterpart risk associated with their transactions with their domestic partners. Although exporters themselves may not use domestic currency in their export transactions, they do so in their interactions with domestic buyers; cash shortages in the economy can, therefore, impact their output. In studying exporters and financial frictions, previous papers have emphasized bank credit (Amiti and Weinstein, 2011; Paravisini et al., 2014; Xu, 2022), credit constraints in general (Minetti and Zhu, 2011; Manova, 2013), the complementarity between multinational activities and exports (Manova et al., 2015; Kalemli-Ózcan et al., 2020), liquidity constraints associated with the fixed entry costs (Chaney, 2016a), financing frictions due to the slow and risky inflow of export revenues (Schmidt-Eisenlohr 2013; Ahn 2020) and exchange rate changes (Acharya and Vij 2020; Bruno and Shin 2023; Hardy and Saffie 2023). Our paper highlights that, in addition to these factors, the availability of cash in the economy is crucial for exports in cash-reliant economies.

More broadly, this paper is closely related to longstanding literature in finance studying corporate liquidity management, beginning from Keynes (1936).[12] While most previous

[11] Indeed, firms also decrease their bank borrowing and interest expenses, indicating the banking system was unable to provide liquidity to help firms during the demonetization episode.

[12] See, for example, Goldberg and Nozawa (2021) on the link between liquidity supply shocks and asset prices, Brown et al. (2021) on the role of bank credit lines in response to cash flow shocks, Campello et al.

studies focus on the general liquidity conditions of firms, our study shows that the shortage of domestic currency notes, which are typically underemphasized in studying corporate liquidity, can have a large real impact on firm production and sales to foreign markets in a cash-reliant economy. In using the firm-level exposure measures, we rely on the literature on the spillovers and propagation of shocks that study financial frictions in production networks (Kim and Shin, 2012; Kalemli-Özcan et al., 2014; Bigio and La'O, 2020) and trade credit specifically (Giannetti et al., 2011; Jacobson and von Schedvin, 2015; Costello, 2020a; Luo, 2020; Reisher, 2020; Altinoglu, 2021; Adelino et al., 2023).[13]

This paper also contributes to the literature studying the effects of demonetization. Previous studies have looked at effects on district-level economic activity (Chodorow-Reich et al., 2019; Chanda and Cook, 2022), electoral outcomes (Bhavnani and Copelovitch, 2018; Khanna and Mukherjee, 2023), domestic agricultural trade (Aggarwal and Narayanan, 2022), digital technology adoption (Crouzet et al., 2023; Aggarwal et al., 2023; Ghosh et al., 2024), household consumption (Karmakar and Narayanan, 2020; Agarwal et al., 2024), tax compliance (Das et al., 2023), and firm-level labor and material shares (Subramaniam, 2020). In contrast to these relatively aggregate analyses, this paper utilizes detailed customs transactions dataset, district-to-district internal trade data, and firm balance sheet data to show the international implications of cash shortage through the domestic supply chain network.

(2011), Iyer et al. (2014), Chodorow-Reich (2014), Chodorow-Reich and Falato (2022), Di Giovanni et al. (2022b) on the role of liquidity on corporate outcomes during the global financial crisis, and O'Hara and Zhou (2021), Kargar et al. (2021), Autor et al. (2022), Gourinchas et al. (2024) for recent studies about liquidity constraints and corresponding policy proposals during the Covid-19 crisis. Almeida et al. (2014), Bolton et al. (2024), Denis and Wang (2024) provide comprehensive surveys of this literature.

[13]More generally, a large literature in economics and finance has studied networks (Chaney, 2014, 2016b; Barrot and Sauvagnat, 2016; Boehm et al., 2019; Costello, 2020b; Carvalho et al., 2021; Di Giovanni et al., 2022a; Huo et al., 2024; Kalemli-Özcan et al., 2025).

2 Demonetization

On November 8, 2016, the Prime Minister of India, Narendra Modi, announced that the government was, with immediate effect, demonetizing "high denomination" currency notes of ₹ 500 or ₹ 1,000 (INR). These notes were immediately invalid as legal tender, but holders of the demonetized currency notes were given until December 31, 2016, to deposit their demonetized notes in their bank accounts and/or exchange demonetized currency for new notes (issued in denominations of ₹ 500 and ₹ 2,000). The rationale offered by the government for this move was that demonetization would allow the state to invalidate undeclared income and wealth held in cash, as well as counterfeit currency in circulation (Lahiri, 2020).

Since demonetized currency notes accounted for over 85 percent of currency in circulation, the implementation of the policy posed enormous logistical challenges. As Lahiri (2020) comprehensively documents, "automatic teller machines ran out of cash for long periods of time across the length and breadth of the country including the major metropolitan cities." Further, when ATMs were supplied with new currency, it was initially mostly in the form of ₹ 2,000 bills, "which was not helpful for daily transactions whose average cash value tended to be much smaller." The process of re-monetizing the economy was not helped by the fact that, in the subsequent days and weeks, the government continuously revised the conditions under which deposits of the older currency could be made, changing both the criteria for deposits of old currency and daily limits on withdrawals of new currency.

By the end of the first quarter of 2017, the RBI reported that nearly all demonetized notes had been returned, and the re-monetization process was essentially complete. However, re-monetizing the economy with the new currency bills proved to be slow and disruptive. This sudden removal of currency in circulation affected the Indian economy (Chodorow-Reich et al., 2019), as it was heavily reliant on cash holdings before demonetization. Domestic firms in India especially relied on cash for wage payments – almost 80% of workers received wages

only in cash before demonetization (Figure OA.3a).[14] Firms widely reported substantial challenges in their ability to pay their suppliers and workers and that demonetization had "chilled" the economy, causing significant supply chain disruptions to small-, medium-, and even large-scale enterprises (Singh 2016).

3 Data and Summary Statistics

This paper uses several novel data sets. First, we construct inter-district trade data using the TINXYS (Tax Information Exchange System) dataset. This dataset is hosted by the Goods and Services Tax Network (GSTN) and contains CST (central sales taxes) invoices for trades between two firms. Since the firm identifier in the dataset (TIN - Tax identification number) could not be matched to the customs transactions data, we use the location information of the firms to construct the district-district trade data. Note that the data is only available until October 2016, and we therefore use it to construct the pre-demonetization exposure to the district-level shocks.

Export data come from Indian Customs, made available by Cybex Exim Solutions. The data includes the monthly value and volume of exports by firm, destination, 8-digit Harmonized System (HS) code, and unit (e.g., Kgs, Pcs, etc.). The sample begins in 2015 and ends in 2017, covering the months before, during, and after the 2016 demonetization episode. Export information is collected from over 140 Indian ports and customs stations, including small Inland Container Depots (ICDS), Land Customs Stations (LCS), Sea Ports, and Air Ports. Firms in the Indian Customs dataset are identified by an Importer-Exporter Code (IEC), a mandatory identification number for any entity exporting from India. After cleaning and aggregating total export values by year, our data cover approximately 70% of average total exports reported, at the sector-level, in the United Nations' COMTRADE

[14] More than 85% of the total workforce in developing economies continue to receive their wages in cash (Breza et al., 2024), underscoring the importance of cash in general.

databse (published online by Trademap.org).[15]

There are two notable advantages to using highly detailed customs data to study the effect of liquidity shocks on exports. First, the dataset documents high-frequency (monthly) firm-level exports. This feature enables us to focus on a narrow window around the demonetization episode and to exploit its sudden nature for our identification strategy. Second, the dataset separately records the price and quantity of exports and document the number of products and destinations to which each firm exports at a given point in time. This information helps uncover the underlying mechanism behind the reduced-form relationship between exports and liquidity.

We combine exporting firm information with Prowess data collected by the Centre for Monitoring Indian Economy (CMIE). The data includes annual balance sheet information for listed and unlisted firms in India. Notably, the data record detailed product codes for firms' inputs and primary outputs, which are useful for investigating the liquidity constraints arising from the domestic input-output network but are rarely available in standard firm-level data. The data includes approximately 30,000 firms annually from 2013 to 2017, the period of analysis for our study. Using this information, we measure firm-specific exposure to demonetization, study the effects on firm production, and test the robustness of the results to control for pre-demonetization firm characteristics and primary industry code. The data records headquarters address information but does not have establishment-specific location information. For each firm with a valid Importer-Exporter Code (IEC) in the Customs dataset, we access the establishment location information from the Indian Customs National Trade Portal (IECGATE). Appendix A provides additional details on data processing.

Table 1 reports summary statistics for the variables. Panel A shows large heterogeneity in exporter characteristics across firms and time. Panels B and C show the variation in the measure of exposures, which are explained in detail in the following sections.

[15]Appendix D.4 shows that the main results are robust to using sectors that cover more than 70%, 75%, 80%, and 85% of the exports and using a balanced set of sectors from 2015-17.

Variable	Obs	Mean	Std. Dev.	P10	P50	P90
	Panel A: Exports by Firm and Month					
ln Export	630561	15.76	1.913	13.373	15.837	18.07
ln Quantity (Tornqvist)	630561	15.586	2.437	12.479	15.776	18.419
ln Price (Tornqvist)	630561	.174	1.511	-1.302	.123	1.728
Number of 8-digit HS code	631289	5.816	9.563	1	3	13
Number of Destinations	631166	4.582	5.68	1	3	10
	Panel B: District-Specific Variables					
$\bar{\mathbb{1}}_{\text{CR}\leq.25}$	132	.303	.461	0	0	1
$\mathbb{1}^{\text{destination}}_{\text{CR}\leq.25}$	132	.431	.169	.243	.415	.644
$\mathbb{1}^{\text{source}}_{\text{CR}\leq.25}$	132	.089	.15	.001	.01	.302
Chest	121	.538	.18	.303	.537	.768
$\text{Chest}^{\text{destination}}$	121	.547	.059	.483	.555	.621
$\text{Chest}^{\text{source}}$	121	.522	.079	.409	.539	.634
	Panel C: Firm-Specific Variables					
AR/S	4035	.21	.16	.063	.178	.374
AP/E_p (Buyer)	3342	.183	.131	.086	.161	.291
ln Age	4034	3.234	.517	2.565	3.258	3.871
ln Bank Borrowings	4034	5.324	1.795	3.049	5.387	7.544
ln Cash	4034	-.173	1.584	-2.181	-.331	1.955
ln Interest Payment	4034	3.381	1.776	1.109	3.438	5.621
ln Total Assets	4034	7.145	1.536	5.268	7.111	9.142
(Domestic S)/(Total S)	3245	.649	.294	.197	.688	.982

Table 1: Summary Statistics

Note. Table 1 reports summary statistics of the variables. Panel A reports export information in the Customs data by firm and month, Panel B reports district-specific variables, and Panel C reports firm-specific variables. Section 4 describes the variables presented in Panel B, Section 5 describes the variables presented in Panel C, and Appendix C describes how export quantity and price indexes presented in Panel A are constructed.

4 Direct and Indirect Measures of Cash Shortage

Cash shortages can affect exporters both directly because of their own cash dependence or indirectly because they are linked to other cash-dependent domestic firms in domestic supply chains. An average exporter in our sample, for example, generates 65% of their total revenues through domestic sales. Whether and to what extent cash shortages affect exporters directly or indirectly, therefore, is an empirical question. We first focus on the consequences of demonetization-induced cash shortages along the domestic supply chain for firm-level exports. Ideally, we would have used firm-to-firm linkages over time matched to exporters in the customs transactions data. Since such data is not available in India, we instead use inter-district domestic trade data described in Section 3 to construct spatially varying measures of exposure to demonetization along the domestic supply chain.

We follow Crouzet et al. (2023) in constructing a measure of district-specific currency shocks by considering the relative importance of banks operating a currency chest ("chest banks") for each district k. Currency chests are branches of commercial banks that conduct currency management on behalf of the RBI, i.e., they receive currency from the RBI and, in turn, manage the local distribution. Thus, districts with larger deposits of chest banks are expected to receive more new currency notes at the time of demonetization and are less exposed to currency shortages. At the same time, currency chests have been active in India for decades before demonetization, and the list of currency chests has largely remained stable over time, making it plausibly exogenous to individual firm exports during the demonetization.

Districts differ in the number of currency chests and in the chest banks' share in the local deposit market. Then, we have:

$$\text{Chest}_k = \frac{\text{pre-demonetization deposits of chest banks}_k}{\text{pre-demonetization total deposits}_k}$$

where Chest_k is the share of deposits held in chest banks in district k. See Crouzet et al.

(2023) for a detailed discussion on the construction of this measure. Since district-level cash shortages were expected to be smaller where the chest banks had a larger share in the local banking market, we have:

$$\text{shock}_k = 1 - \text{Chest}_k$$

Next, we use the inter-district trade data to define for each district how much it sells to other districts (destination districts) and how much it purchases from all other districts (source districts). Then, we measure the destination shock as follows:

$$\text{shock}_k^{\text{destination}} = \sum_d \omega_{k,d}^{\text{destination}} \text{shock}_d$$

where $\omega_{k,d}^{\text{destination}}$ is the share of values sold to destination d by district k, and chest shock_d is the destination currency replacement measure. Similarly, the source shock is defined as:

$$\text{shock}_k^{\text{source}} = \sum_s \omega_{k,s}^{\text{source}} \text{shock}_s$$

where $\omega_{k,s}^{\text{source}}$ is the share of values purchased from source district s by district k.

Using the district-level shocks (destination, own, and source), we estimate event-study specifications on firm exports of the form:

$$\begin{aligned} y_{ikjt} = &\sum_{t=-11}^{t=-2} \beta_t [\text{shock}_k^{\text{destination}}] + \sum_{t=-11}^{t=-2} \beta_t [\text{shock}_k^{\text{own}}] + \sum_{t=-11}^{t=-2} \beta_t [\text{shock}_k^{\text{source}}] \\ &+ \sum_{t=0}^{t=13} \beta_t [\text{shock}_k^{\text{destination}}] + \sum_{t=0}^{t=13} \beta_t [\text{shock}_k^{\text{own}}] + \sum_{t=0}^{t=13} \beta_t [\text{shock}_k^{\text{source}}] \\ &+ \lambda_i + \delta_{jt} + \nu_t + \epsilon_{ikjt}, \end{aligned} \tag{4.1}$$

where y_{ikjt} denotes firm-level exports for firm i, headquartered in district k, producing products in industrial sector j, in time t. λ_i denotes firm fixed effects that control for

all time-invariant firm characteristics, δ_{jt} denotes industrial sector $\times$ month fixed effects that control for time-varying characteristics at the industry level, and ν_t denotes month fixed effects. We normalize $t = 0$ to be the month-year (November of 2016) in which the Government of India made the demonetization announcement and set $t = -1$ to be the omitted base period (October of 2016, i.e., one month before demonetization). Finally, ϵ_{ikjt} denotes the idiosyncratic error term. We cluster standard errors at the headquarter district level. The β_t's are the coefficients of interest and capture the differential outcomes for firms with different levels of own, destination, and source shocks for each month relative to the base period. The month-by-month coefficients (β_t) depict the dynamic evolution over time of our outcomes of interest and, in turn, allow us to test for the parallel pre-trends assumption.

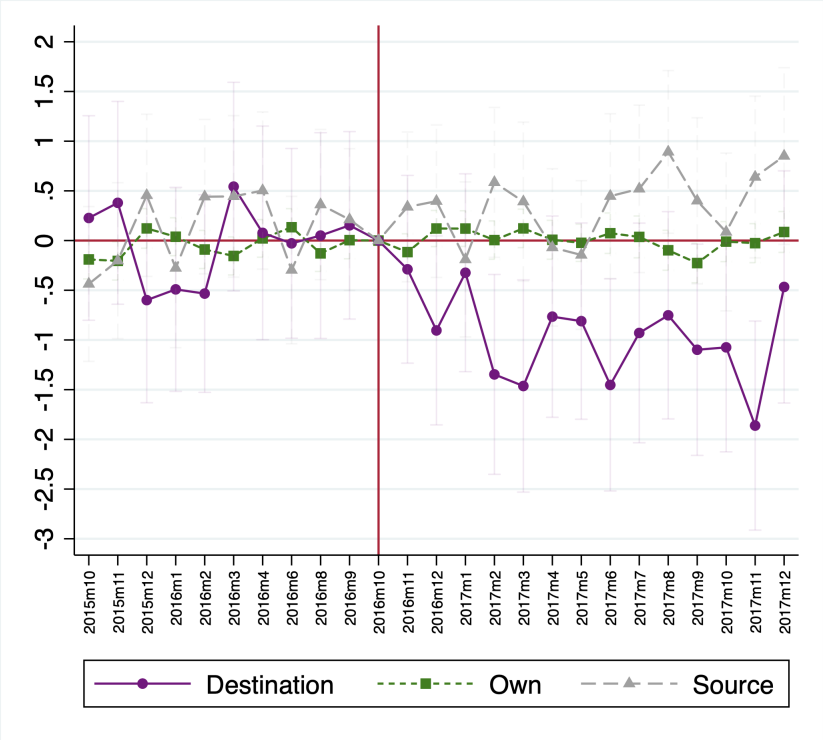


Figure 1: Exports and Demonetization: Using District-level Shock

Notes. Figure 1 plots the month-by-month coefficients (β_t) in Equation (5.1). The 90% confidence interval is reported for each estimated coefficient, and standard errors are clustered by firm headquarter district.

Figure 1 plots the β_t's on own, destination, and source shocks from estimating Equation (4.1). Before demonetization, we find that the coefficients on own, destination, and source shocks are statistically insignificant, confirming the parallel pre-trends assumption required for causal inference in event-study designs. Notably, we also do not find any anticipatory effects before demonetization, thus re-emphasizing the unanticipated nature of demonetization. We find an immediate post-demonetization decline in firm exports in response to destination shocks. However, we find no impact of own or source shocks on firm-level exports. In sum, we find that firm exports decline more for firms whose customers are in districts facing large currency shortages relative to those whose customers are in districts with smaller currency shortages. Since own and source shocks did not affect firm-level exports, our results point to the fact that exporters most likely do not use cash for their own transactions with input suppliers.

It is possible, that along with cash shortages, the demonetization episode increased overall uncertainty. The addition of month fixed effects would controls for overall macroeconomic uncertainty affecting all firms. It is also plausible that the level of cash shortages across districts led to differential uncertainty. For example, a district facing a larger cash shortage faced higher uncertainty. In such a case, firm exports would have decreased more in districts with higher uncertainty (cash shortages) than in districts with lesser uncertainty. However, we do not find any decrease in firm exports in response to own shocks. Furthermore, in the firm-level analysis discussed in Section 5, we also add district $\times$ month fixed effects and thus control for differential district-level uncertainty.

Having shown that the parallel pre-trends assumption is satisfied, next, we estimate the "static" average treatment effect of district-level shocks (destination, own, and source) on firms using difference-in-differences specifications of the form:

$$\begin{aligned} y_{ikjt} = \beta_1[\text{shock}_k^{\text{destination}}] \times post_t + \beta_2[\text{shock}_k^{\text{own}}] \times post_t \\ + \beta_3[\text{shock}_k^{\text{source}}] \times post_t + \lambda_i + \delta_{jt} + \nu_t + \epsilon_{ikjt} \end{aligned} \tag{4.2}$$

where y_{ikjt}, λ_i, δ_{jt}, and ν_t are the same as described in Equation (4.1). $post_t$ is a dummy variable that equals 1 for all months/years after demonetization (November 2016) and is 0 for months preceding the event. The own, destination, and source shocks are $\text{shock}_k^{\text{own}}$, $\text{shock}_k^{\text{destination}}$, and $\text{shock}_k^{\text{source}}$, respectively. Apart from the Crouzet et al. (2023) measures for these shocks as described earlier, we also use an alternate measure using Chodorow-Reich et al. (2019). Specifically, we use Chodorow-Reich et al. (2019) in constructing a measure of district-specific currency shocks by considering the currency replacement measure for each district k:

$$\text{CR}_k = \frac{\text{post-demonetization currency}_k}{\text{pre-demonetization currency}_k}$$

where the post-demonetization currency_k is the post-demonetization currency notes in circulation in district k and pre-demonetization currency_k is the pre-demonetization currency notes in circulation in district k.[16] Since these measures are not publicly available, we define the district-specific shock based on the map provided in Figure 5 of Chodorow-Reich et al. (2019), which defines seven categories of cash shortage across districts and the range of currency replacement values in each category. As in Chodorow-Reich et al. (2019), we use a cutoff of $\text{CR}_k = 0.25$ to categorize districts that are the most affected by currency shortages. Specifically, we define an indicator variable measuring the shock_k for district, which takes the value of 1 if the district is the most affected and 0 otherwise:

$$\text{shock}_k = \mathbb{1}_{\text{CR}\leq.25,k} = \begin{cases} 1 & \text{if } \text{CR}_k < 0.25 \\ 0 & \text{otherwise} \end{cases}$$

We then use this indicator variable in conjunction with the inter-district trade data to define

[16] Chodorow-Reich et al. (2019) provide a detailed discussion on the plausible exogeneity of the district-level currency replacement measure (CR). The rationale is that, due to the unanticipated nature of demonetization, the RBI did not precisely know the geographic distribution of existing 500 and 1000 INR notes in October 2016, and hence until 2017Q1, the replacement rate of currency across districts was limited and not related to local demand conditions.

the source, own, and destination shocks similar to their construction using the Crouzet et al. (2023) measure.[17] Note that although the district-level shock is an indicator variable, the weighted average of how much each district sells (purchases) to (from) other districts generates variation in the source and destination shocks.

In using the district-level shocks, we primarily rely on firms' headquartered districts. However, exporters may have multiple establishments, and the location of the headquarters may imprecisely measure the exposure to the cash shortage. As a supplementary measure, we use information on the location of establishments, assign the district-level shock measure to each establishment, and take a simple average of this measure across establishments to consider the firm-specific measures. Using all the establishment locations for a firm i, the shock^l for all $l \in \{\text{own, destination, source}\}$ is defined as:

$$\text{shock}_i^l = \frac{1}{N_i} \sum_e \text{shock}_{k,e}^l$$

where i is firm, e is the establishment, and N_i is the number of establishments of firm i.[18]

We begin by discussing our results from estimating Equation (4.2), where we essentially compare the exports of firms facing shocks across districts (destination, own, and source) exposed to different levels of cash shortages both before and after demonetization. To shed light on the effects of cash shortage shocks across the domestic supply chain, across the columns in Table 2, we use two alternate definitions for destination, own, and source districts. In column (1), we use the three district-level shocks constructed using the measure of Crouzet et al. (2023), but only use the headquarter location of the firm. Since firms in our data set are multi-plant establishments, in column (2), we consider all the plants of a firm and take the average value of $\text{shock}_{k,e}^{\text{l}}$ for all $l \in \{\text{own, destination, source}\}$ across districts where their

[17] We replace chest shock_k with shock_k to construct the own, destination, and source shocks using the Chodorow-Reich et al. (2019) measure.

[18] Note that the establishment location is based on the data downloaded in 2023, not the year before demonetization. Also, we don't have establishment-specific export information and can only take a simple average across establishments. Thus, we use this specification only as a robustness check.

	(1)	(2)	(3)	(4)
	Exports			
	$\text{shock}_i^{\text{destination}}$, shock_i, $\text{shock}_i^{\text{source}}$ are			
	Chest^{hq}	$\overline{\text{Chest}}$	$\mathbb{1}^{\text{hq}}_{\text{CR}\leq.25}$	$\bar{\mathbb{1}}_{\text{CR}\leq.25}$
$\text{Post}_t \times \text{shock}_i^{\text{destination}}$	-1.087***	-0.922**	-0.144***	-0.116***
	(0.311)	(0.353)	(0.050)	(0.042)
$\text{Post}_t \times \text{shock}_i^{\text{own}}$	0.052	0.015	-0.016	-0.011
	(0.066)	(0.062)	(0.017)	(0.016)
$\text{Post}_t \times \text{shock}_i^{\text{source}}$	-0.141	-0.110	0.158*	0.127
	(0.295)	(0.294)	(0.091)	(0.092)
Firm FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
Month x Sector FE	✓	✓	✓	✓
Number of Clusters	118	118	131	218
R^2	0.591	0.591	0.578	0.571
$\text{E}[\text{Exports}_i\text{:Post} \times (\text{shock}^d_{\text{p90}}\text{-shock}^d_{\text{p10}})]$	-.104	-.083	-.041	-.033
$\text{E}[\text{Exports}_i\text{:Post} \times (\text{shock}^o_{\text{p90}}\text{-shock}^o_{\text{p10}})]$	.028	.008	-.016	-.011
$\text{E}[\text{Exports}_i\text{:Post} \times (\text{shock}^s_{\text{p90}}\text{-shock}^s_{\text{p10}})]$	-.019	-.012	.001	.001
Observations	84059	84059	193288	230782

Table 2: Exports and Demonetization: Using District-level Shock

Note. The sample is at firm-month-level, covering the years 2015-17. Post_t equals one after October 2016 and 0 otherwise. The dependent variable is the log value of exports at the firm-month level, and shock_i is measured in four different ways. Chest^{hq} in column (1) is measured by assigning the district-specific chest exposure measure to each firm based on their headquarters district, and $\overline{\text{Chest}}$ in column (2) is measured by taking the average of the district-specific chest exposure across districts within each firm. Similarly, $\mathbb{1}^{\text{hq}}_{\text{CR}<.25}$ in column (3) is measured by taking the average of the district-specific dummy variable measuring currency CR ratio to each firm based on their headquarters district, and $\bar{\mathbb{1}}_{\text{CR}\leq.25}$ used in columns (4) is measured by taking the average of the district-specific dummy variable measuring currency CR ratio across districts where firms have their plants within each firm. The $\text{shock}_i^{\text{destination}}$ and $\text{shock}_i^{\text{source}}$ are measured by taking the weighted average of each district-specific shock across the destination and source districts, respectively. The weight is the total values sold to the destination and source districts, respectively, from January 2011 to October 2016. Given the weighted average district-level measure, we again assigned them to firm headquarters for columns (1) and (3) and took the average across districts where firms had their plants within each firm for columns (2) and (4). In using $\text{shock}_i^{\text{destination}}$ and $\text{shock}_i^{\text{source}}$, we control for the initial share of missing destination and source shock, respectively, each interacting with the post dummy variable. The headquarters district population (interacted with the post-dummy variable) is controlled in all columns. Standard errors are clustered at the headquarters district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

establishments are located. In columns (3) and (4), we use the shocks constructed similarly using Chodorow-Reich et al. (2019) measure. In column (1), we find that exports of firms that experienced a destination district shock at the 90th percentile (i.e. highly affected) relative

to another that received a shock at the 10th percentile (i.e. less affected) declined by 10.4%. This pattern remains consistent across columns 2 through 4 while using alternate measures for the shock definitions with a decline in exports by 3.3%-8.3%. We find insignificant effects of shocks in own and source districts. Across columns, firm exports decline significantly in response to shocks to destination districts, but we find no changes in response to shocks in the own districts or the source districts. Taken together, our results suggest that cash shortage shocks in destination districts significantly reduce firm exports. This result highlights that even when exporters themselves may not heavily rely on cash for their input purchases, their exports can be indirectly affected due to cash shortages for their domestic customers.

5 Firm-level Exposure

In section 4, we showed that cash shortage shocks in destination districts (but not in source or own districts) negatively affect firm-level exports. We interpret these results as suggesting that cash shortages in districts where the domestic customers of exporters are located resulted in negative effects on exports. Our approach to measuring a firm's exposure to demonetization reflects the cascading effect of cash shortages: domestic customers facing liquidity constraints subsequently impact exporters. We, therefore, use the most related relevant item in a firm's balance sheet as our primary measure of firm-specific exposure to demonetization. We use the *pre-demonetization* ratio of mean accounts receivable to mean sales, denoted by (AR/S). Specifically, we calculate a firm's (AR/S) by taking the ratio of the mean value of accounts receivable (AR) between 2013-15 and the mean value of sales (S) between 2013-15. As discussed earlier, accounts receivable are created when a firm (seller) allows buyers to purchase their goods or services on credit, likely because these buyers cannot easily access credit from financial institutions or because of pre-existing relational contracts (Petersen and Rajan, 1997; McMillan and Woodruff, 1999). Thus, firms with accounts receivable have already sold output, with the expectation that they would receive some part of the

corresponding payment at a future date. If domestic buyers are unable to make timely payments for their prior purchases, sellers face problems as they depend on payments from buyers to handle their working capital needs for their input purchases.[19] While the main analysis in this section focuses on total account receivables for simplicity, Appendix D.1 shows that all the effect arises from the *domestic short-term* receivables. Also, our results remain robust to the adjustment of the AR/S measure by the firm's accounts payable (AP) and borrowings, and, separately, through the use of indicator variables that are assigned based on whether the AR/S for the firm is above or below the mean, median, 75th, and 25th percentiles of AR/S (see Appendix D.3).

To analyze the effect of demonetization on firm-level outcomes, we estimate event-study specifications of the form:

$$y_{it} = \beta_0 + \sum_{t=-11}^{t=-2} \beta_t \left[\frac{AR}{S}\right]_i + \sum_{t=0}^{t=13} \beta_t \left[\frac{AR}{S}\right]_i + \lambda_i + \nu_t + \epsilon_{it}, \tag{5.1}$$

where y_{it} is the outcome of interest for firm i and month t, $\left[\frac{AR}{S}\right]_i$ is the pre-demonetization mean ratio of accounts receivable to sales as defined earlier, λ_i denotes firm fixed effects that control for all time-invariant firm characteristics, and ν_t denotes month fixed effects. Finally, ϵ_{it} denotes the idiosyncratic error term. We normalize $t = 0$ to be the month-year (November of 2016) in which the Government of India made the demonetization announcement and set $t = -1$ to be the omitted base period (October of 2016, i.e., one month before demonetization). The inclusion of firm fixed effects means that we estimate within-firm changes over time for firms with different levels of exposure to demonetization. The β_t's are the coefficients of interest and capture the differential outcomes for firms with different levels of pre-demonetization

[19] See Appendix B.2 for a simple illustration of this logic with a figure. See also Reisher (2020) for a model showing the differential exposure to a shock depending on the accounts receivable (conditional on other variables that we control for), and Love et al. (2007); Levchenko et al. (2011) for the empirical use of this measure. Following the previous literature, we normalize the value of accounts receivable by the value of the sales of the firm.

AR/S for each month relative to the base period. This event-study design specification has two distinct advantages in our setting. First, the month-by-month coefficients (β_t) depict the dynamic evolution over time of our outcomes of interest. Second, the coefficients for the months preceding demonetization help us test for the parallel pre-trends assumption central to estimating our difference-in-differences specification.

Further, to estimate the average treatment effect of the effects of demonetization on firms, we estimate difference-in-differences specifications of the form:

$$y_{ijkt} = \beta_0 + \beta_1 \left[\frac{AR}{S}\right]_i \times post_t + X_{i(2013-15)} \times post_t + \lambda_i + \upsilon_{kt} + \delta_{jt} + \epsilon_{ijkt}, \tag{5.2}$$

$post_t$ is a dummy variable that equals 1 for all months/years after demonetization (November 2016) and is 0 for months preceding the event, $X_{i(2013-15)}$ consists of a set of pre-demonetization firm-level control variables (age, bank borrowing, cash holding, interest expense, total assets, accounting profit, capital, cash to assets), measured as averages over 2013-15 and all other terms are as previously defined in Equation (5.1). Some outcome variables of interest are measured at an annual level, and for those regression specifications, t denotes the year of observation. We also control for district $\times$ month fixed effects (ν_{kt}) in these specifications. This allows us to control for district-level time-varying characteristics such as differential uncertainty, labor market conditions, and local demand across districts. δ_{jt} denotes industry-by-month fixed effects that control for time-varying characteristics at the industry level. In contrast to Equation (4.1), this difference-in-differences specification provides a "static" estimate of the average treatment effect represented by β_1, the coefficient on the interaction of $\left[\frac{AR}{S}\right]_i$ and $post_t$, which measures the average of the within-firm differences in outcomes for firms with different levels of exposure to demonetization before and after November 2016.

The identification strategy for equations (5.1) and (5.2) is based on two key assumptions. First, exporters were not able to anticipate the demonetization announcement and change their behavior accordingly. As discussed in Section 2, the demonetization episode was indeed

unexpected, as it was intended to remove undeclared wealth and counterfeit currency by suddenly invalidating the relevant currency notes. It is widely recognized that the policy was a surprise to economic entities in India (Lahiri, 2020) – and is confirmed by the pre-trends results for various outcome variables based on equation (5.1). Second, exporters that initially had high ratios of accounts receivable to sales must not be differentially affected by other events (if any) that happened simultaneously with demonetization. Focusing on the narrow time window around demonetization and studying foreign (rather than domestic) market outcomes eases this concern since other macroeconomic events are unlikely to be correlated with the exporter's initial ratio of accounts receivable to sales and exports simultaneously. Therefore, any confounding domestic shocks unrelated to exports will not bias the estimate of interest. As we will discuss, controlling for important pre-demonetization characteristics that are likely to be relevant for both initial trade credit and exports, such as firm age, size, and the other corporate financing options, as well as industry fixed effects, does not make meaningful changes in the estimated coefficients. Further, in Appendix C, we consider the possibility of differential change in foreign demand across firms – by using the Eslava et al. (2023) utility-based, taste-corrected firm price index – and this does not alter the estimated coefficients.

We also use an alternate exposure measure, which relies on domestic customer information. For a firm that primarily produces product p, the exposure measure is defined as the pre-demonetization product-specific mean ratio of accounts payable to expenditures of all domestic buyers of that product, $[\text{AP/E}]_p$, defined as

$$\left[\frac{\text{AP}}{\text{E}}\right]_p \equiv \sum_b \omega_{bp} \left[\frac{\text{AP}}{\text{E}}\right]_b, \tag{5.3}$$

where b indexes a firm's domestic buyers, $[\text{AP/E}]_b$ is a buyer b's mean ratio of short-term accounts payable (AP) to expenditures (E) between 2013-15 and w_{bp} is the 2013-15 average share of input purchases of domestic buyer b for the exporter's main product p. $[\text{AP/E}]_b$ are

created when the domestic buyers make a payment with short-term credit; if an exporter has only one domestic buyer, its receivable is the domestic buyer's payable. Given the domestic buyer's accounts payable (normalized by their expenses), we take a weighted average across all buyers within an exporter's main product, where the weight reflects the importance of each buyer in the same years (2013-15). If one buyer accounts for more purchases of the product p relative to the other buyers, this buyer becomes more important.

$[\text{AP/E}]_p$ can be argued to be plausibly exogenous because it is unlikely to be chosen by the exporter i prior to demonetization for a couple of reasons. First, any exporting firms' choice of products is unrelated to buyers' willingness to pay with credit. Second, each product has many buyers, and any individual buyer's characteristics are unlikely to be related to the product-specific payables on average.[20] At the same time, this measure of buyers' payable is highly correlated with the domestic receivables of exporters, as discussed in Petersen and Rajan (1997) and confirmed in our data (Appendix D.2), making it a good measure of exposure to demonetization.

Figure 2, which plots the estimated month-by-month coefficients (β_t) based on equation (5.1), depicts a strong but short-lived negative effect of the demonetization episode on firm exports. As Figure 2 indicates, before demonetization, firms that initially had higher accounts receivable-to-sales (AR/S) had similar trends of export sales relative to their counterparts; the estimated coefficients are statistically indistinguishable from zero. However, in November 2016–when the demonetization policy was enacted–firms with 10 percentage points higher baseline AR/S saw a 4% decrease in exports relative to their counterparts.[21] This effect on exports gradually attenuated over time and was fully eliminated by December 2017, suggesting that the effect only lasted a little over a year.

Columns (1)-(4) of Table 3 confirm the negative effect of demonetization on firm exports

[20]For example, the median number of buyers is 110, and the median share of input purchases (ω_{bp}) is 0.001.

[21]The mean and standard deviation of AR/S are .21 and .16, respectively, as shown in Table 1.

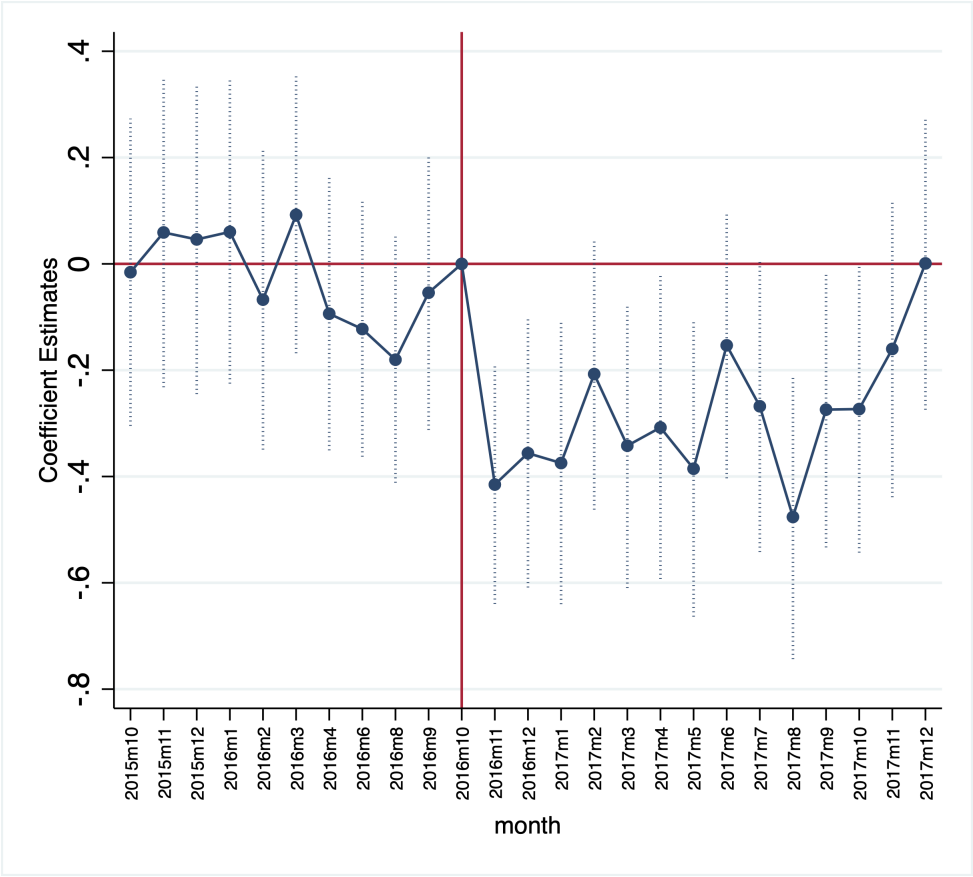


Figure 2: Exports and Demonetization

Notes. Figure 2 plots the month-by-month coefficients (β_t) in Equation (5.1). Testing the null hypothesis of all pre-demonetization coefficients jointly equalling zero leads to a p-value of 0.86. The 90% confidence interval is reported for each estimated coefficient, and standard errors are clustered by firm.

using the difference-in-differences (DID) specification presented in Equation (5.2). The results from our baseline (DID) specification that includes firm and month fixed effects are presented in column (1); they show that firms with 10 percentage points higher baseline AR/S decrease their exports by 2.76 percent on average relative to their counterparts. Column (2) includes the district × month effects to compare the differential change in exports within firms, controlling for time-varying district-specific characteristics. Column (3) additionally includes industry × month fixed effects (at the NIC 4-digit level) to compare the differential

	(1)	(2)	(3)	(4)	(5)	(6)
	Exports					
Post x $AR/S_{i,t-1}$	-0.276**	-0.342***	-0.353***	-0.293**		
	(0.125)	(0.115)	(0.129)	(0.131)		
Post x $AP/E_{p,t-1}$ (Buyer)					-0.311**	-0.301**
					(0.125)	(0.126)
Post x $AP/S_{i,t-1}$ (Own)				-0.183		-0.335
				(0.172)		(0.210)
Post x Interest $\text{Payment}_{i,t-1}$				-0.032		-0.050**
				(0.020)		(0.024)
Post x Bank $\text{Borrowing}_{i,t-1}$				0.028		0.039*
				(0.019)		(0.021)
Post x Age_i				-0.046		-0.039
				(0.031)		(0.039)
Post x Total $\text{Assets}_{i,t-1}$				0.012		0.031
				(0.033)		(0.034)
Post x $\text{PBIT}_{i,\ t-1}$				0.005		-0.004
				(0.022)		(0.025)
Post x $K_{i,\ t-1}$				0.002		-0.010
				(0.012)		(0.013)
Post x $\text{Cash/Asset}_{i,\ t-1}$				-5.404		-2.855
				(3.406)		(3.820)
Firm FE	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓
District x Month FE		✓	✓	✓	✓	✓
NIC4 x Month FE			✓	✓	✓	✓
Number of Clusters	3,406	3,406	3,406	3,406	311	311
R^2	0.768	0.787	0.804	0.804	0.811	0.811
Observations	89214	89214	89214	89214	75678	75678

Table 3: Exports and Demonetization: Difference-in-Differences

Note. The dependent variable is the log value of exports at the firm-month level, and $AR/S_{i,t-1}$ is the 2013-2015 mean ratio of accounts receivable to sales. $AP/E_{p,t-1}$ (Buyer) is the product-specific 2013-2015 mean ratio of account parables to expenditure of buyers, $AP/S_{i,t-1}$ (Own) is the 2013-2015 mean ratio of account payables to sales, Interest $\text{Payment}_{i,t-1}$ is 2013-2015 log mean interest payment, Bank $\text{Borrowing}_{i,t-1}$ is 2013-2015 log mean bank borrowing, Age_i is log firm age, Total $\text{Assets}_{i,t-1}$ is 2013-2015 log mean total assets, $\text{PBIT}_{i,t-1}$ is the 2013-15 log mean total profit before interest and tax, $K_{i,t-1}$ is the 2013-15 log mean capital, and $\text{Cash/Asset}_{i,t-1}$ is 2013-2015 mean cash to total assets. The sample covers 2015-2017. Standard errors are clustered at the firm level for columns (1)-(4) and at the major product code level for columns (5) and (6). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

change in exports within firms controlling for time-varying industry-level characteristics.[22] Column (4) adds the interaction of the $post_t$ dummy with the other firm characteristics that are likely to be correlated with firms' own cash usage during the demonetization: accounts payable, interest payment, banking borrowing, firm age, total assets, accounting profit, capital, and cash holdings. Note that the estimated coefficients of the interaction of the $post_t$ and additional variables are statistically insignificant, suggesting a negligible effect of *own* cash shortages on firm exports. This is likely because exporters do not use currency notes for their payments, corroborating the results in Section 4. Columns (5) and (6) confirm the results by using the product-specific buyers' mean accounts payable to expenditure, as defined above. The negative effect of demonetization on exports remains strong with or without the fixed effects and control variables.[23]

5.1 Heterogeneous Treatment Effects.

We divide the sample based on firms' main product and other characteristics and provide supplementary evidence on the effects of cash shortages on exports. First, since demonetization limits households' access to cash, the effect through receivables and domestic cash shortfall, in general, must be stronger for firms that mainly sell to households directly (Business-to-Customers) relative to firms that mainly sell to other firms (Business-to-Business). Assuming that firms advertise when they mainly sell to households, we proxy the proximity to households using the advertising intensity of the main product, defined as the average pre-demonetization, product-specific advertising-to-sales ratio. Second, we use the initial domestic share of the

[22]We therefore control for potentially time-varying differential tax rates across industries. This includes the Goods and Services Tax (GST) introduced in 2017 (Barnwal et al., 2024).

[23]Note that, based on column (6), the bank-related variables affect firm exports. The negative coefficient associated with interest payment indicates that firms that pay higher interest on borrowings are likely to be riskier and suffer more during demonetization. Further, the coefficient on bank borrowing (interacted with $post_t$) is positive, suggesting that banks may help firms hedge against the shock through additional borrowing. However, these effects are generally not robust to the other firm-specific variable (AR/S), as shown in column (4).

	Advertising Intensity		Domestic Intensity		Firm Size	
	(1)	(2)	(3)	(4)	(5)	(6)
			Exports			
Post x $AR/S_{i,t-1}$	-0.560***	-0.135	-0.453***	-0.219	-0.353	-0.210
	(0.208)	(0.179)	(0.173)	(0.239)	(0.253)	(0.162)
Firm FE	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓
NIC4 x Post FE	✓	✓	✓	✓	✓	✓
Firm Control x Post FE	✓	✓	✓	✓	✓	✓
Number of Firms	1,125	2,208	2,502	802	1,488	1,786
R^2	0.816	0.812	0.790	0.845	0.827	0.795
More Exposed	✓		✓		✓	
Observations	28451	58166	62493	23211	40493	44672

Table 4: Heterogeneous Treatment Effect

Note. All the regression specifications are identical to Table 3 column 4, except that we divide samples into more and less exposed firms. Advertising Intensity is 2013-15 average advertising to sales. This product-level measure is winsorized by the upper 99% and the bottom 1%, and we take the median by the main product code to measure the intensity at the main product level. Domestic Intensity is 2013-15 average domestic share of total revenue, and more exposed refers to those exporters having greater than 50% of domestic sales share. Firm Size is measured by the 2013-15 total assets by firms, and we take the median of the final sample to divide them into large and small firms. More exposed refers to higher advertising intensity, higher domestic intensity, and larger firm size. Standard errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

total exporters' revenue. Since the currency note shortages only affect domestic sales, firms that rely more on the domestic market must be more negatively affected. Finally, smaller firms may transact more with cash-intensive domestic customers. If so, smaller exporters would be the most affected after demonetization. To test this, we proxy for firm size based on firms' total assets.

Table 4 shows the results. Columns (1) and (2) show that the negative cash shortage effect is stronger when firms are more reliant on households. Since households are more likely to use cash, these results suggest that the negative effects on exports are driven by cash-constrained customers. Columns (3) and (4) consider the domestic intensity, and the cash shortage effect is stronger for exporters relying heavily on the domestic market. This result

additionally confirms that exporters are affected by domestic customers due to aggregate currency note shortages. In columns (5)-(6), we do not find evidence that smaller exporters are more affected, suggesting that, within the set of exporters, firm size does not determine the degree of domestic buyers' use of domestic currency notes.

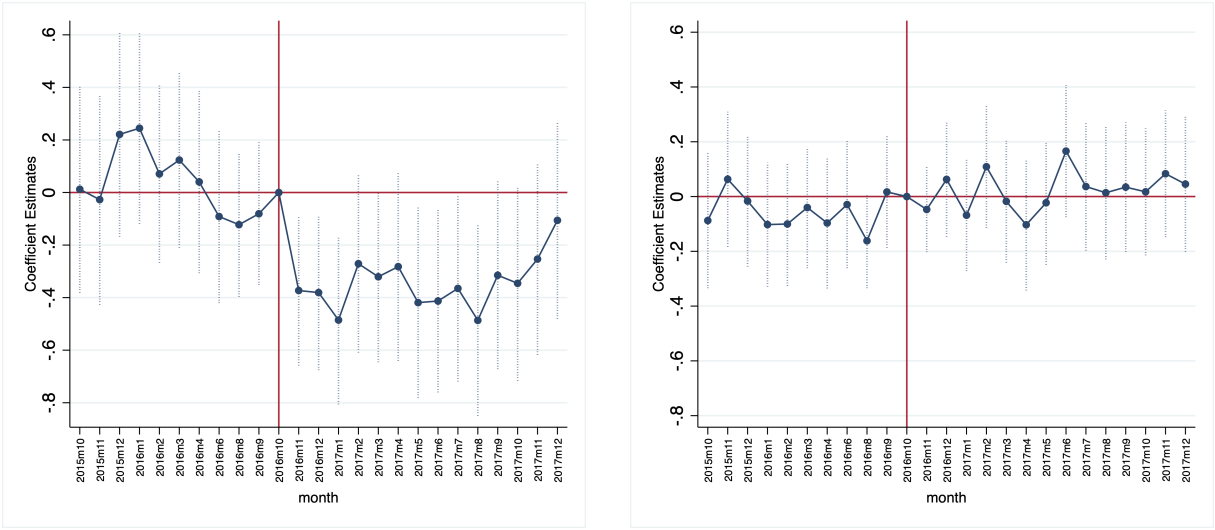
5.2 Quantity vs. Price

Our analyses so far have focused on export sales, which is consistent with papers studying firm exports with firm-level data (Amiti and Weinstein, 2011; Liu and Lu, 2015; Barrows and Ollivier, 2021). Our detailed custom-firm matched data allow us to further decompose firm export sales into quantity and price separately to disentangle the real and nominal effects of demonetization on exports. For simplicity, we construct and use a conventional chain-weighted Tornqvist price index at the firm level and calculate the associated quantity index by dividing the export value by the price index.[24]

By distinguishing between price and quantity effects, we are able to speak to the mechanisms underlying the reduced-form effect of demonetization on export values. On the one hand, firms with high ratios of accounts receivable to sales may be affected as cash flows dry up following demonetization, leading to lower production and volume of exports. This case implies a short-run, real effect in terms of a quantity decline and confirms monetary non-neutrality at the firm level. On the other hand, affected firms may be forced to raise export prices due to the increased financial costs (Ahn et al., 2011; Haddad et al., 2011) and significantly lose their market share, leading to a decrease in the total value of exports.

Figure 3 presents the real and short-lived effect of demonetization on firm exports. As the figure indicates, the short-term effect of on firm exports entirely arises from changes in export quantities rather than export prices. The effects on export quantity shown in Figure

[24]Using instead the variety- and quality-adjusted price index following Eslava et al. (2023); Lenzu et al. (2022) does not alter the results. See Appendix C for the construction of the price indices and the robustness exercises.



(a) Quantity **(b)** Price

Figure 3: Exports and Demonetization: Quantity and Price

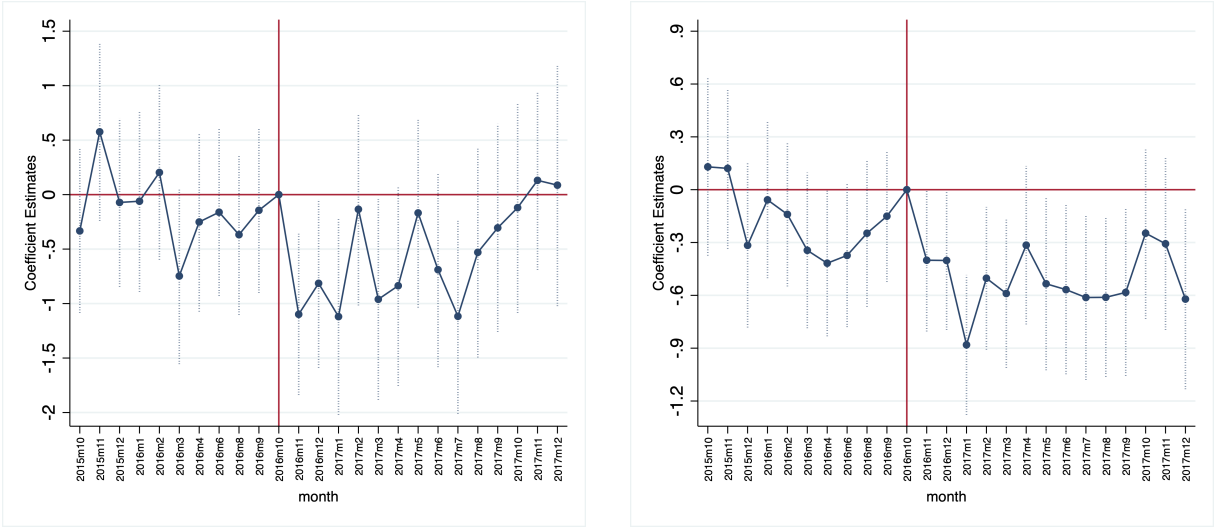
Note. Figure 3 plots the month-by-month coefficients (β_t) in equation (5.1) using log export quantity and price indices as dependent variables. The chain-weighted firm-level Tornqvist quantity and price index are used in this figure, as discussed in Appendix C. Testing the null hypothesis of all pre-demonetization coefficients jointly equalling zero leads to p-values of 0.8 and 0.73 for quantity and price, respectively. A 90% confidence interval is reported for each estimated coefficient, and standard errors are clustered at the firm level.

3a closely follow the total effect on exports in Figure 2. The effects on export price, however, are not significantly different from zero in the short- or long-run, as shown in Figure 3b. The estimated coefficients in the pre-demonetization period are not statistically different from zero for either quantity or price. We present the corresponding difference-in-differences specification (equation 5.2) for export price and quantity in Table OA.4. Consistent with Chodorow-Reich et al. (2019), these results reject monetary neutrality in the short run.

5.3 Extensive Margins

Seen through the lens of standard models with imperfect competition, in which equilibrium export prices would increase when firms lower their export quantity, our finding of a muted effect on export prices may look surprising. A potential explanation, however, is based on

adjustments that take place through the extensive margin. Specifically, firms may reduce their number of products and destinations, which would lower their overall export quantity without affecting observed prices. We investigate this hypothesis using the monthly number of export products and destinations available in the Customs data. We use the most granular product category available in the Customs data (8-digit HS code) as a baseline analysis but find similar results using broader product categories (6-digit HS code or 4-digit HS code). Appendix D.6 highlights that the effects of demonetization on these extensive margins are key to understanding the overall fall in total exports.



(a) Number of Products **(b)** Number of Destinations

Figure 4: Exports and Demonetization: Extensive Margins

Note. Figures 4a and 4b plot the month-by-month coefficients (β_t) in equation (5.1) using number of products and destinations as the dependent variables, respectively. The 8-digit HS code defines the product, and destination refers to the foreign country to which the firm exports its products. Testing the null hypothesis of all pre-demonetization coefficients jointly equalling zero leads to p-values of 0.13 and 0.37 for the number of products and destinations, respectively. A 90% confidence interval is reported for each estimated coefficient, and standard errors are clustered at the firm level.

Figure 4 shows that more exposed exporters reduced their number of product lines and product destinations, reemphasizing the real effects of demonetization on exports. Based on Figure 4a, exporters with AR/S=1 dropped one product (8-digit HS code) relative to the

exporters with AR/S=0 after demonetization but recovered the original number of products after about a year. Given that the median exporter has three products (table 1), the estimated coefficients point to a non-trivial effect on the extensive margin of exports. Figure 4b similarly shows that the demonetization leads to a decrease in the number of destinations. Table OA.4 shows that the results are robust to using a difference-in-differences specification. Note that the temporary effects of demonetization are more pronounced in the number of products relative to the number of destinations. Exporters recovered their product lines after a year, but the number of export destinations remained relatively low until the end of 2017. These results are plausible because it is likely that recovering access to a new destination country is much more costly for exporters than producing more product lines. To enter a new destination country, exporters have to pay economic costs, such as transportation and tariffs, and other intangible fixed costs that allow them to overcome differences in non-economic factors.

Our results on the extensive margin provide suggestive evidence that exporters cut expenditures associated with less profitable product lines and destinations. This empirical pattern is consistent with the idea that firms focus more on core-competency products in response to shocks, relating to recent growing literature studying the importance of multi-product firms in international trade.[25] Specifically, Mayer et al. (2021) show that tougher competition leads exporters to focus on their best-performing products, and our analyses reveal that short-run cash shortages have a similar effect on exports. Furthermore, using the Feenstra (1994) variety correction, which considers each product's relative importance, we find evidence consistent with firms continuing with their core-competency products and dropping others (Appendix C).

[25] On this important issue, see Goldberg et al. (2010), Dhingra (2013), Mayer et al. (2014), Boehm et al. (2022).

5.4 Production

Next, we corroborate the underlying mechanism and the validity of the exposure variable (AR/S) using measures of production and other firm activities available in the Prowess firm-level data. Although these firm-level data do not provide high-frequency information, these analyses still capture differential changes in firm-level outcomes, both real and financial, in response to demonetization.

	(1) Material	(2) Employee	(3) Inventories	(4) Exports	(5) Bank Borr.	(6) Interest Exp.	(7) Write-off
$Post_t$ x $AR/S_{i,t-1}$	-0.235***	-0.136***	-0.273***	-0.260***	-0.149***	-0.204**	0.458*
	(0.082)	(0.044)	(0.063)	(0.099)	(0.055)	(0.100)	(0.251)
Firm FE	✓	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓	✓
Number of Firms	2,947	3,567	3,378	1,759	3,064	3,420	457
Firm Control x Post FE	✓	✓	✓	✓	✓	✓	✓
R^2	0.960	0.980	0.958	0.936	0.914	0.933	0.737
Observations	5894	7134	6756	3518	6128	6840	914

Table 5: Exports and Demonetization: Production

Note. Material is log material expense, Employee is log compensation to employees, Inventories is the value of inventories, Exports is log firm exports, Bank Borr. is log bank borrowings, Interest Exp. is the log interest expenses, and Write-off is the log write-off. AR/S is the 2013-2015 log mean accounts receivable over deflated sales. The sample is restricted to exporters only, and the exporters are defined as those firms that have non-missing export value in 2013-2015 based on the Prowess data. We control for log firm age, 2013-2015 log mean bank borrowing, cash holdings, interest expenses, and total assets. Standard errors are clustered by firm. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5 confirms the negative effects of demonetization on production using the difference-in-differences specification in equation (5.2). Columns (1) and (2) show that firms that are more exposed to demonetization decrease their material expenses and compensation to employees. These results are consistent with the notion that these exporting firms could not receive revenues from domestic buyers and subsequently could not pay for their labor and material input expenditures, thereby lowering their production. These firms also lower their inventory (column 3), potentially liquidating it to mitigate the financing problem, consistent with Kim (2020). Although the Prowess data do not record high-frequency export

information, we still find a statistically significant negative effect on exports in Column (4), consistent with Table 3. Firms may have been able to substitute the fall in cash with bank credit, which would increase borrowings and interest rates. However, in columns (5) and (6), we show that affected firms lower their bank borrowings and interest expenses. These results are consistent with the notion that affected firms decrease their export production and, correspondingly, decrease their credit demand from banks. They are also consistent with the recent literature highlighting the earnings-based constraint (Lian and Ma, 2021; Drechsel, 2023). Finally, column (7) shows an increase in write-offs, suggesting that affected firms forgive the debt of domestic buyers at the time of demonetization.

6 Conclusion

This paper examines the impact of a liquidity shock caused by India's demonetization on the export performance of firms. We find that firms more reliant on liquidity, particularly through the domestic supply chain network, experienced a relative decline in exports following the shock. Moreover, this reduction in exports was primarily driven by adjustments in the number of products and destinations, rather than price changes, suggesting that the policy had real effects. Overall, exporters dependent on domestic markets for sales faced constraints due to negative cash flow shocks, leading to reductions in both production and actual exports.

Our findings highlight the crucial role of domestic supply chains in transmitting liquidity shocks. The granularity of our firm-month-level data allows us to rule out alternative forces driving the results—such as local uncertainty, local labor market conditions, and local demand. While our paper specifically focuses on the relationship between aggregate cash constraints and firm exports, a broader examination of other channels through which demonetization may have impacted the economy—such as reducing reliance on cash, promoting digital transactions[26], or influencing firm entry and exit through general equilibrium effects—lies

[26]For instance, see the recent work of Dubey and Purnanandam (2023), showing that the adoption of

beyond the scope of this study. However, these remain important avenues for future research.

cashless payments improved local economic outcomes in India.

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ONLINE APPENDIX

A Data Description

Data Cleaning. We take the following steps to clean the India Customs export database. First, we manually check and clean for misreported and inconsistent variables and duplicated observations in the customs data.[27] Second, we merge each 8-digit HS code and year available in the Customs data with the sector-level export data downloaded from the Trade Map database. We generate the ratio of the aggregated sectoral export value in the Customs data and the export value available in Trade Map by year and drop the sectors in the top and bottom 1% of the distribution. This filtering removes a tiny number of observations with excessively large export values, potentially because of misreporting or data entry errors. Third, after aggregating export information by firm and month and combining the customs data with Prowess data, we trim the top and bottom 1% of observations for each variable and keep firms that export for at least three consecutive months to minimize measurement error. Last, we exclude observations from May and July of 2016 from the event study analyses as the mean and median export values and the number of destinations fall dramatically in these months, inconsistent with official statistics (Trade Map). The main results are generally robust to the inclusion of these months, indicating that removing them is not driving our results in any substantial way.

Combining the Customs and Prowess data. After aggregating export information by firm and month, we combine the Customs data with the Prowess data using the firm

[27] For example, "HSCODE = ########" is recorded instead of the actual HS code, Destination_Country is recorded as "GAUTEMALA" for GUATEMALA, and the same country (South Korea) is recorded as "KOREA,REPUBLIC O", "KOREA,REPUBLIC OF", and "SOUTH KOREA." The duplicated observations arise in the customs data for various reasons. For example, an error is identified by the customs officer after the shipping bill is filed (e.g., wrong export value), and the shipment is not given "LET EXPORT ORDER". The exporter then files another shipping bill with necessary changes until there is no error, leading to duplicates in the raw data.

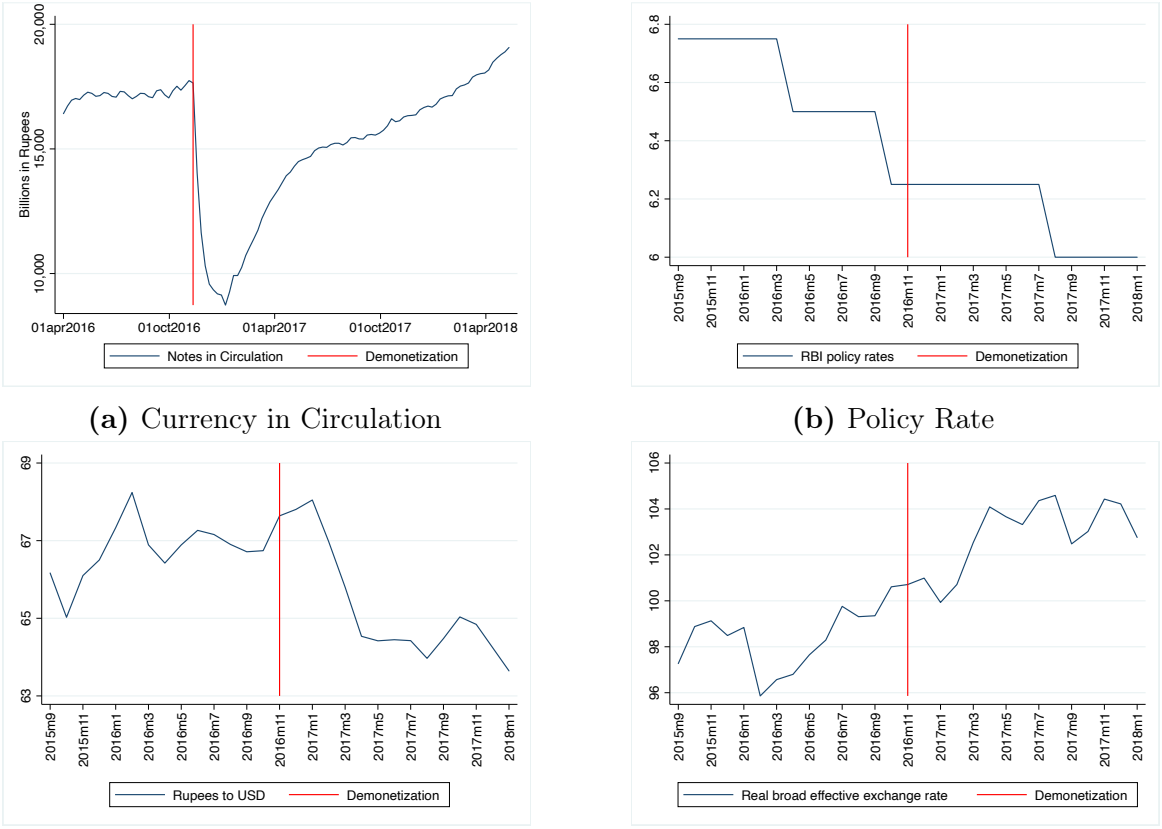
name and address available in both data sets. First, we clean the company name in each database.[28] After basic cleaning, we combine the firm names in the Customs data with the "Listed Status" data downloaded from https://dgft.gov.in/sites/default/files/statusList_0.pdf. Thirty-one official firm names are duplicated within the firm identifier in the customs data (Importer-Exporter Code or IEC). We manually check each name and choose the name that is likely to be the most informative (typically the longest name). We drop a small number of observations that have very different names within the IEC code. For both the Customs and Prowess data, we further clean firm names using the "stnd_compname" STATA command developed by Wasi and Flaaen (2015) and check the names manually. In extracting firm addresses from the Customs data, we only use state names to ease the merging procedure with the Prowess data. For non-missing values in the Customs data, we manually replace misspelled/misreported state names with formal names and double-check these names with the Prowess data. Whenever a state variable is missing, we extract state information from the city, pincode, and long address information.

In matching the two databases with firm names and states, we proceed as follows. First, we identify observations that match the name and state perfectly. Second, among the unmatched observations, we use the STATA "reclink2" command developed by Wasi and Flaaen (2015) to fuzzy match the observations. We only keep observations above the 0.99 threshold and double-check these matches by having two research assistants independently check the matches by searching the company names on Google and Zauba. Note that the firm is identified by the IEC code in the Customs data and by the variable "co_code" in the Prowess data. We define a firm boundary that aggregates both IEC and "co_code" into one unique firm identifier.

[28] Specifically, we set space if the company name contains a comma, period, parenthesis, unknown character, the lowercase letter i (all names are in upper case), plus or minus sign, question mark, M/S, semicolon, or [MERGED]. We replace three consecutive quotes with two consecutive quotes, LIMITED to LTD, and PRIVATE to PVT. We eliminate spaces and double spaces at the beginning and end of the firm name.

B Illustrations

B.1 Demonetization: Currency Notes, Policy Rates, and Exchange Rates



(a) Currency in Circulation

(b) Policy Rate

(c) Rupees to USD

(d) Real Exchange Rate

Figure OA.1: Currency Notes, Policy Rate, and Real Exchange Rates

Note. Source: Reserve Bank of India (currency circulation) and Bank for International Settlements (policy rates and exchange rates). The real exchange rate is the broad effective exchange and is normalized to 100 in 2020.

Figure OA.1 shows that the overall money supply, interest rates, and exchange rates did not change due to demonetization. The currency in circulation fell dramatically during demonetization, as already documented in previous studies (Figure OA.1a). At the same time, the policy rate was stable (Figure OA.1b), consistent with the notion that demonetization

did not lower the overall money supply but only decreased the currency notes in circulation (Crouzet et al. 2023). The stable policy rate has also been documented in Chodorow-Reich et al. (2019), who additionally show the stability of other private rates, such as the rate on deposits, outstanding and new loans, call money, and bank rate. Exchange rates were stable; the nominal (Rupees to USD) and real exchange rates changed little.[29] The stable policy rates and exchange rates help isolate exporters' working capital constraint channel from the other potential effects of monetary policy.

B.2 Accounts Receivable: Exposure to Demonetization

Figure OA.2 illustrates how accounts receivable measure firm-level exposure to demonetization. For simplicity, consider two otherwise identical firms: one with no accounts receivable ("No AR/S") and the other that generates all their revenues in accounts receivable ("100% AR/S"). A firm without receivables creates cash flow and purchases inputs in each period, but a firm with receivables faces a timing difference (Figure OA.2a). These firms must first produce by asking workers or intermediate goods suppliers to provide inputs before receiving revenues (or borrowing from the banks). In this setup, when demonetization affects the economy at a time t, those firms without receivables are negatively affected as they no longer have revenues at time t. However, those firms with receivables are differentially more affected because they cannot finance inputs used in the past (time $t-1$) and concurrently cannot pay for the inputs at time t that they will use to generate revenues in the future ($t+1$). Thus, the working capital of firms with high receivables is more constrained after demonetization. See, e.g., Altinoglu (2021); Reisher (2020) for how a similar logic is integrated into general equilibrium models to show the importance of trade credit.

[29] If anything, the currency in circulation and the exchange rates move in the opposite direction, inconsistent with a standard model of international monetary policy (Gali and Monacelli, 2005).

B.3 Cash Reliance in India

Figure OA.3a shows that Indian households and firms heavily relied on cash holdings before demonetization using World Bank Payment Survey data.[30] More than 80% of people did not use a debit or credit card in the last year, and more than 40% of people did not have banking or other financial accounts. Close to 80% of people received wages only in cash and approximately 75% of people received agriculture product payments in cash only. These facts suggest that demonetization likely influences both households who have to rely on cash to purchase goods and services and entrepreneurs who need to pay workers and receive revenues in cash.

B.4 Mechanism: Exporter Working Capital Constraint

The key transmission mechanism in our paper is the exporter's working capital constraint, which arises from a decrease in cash flow from the domestic market due to demonetization. For simplicity, consider only exporters that sell to both domestic and foreign markets (Figure OA.4a). Since these exporters sell goods and services to foreign counterparts, they are unlikely to use Indian rupees in favor of electronic payment systems or foreign currencies, such as US dollars. However, in general, their domestic counterparts rely heavily on Indian rupees. For example, according to the 2014 World Bank payment survey, approximately 80% and 75% of wages and agriculture products payments in India were received only in cash, respectively (Figure OA.3). In this setup, when domestic customers cannot pay international firms with rupees due to the demonetization policy, exporters decrease their production as they cannot pay their employees and domestic suppliers. As a result, these firms lower their exports (quantity, particularly the number of products and destinations) as illustrated in Figure OA.4b and consistent with the results reported in Figure 2.

[30] See https://www.worldbank.org/en/topic/paymentsystemsremittances.

C Export Price and Quantity Index

Following Eslava et al. (2023) and Lenzu et al. (2022), we construct the firm-time-specific chain-weighted export price index, which is defined recursively as follows:

$$P_{ft} = P_{f,B_f} \prod_{\tau=B_f+1}^{t} \Phi_{f\tau} \tag{C.1}$$

where f denotes the firm and t denotes time (month). B_f is the first time when firm f starts to export. P_{ft} is the export price index at the firm-time level, which is the main price index we use in our analyses. P_{f,B_f} is a baseline export price index for firm f and Φ_{ft} is the change in export price index from period $t-1$ and t for firm f. In constructing P_{ft}, we use the custom-firm combined data at the month level from January 2015 to December 2017.

Our main analyses use the conventional Tornqvist price index for simplicity. However, adjusting for variety correction (Feenstra 1994) and taste correction (Redding and Weinstein 2019) does not change the main results. P_{f,B_f} is the same across all indices, but Φ_{ft} changes with different indices. The export-quantity index is defined as the total export value divided by the export price index.

Firm-level Baseline Export Price Index. The baseline export price index at the firm level, P_{fB_f}, is defined as follows:

$$P_{f,B_f} = P_{B_f} \prod_{p \in \Omega_{f,B_f}} \left(\frac{P_{fp,B_f}}{\bar{P}_{p,B_f}} \right)^{s_{fpB}}, \ \bar{P}_{p,B_f} = \prod_{f} P_{fp,B_f} \tag{C.2}$$

where P_{B_f} is a baseline aggregate export price index in time B_f, P_{fp,B_f} is firm-product-level price in time B_f, $\bar{P}_{p,B_f}$ is product-level price index in time B_f (the geometric average of P_{fp,B_f}), and s_{fpt} is the share of product p in firm f's revenue in period t. The set Ω_{f,B_f} is the collection of all products p provided by firm f in its baseline year B_f. The product is defined

at the most granular level we observe in the data, which is the 8 digit HS code x unit. The 8-digit HS code reported in the India Customs data is the Indian Tariff Code (ITC) number. The first six digits are identical to the 6-digit HS code used globally, and the last two digits are added to denote more detailed product categories. For example, the 6-digit HS code "84022000 Freezers of the chest type, not exceeding 800 liters capacity" is further subdivided into the "84183010 Freezers, electrical" and "84183090 Freezers, other than electrical".

The aggregate baseline export price index, P_{B_f}, is:

$$P_{B_f} = \begin{cases} 1, & \text{if B is the first month of the sample} \\ \prod_{f'} P_{f',B-1}, & \text{if B is after the first month of the sample.} \end{cases}$$

Intuitively, P_{f,B_f} is the modified version of the weighted geometric average of product-firm-specific export prices across products within the firm at time B_f, where the weight is the sales share of each product within the firm and time B_f. There are two modifications. First, it adjusts for the average product-specific export price index such that the firm-level export price index reflects what is relative to the average export price of the same product sold by other firms. Second, it combines with the aggregate export price index so that the export baseline price index for firms newly entering the market can be adjusted with the aggregate export prices.

Change in Firm-level Export Price Index: Tornqvist. Our main export price index is constructed following the conventional Tornqvist index:

$$\Phi_{ft} = \Phi_{ft}^{T} = \frac{\prod_{p \in \Omega_{ft,t-1}} (P_{fpt})^{s_{ft,t-1}}}{\prod_{p \in \Omega_{ft,t-1}} (P_{fp,t-1})^{s_{ft,t-1}}} \tag{C.3}$$

where $s_{ft,t-1} \equiv \frac{s_{f,t-1}+s_{ft}}{2}$, and $\Omega_{ft,t-1}$ is the set of products p firm f provides in both period t and $t-1$.

Change in Firm-level Export Price Index: Variety and Taste Correction. Following Eslava et al. (2023) and Lenzu et al. (2022), the change in price index at the firm-time level can be written as:

$$\Phi_{ft} = \Phi_{ft}^{J} \Phi_{ft}^{F} \Phi_{ft}^{RW} \tag{C.4}$$

where Φ_{ft}^{J} is an equal-weighted geometric average (a Jevons index) of the prices for all products continuing from period $t-1$ to t, Φ_{ft}^{F} is the Feenstra (1994) variety correction, and Φ_{ft}^{RW} is the Redding and Weinstein (2019) consumer taste-bias correction.

The Jevons index is defined in the following way:

$$\Phi_{ft}^{J} = \frac{\prod_{p \in \Omega_{ft,t-1}} (P_{fpt})^{\frac{1}{|\Omega_{ft,t-1}|}}}{\prod_{p \in \Omega_{ft,t-1}} (P_{fp,t-1})^{\frac{1}{|\Omega_{ft,t-1}|}}} \tag{C.5}$$

where $\Omega_{ft,t-1}$ is the set of products p firm f provides in both period t and $t-1$, and $|\Omega_{ft,t-1}|$ is the number of these continuing products provided by firm f.

The Feenstra (1994) variety correction is as follows:

$$\Phi_{ft}^{F} = \left(\frac{\sum_{p \in \Omega_{ft,t-1}} s_{fpt}}{\sum_{p \in \Omega_{ft,t-1}} s_{fp,t-1}} \right)^{\frac{1}{\sigma - 1}} \tag{C.6}$$

where σ is the demand elasticity, and s_{fpt} is the share of product p in firm f's revenue at time t. This term captures the taste for variety. The intuition is that if one more varietal of a product is added to the market, the share of common products must fall, leading to a smaller Φ_{ft}^{F} and price (cost of living) index. If products can be substituted easily (higher σ), this effect is lower; the variety effect is stronger if the products cannot be substituted easily.

The Redding and Weinstein (2019) taste correction is as follows:

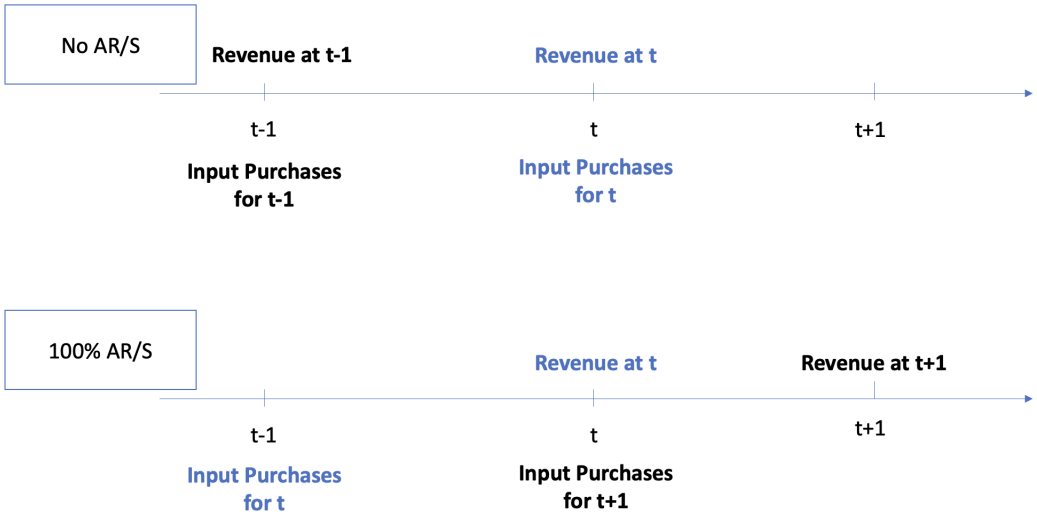
$$\Phi_{ft}^{RW} = \left(\frac{\prod_{p \in \Omega_{ft,t-1}} \left(s_{fpt}^{*} \right)^{\frac{1}{|\Omega_{ft,t-1}|}}}{\prod_{p \in \Omega_{ft,t-1}} \left(s_{fp,t-1}^{*} \right)^{\frac{1}{|\Omega_{ft,t-1}|}}} \right)^{\frac{1}{\sigma-1}} \tag{C.7}$$

where s_{fpt}^{*} is the share of product p in firm f's revenues at time t *among all products continuing from period* $t-1$ *to* t. Thus, $\sum_{p \in \Omega_{ft,t-1}} s_{fpt}^{*} = \sum_{p \in \Omega_{ft,t-1}} s_{fp,t-1}^{*} = 1$. This term captures the utility gains from the taste shift. The intuition is as follows. If the product share is more dispersed across products within firms, Φ_{ft}^{RW} and price (cost-of-living index) fall because the geometric average of shares decreases with a higher dispersion. A more dispersed product share benefits consumers if the dispersion arises from the taste-adjusted prices. As the taste-adjusted prices are more dispersed across products within firms, households facing more dispersed prices can substitute away from high taste-adjusted price products to low taste-adjusted price products. If products can be substituted easily (higher σ), this effect is lower; the taste effect is stronger if the products cannot be substituted easily.

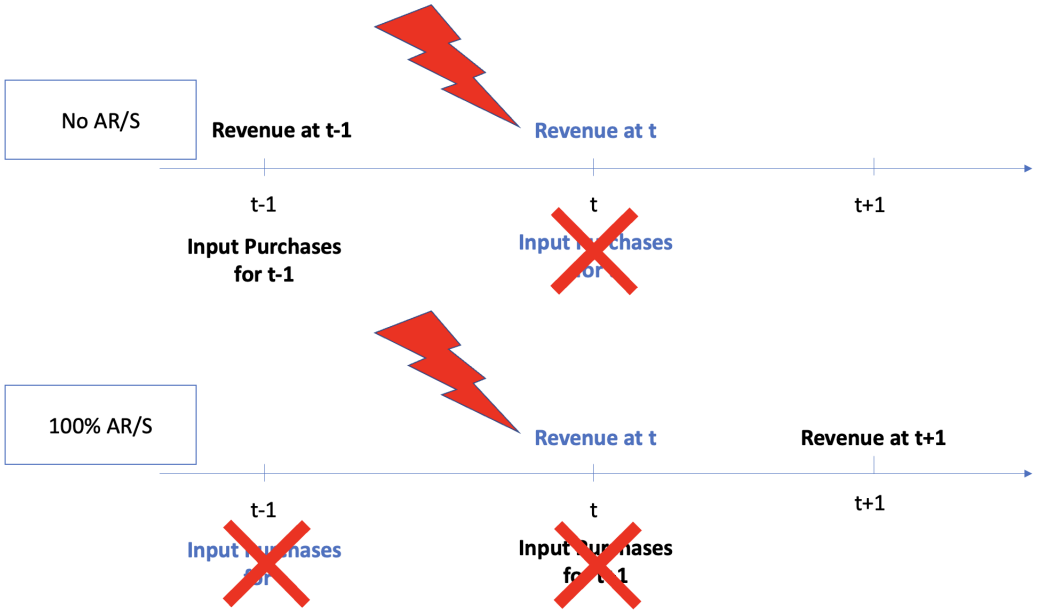
One practical challenge in using the utility-based price index is the unknown measure of the demand elasticity σ. For the baseline analysis, we calibrate $\sigma = 6$ and show that the results are analogous when using $\sigma = 4$ and $\sigma = 8$. These values are used to match the average import demand elasticity the Indian economy faces in exporting products. Specifically, we bring in the import demand elasticity made available by the Economic and Social Commission for Asia and the Pacific (ESCAP). Utoktham et al. (2020) provide these elasticities by applying the estimation method developed by Feenstra (1994) and extended by Broda and Weinstein (2006) and Soderbery (2015) to the UN Commodity Trade Statistics Database (COMTRADE). The elasticities can be downloaded from https://www.unescap.org/resources/new-global-estimates-import-demand-elasticities-technical-note#. We aggregate export values in the customs data by 6-digit HS code and destination country and use this as a weight to calculate the mean and median import demand elasticity. The mean is 5.08 and the median is 6.66.

Figure OA.5 replicates Figure 3 using the utility-based quantity and price indexes. The results reported in Figures OA.5a and OA.5b are similar to the results reported in Figure 3: there is a strong temporary effect on quantity, but the effect on price is muted in the short- and long-run. Since conventional price, variety, and taste effects may move in opposite directions (such that the total price effect is muted), we separately analyze each component (added by $\ln P_{f,B_f}$, the log baseline firm-specific price index): $\ln \Phi^J_{ft}$, $\ln \Phi^F_{ft}$, and $\ln \Phi^{RW}_{ft}$. Figures OA.5c, OA.5d, and OA.5e show that there is no significant effect on price regardless of using the conventional Jevon's price index, variety correction, or taste correction.

The two results using the utility-based price index are noteworthy. First, despite the fact that affected firms reduced the number of products they export, as shown in Figure 4, the Feenstra variety correction term shows no effect. This result suggests that firms temporarily drop those products that are unimportant to them, but do not drop those that are important, consistent with the idea of core competence. Essentially, firms that are more exposed to demonetization drop non-core products and focus on their most important products. Second, the results on taste correction in Figure OA.5e suggest that the export value effect is unlikely to be driven by differential changes in consumer demand across firms. This result reinforces the idea that firms with higher AR/S did not face differential demand shocks during or after the demonetization.

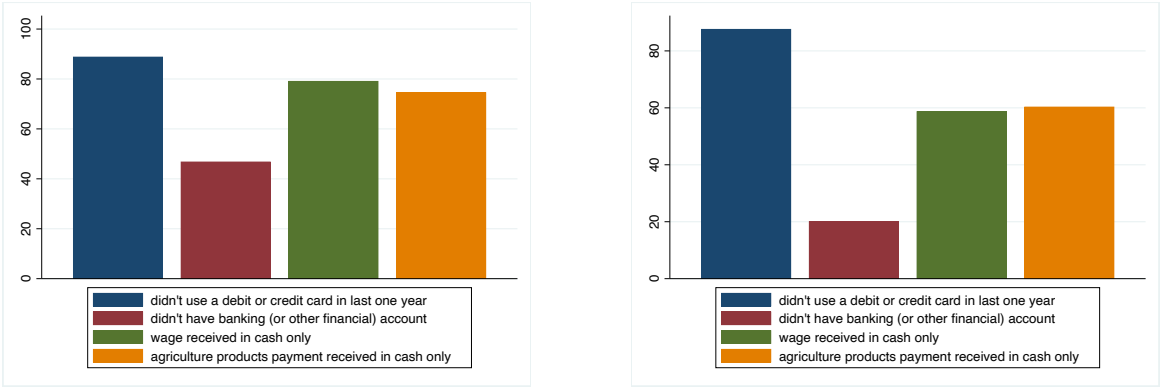


(a) Before Demonetization



(b) After Demonetization

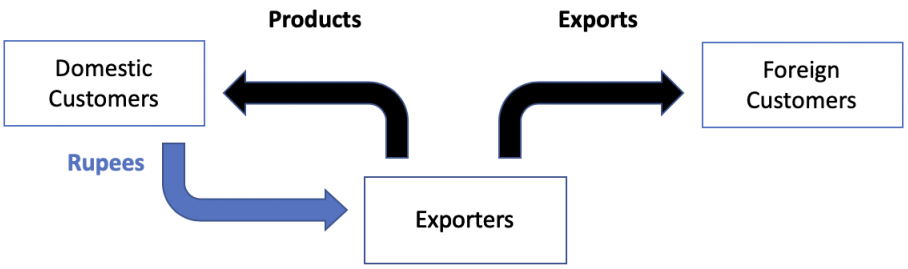
Figure OA.2: 100% AR/S vs. No AR/S



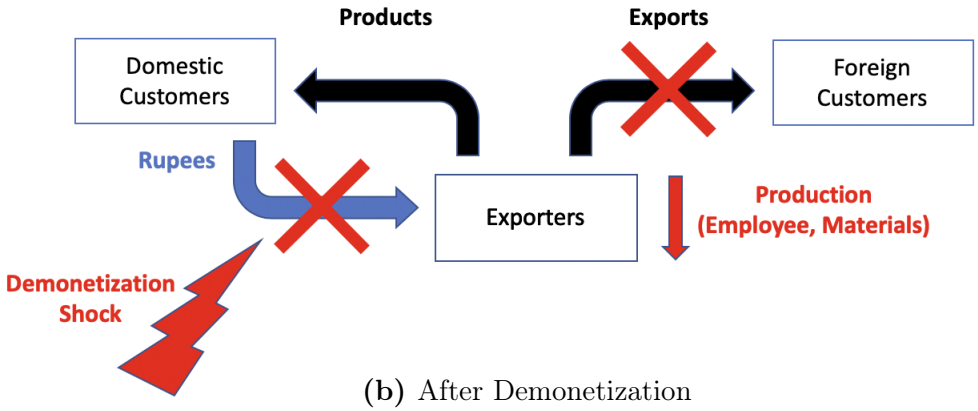
(a) 2014 **(b)** 2017

Figure OA.3: Cash Reliance in India

Source: World Bank Payment Survey.

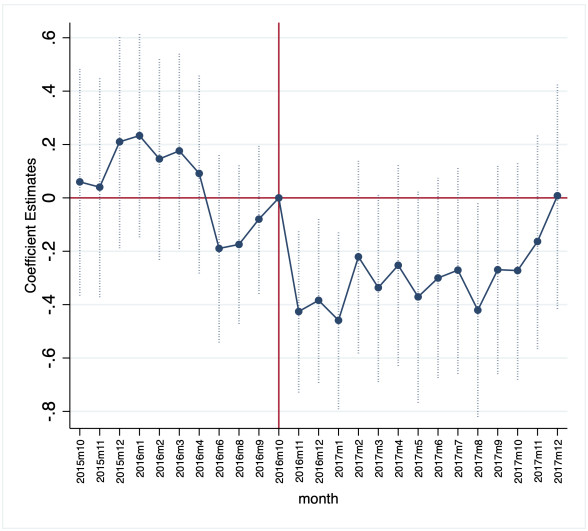


(a) Before Demonetization

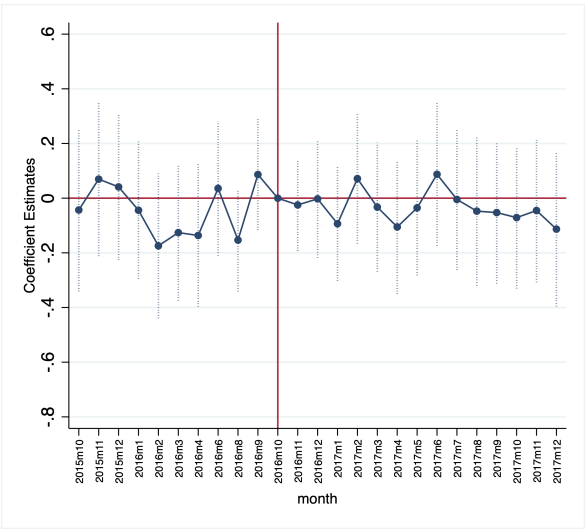


(b) After Demonetization

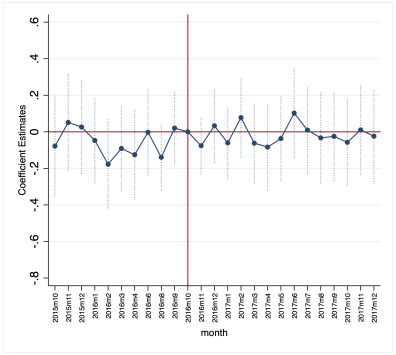
Figure OA.4: Mechanism: Illustration



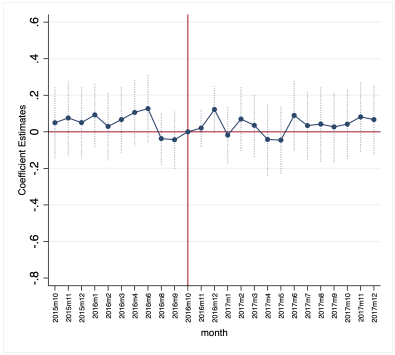
(a) RW Quantity Index



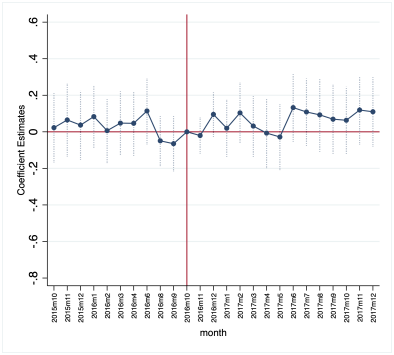
(b) RW Price Index



(c) Price: Jevons Index



(d) Price: Variety Correction



(e) Price: Taste Correction

Figure OA.5: Exports and Demonetization: Price and Quantity, RW Index

Note. Figure OA.5 replicates figure 3 using the Redding and Weinstein (2019) quantity and price indexes with $\sigma = 6$, as discussed in Appendix C. Testing the null hypothesis of all the pre-demonetization coefficients jointly equalling zero leads to p-values of 0.75, 0.47, 0.68, 0.91, and 0.82 for Figures OA.5a-OA.5e, respectively. A 90% confidence interval is reported for each estimated coefficient, and standard errors are clustered by firm.

D Additional Analyses

D.1 Accounts Receivable: Other Measures

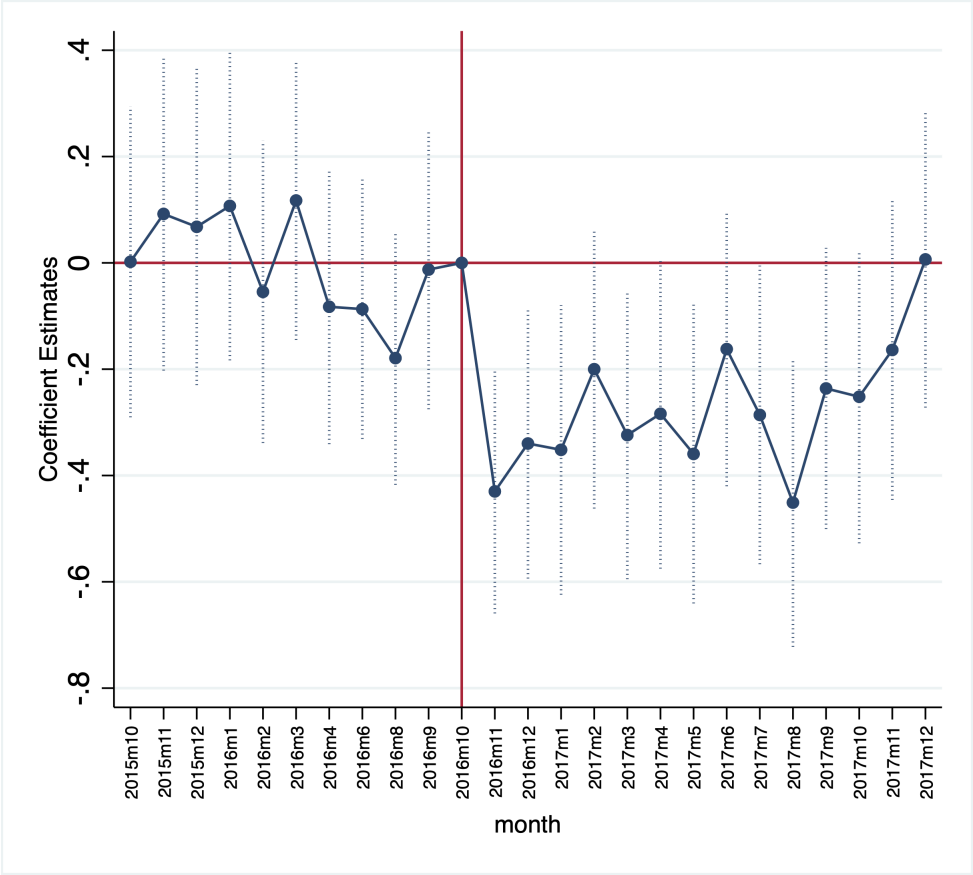


Figure OA.6: Using Short-Term Receivables Only

Note. Figure OA.6 replicates Figure 2 using the short-term accounts receivable (normalized by sales). Testing the null hypothesis of all pre-demonetization coefficients jointly equalling zero leads to a p-value of 0.8. A 90% confidence interval is reported for each estimated coefficient, and standard errors are clustered by firm.

First, in our main analysis, we use the total accounts receivable to maximize the number of non-missing observations (instead of separating them into short-term and long-term receivables). However, since demonetization only lasted approximately a year, only the short-term receivables, which must be paid within 6 months, would be relevant. To reflect

this idea, we only use short-term accounts receivable (which must be paid within 6 months or less) instead of total receivables as the exposure measure and still find negative effects of demonetization on exports, as shown in Figure OA.6. Note that the product-specific accounts payable to expenditures of buyers only use short-term payables and address this concern explicitly.

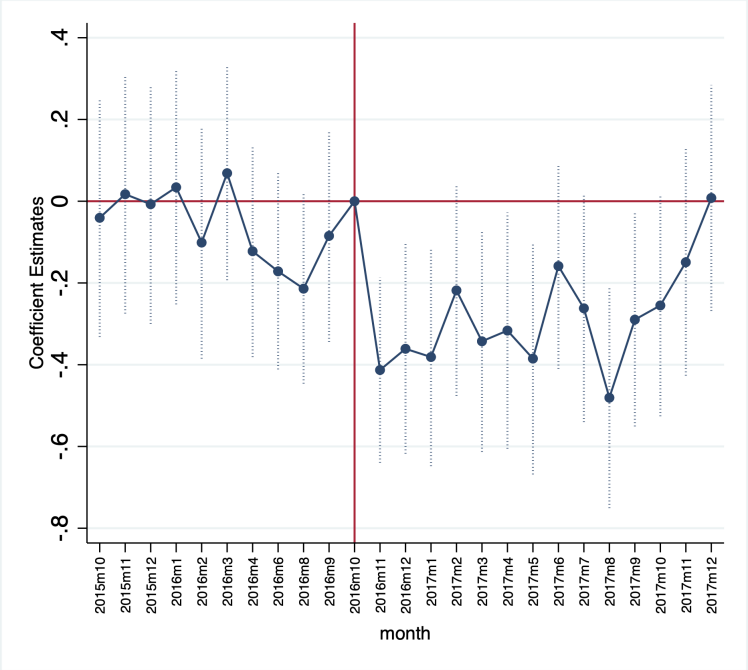


Figure OA.7: Excluding foreign receivables

Note. Figure OA.7 replicates Figure 2 using the accounts receivable (normalized by sales) after excluding firms that have experienced the change in receivables due to the foreign exchange rate fluctuations in 2010-17. Testing the null hypothesis of all pre-demonetization coefficients jointly equalling zero leads to a p-value of 0.79. A 90% confidence interval is reported for each estimated coefficient, and standard errors are clustered by firm.

Second, the main draft do not distinguish between domestic and foreign receivables because the Prowess data do not separately report information about foreign receivables.[31] However, the data report the change in the receivables due to the foreign exchange rate

[31] A potential concern is that the total receivables may reflect foreign (instead of domestic) receivables, and exports may fall due to foreign-related reasons instead of the domestic cash shortage.

fluctuation. Figure OA.7 shows the results by excluding all firms that have experienced the change in receivables due to the foreign exchange fluctuations in 2010-2017. The effect of cash shortage on exports via initial receivables remains strong. This result is consistent with the view that, in a short time window around demonetization, the effect of the other foreign shocks (or a general equilibrium effect of demonetization that affects firms through foreign receivables) did not affect firms differentially based on the foreign receivables, consistent with the small movement in the exchange rates (Appendix B.1) and the fact that the foreign taste changes do not bias the coefficient (Appendix C). Note that we additionally confirm our results using another exposure measure that only captures the domestic receivables: the product-specific accounts payable to expenditures of buyers. This measure only utilizes the domestic buyers' information and does not suffer from concerns related to foreign receivables. As shown in the main draft, the effect is also stronger for firms that rely heavily on the domestic market, consistent with these results.

D.2 $[AR/S]_i$ and $[AP/E]_p$

Table OA.1 shows a strong, positive relationship between the accounts receivable to sales and product-specific accounts payable to expenditures. The correlation remains strong regardless of including other control variables or using the short-term accounts receivable used in Appendix D.1. These results ensure that the $AP/E_{\text{p,t-1}}$ is a good measure of exposure to demonetization. When firms mainly sell products paid for with buyers' credit, they hold more receivables and suffer more during demonetization. Cash holding is negatively related to receivables, suggesting that cash and receivables are substitutes but affect exporters independently, as shown in Table 3.

	(1)	(2)	(3)	(4)	(5)	(6)
	$[AR/S]_i$ (total)			$[AR/S]_i$ (short-term)		
$AP/E_{p,t-1}$	0.084***	0.099***	0.077***	0.086***	0.097***	0.080***
	(0.029)	(0.035)	(0.028)	(0.029)	(0.034)	(0.028)
ln Age		-0.002	0.014***		-0.003	0.014***
		(0.006)	(0.005)		(0.006)	(0.005)
ln Cash		-0.007***	-0.004*		-0.007***	-0.004**
		(0.002)	(0.002)		(0.002)	(0.002)
ln Interest Payment		-0.000	0.003		-0.000	0.002
		(0.005)	(0.004)		(0.005)	(0.004)
ln Total Assets		0.001	-0.005		-0.000	-0.009
		(0.005)	(0.007)		(0.004)	(0.006)
ln Bank Borrowings		0.003	0.000		0.003	0.002
		(0.004)	(0.004)		(0.004)	(0.004)
$PBIT_{i,\ t-1}$			0.001			0.003
			(0.005)			(0.005)
$AP/S_{i,t-1}$			0.531***			0.514***
			(0.056)			(0.054)
Firm FE	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓
R^2	0.006	0.013	0.184	0.007	0.014	0.182
Observations	4697	3562	3097	4698	3562	3096

Table OA.1: Using Additional/Alternative Controls

Note. Table OA.1 regresses accounts receivable to sales on accounts payable to expenditures and other control variables. All variables are average across 2013-15. Standard errors are clustered by major product code. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.3 Using an Indicator Variable

Our identification strategy relies on the difference-in-differences framework using accounts receivable to sales (AR/S) as exposure to the demonetization episode. One concern in using the AR/S is that it is a continuous variable and requires a stronger assumption to obtain a causal interpretation on the estimated parameter (the "strong parallel trend assumption", as discussed in Callaway et al. (2021)).

As a robustness exercise, we define three different indicator variables based on firms' AR/S. First, we define an indicator variable equal to 1 if the firm's AR/S is larger than 0.5 and 0 otherwise. Second, we use an indicator variable equal to 1 if the firm's AR/S is larger

Cutoff:	Exports					
	$AR/S_{i,t-1}$=0.5		p50		p75 and p25	
	(1)	(2)	(3)	(4)	(5)	(6)
$Post_t$ x $D_{i,t-1}$	-0.118***	-0.157**	-0.060***	-0.068**	-0.098***	-0.108**
	(0.039)	(0.077)	(0.022)	(0.029)	(0.031)	(0.050)
Firm FE	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓
NIC4 FE x $Post_t$		✓		✓		✓
Other Firm Controls x $Post_t$		✓		✓		✓
Number of Firms	6,439	4,120	6,439	4,120	3,598	2,156
R^2	0.763	0.764	0.763	0.764	0.753	0.756
Observations	160300	105658	160300	105658	84277	52329

Table OA.2: Exports and Demonetization: Using an Indicator Variable

Note. Table OA.2 considers two different indicator variables defined based on $AR/S_{i,t-1}$. Columns (1)-(3) consider an indicator variable equal to 1 if $AR/S_{i,t-1}$ is larger than 0.5 and 0 otherwise. Columns (4)-(6) consider an indicator variable equal to 1 if $AR/S_{i,t-1}$ is larger than the 75th percentile of the distribution and 0 if $AR/S_{i,t-1}$ is smaller than the 25th percentile of the distribution. All other specifications are identical to table 3 columns (4)-(6). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

than the median value of AR/S and 0 otherwise. Lastly, we consider an indicator variable equal to 1 if the firm's AR/S is larger than the 75th percentile of the distribution and 0 if the AR/S is smaller than the 25th percentile of the distribution. Table OA.2 reports the results using these three different indicator variables.

The negative demonetization effect on exports remains strong regardless of the choice of indicator variables. Firms with higher accounts receivable to sales decrease their exports more than their counterparts after the demonetization episode. The results are robust to including additional controls or using alternative indicator variables.

D.4 Restricting Sectors

One potential concern is that our sample does not cover total exports by Indian firms. Similarly, the extensive margin results we emphasize in Figure 4 may simply reflect decreased sample coverage after demonetization. To address this concern, we restrict the sample such

that we have the same number of sectors in 2015-2017. We also use only those sectors with at least 70%, 75%, 80%, and 85% of total exports reported in official sectoral Trade Map data. As shown in Table OA.3, we still find that the negative effect on exports is robust across different subsectors available in our sample.

	Exports					
	Balance Sectors		>70%	>75%	>80%	>85%
	(1)	(2)	(3)	(4)	(5)	(6)
$Post_t$ x $AR/S_{i,t-1}$	-0.311***	-0.310***	-0.317***	-0.367***	-0.376***	-0.321***
	(0.104)	(0.110)	(0.108)	(0.113)	(0.110)	(0.121)
Firm FE	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓
NIC4 FE x $Post_t$		✓	✓	✓	✓	✓
Other Firm Controls x Post FE		✓	✓	✓	✓	✓
Number of Firms	4,020	4,020	3,929	3,895	3,863	3,808
R^2	0.765	0.767	0.773	0.772	0.772	0.769
Observations	103236	103236	99311	97726	95927	92871

Table OA.3: Exports and Demonetization: Restricting Sectors

Note. The dependent variable is the value of exports at the firm-month level, and AR/S is the 2013-2015 log mean ratio of accounts receivable to deflated sales. Other firm controls are the log firm age and 2013-2015 log mean bank borrowing, cash holdings, interest expenses, and total assets. The sample covers 2015-2017. Standard errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.5 Price, Quantity, and Extensive Margins

Table OA.4 presents the real effect of demonetization on firm exports using the same specifications used in Table 3. The demonetization effect on export quantity (columns (1) and (2)), export price (columns (3) and (4)), number of products (columns (5) and (6)), and number of destinations (columns (7) and (8)) are presented. Consistent with the event study results in Figure 3, the demonetization effect on firm exports mainly arises from the export quantity rather than export prices. More affected firms decrease the number of exporting products and destinations, similarly to the results in Figure 4. These results reinforce the

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Quantity		Price		N. of Products		N. of Destinations	
Post_t x $\text{AR/S}_{\text{i,t-1}}$	-0.444***	-0.380**	0.077	0.017	-0.727**	-0.735**	-0.742***	-0.526**
	(0.144)	(0.153)	(0.104)	(0.112)	(0.310)	(0.328)	(0.240)	(0.252)
Firm FE	✓	✓	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓	✓	✓
Nic4 FE x Post_t		✓		✓		✓		✓
Firm Control x Post_t		✓		✓		✓		✓
Number of Firms	4,043	4,043	4,046	4,046	4,042	4,042	4,045	4,045
R^2	0.734	0.738	0.593	0.599	0.823	0.825	0.891	0.893
Observations	103984	103984	103851	103851	104471	104471	104404	104404

Table OA.4: Price, Quantity (Tornqvist), Extensive Margins

Note. AR/S is 2013-2015 log mean accounts receivable to sales. All variables are deflated. The Tornqvist index is used for the construction of quantity and price indexes. We control for log firm age, 2013-2015 log mean bank borrowing, cash holdings, interest expenses, and total assets. Standard errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

ones presented in the main body of the paper.

D.6 Extensive vs. Intensive Margins

Our analyses so far emphasize the importance of the extensive margin in part because this margin shows the real effect, consistent with effects on export quantity. This section further investigates the relative importance of the extensive and intensive margins to better understand the effect of demonetization on exports. Specifically, we decompose the value exports as follows:

$$\ln \text{Exports} = \underbrace{\ln\left(\text{Number of X}\right)}_{\text{Extensive Margin}} + \underbrace{\ln\left(\frac{\text{Exports}}{\text{Number of X}}\right)}_{\text{Intensive Margin}}$$

where X is products, destinations, and products X destinations. We regress each margin on the interaction of *Post* X AR/S along with firm and time fixed effects following equation

(5.2).

Margins		Product		Destination		Product x Dest.	
	(1) Exports	(2) Ext.	(3) Int.	(4) Ext.	(5) Int.	(6) Ext.	(7) Int.
$Post_t$ x $AR/S_{i,t-1}$	-0.323***	-0.143***	-0.181*	-0.115***	-0.208**	-0.197***	-0.126
	(0.111)	(0.046)	(0.098)	(0.043)	(0.088)	(0.055)	(0.084)
Firm FE	✓	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓	✓
Nic4 FE x $Post_t$	✓	✓	✓	✓	✓	✓	✓
Number of Firms	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Firm Control x Post FE	✓	✓	✓	✓	✓	✓	✓
R^2	0.757	0.784	0.714	0.833	0.667	0.824	0.675
Observations	100021	100021	100021	100021	100021	100021	100021

Table OA.5: Exports and Demonetization: Extensive vs. Intensive Margins

Note. Samples are balanced across specifications such that the total effect is decomposed into extensive and intensive margins. *Ext.* indicates the extensive margin, *Int.* indicates the intensive margin, and *Dest.* indicates product destination. Products are defined using 8-digit HS codes. We control for log firm age, 2013-2015 log mean bank borrowing, cash holdings, interest expenses, and total assets. Standard errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The results in table OA.5 suggest that both margins are important. Columns (2) and (3) decompose exports into the number of products and the average exports per product. The effects on the intensive and extensive margins account for approximately 56% (=.181/.323) and 44% (=.143/323), respectively. Decomposing the export values into the destination margins, the effect within each destination is stronger. As shown in columns (4) and (5), the effect on exports per destination is approximately 64% (=.208/323), whereas the effect on the number of destinations is approximately 36% (=.115/323). If we combine both margins, the extensive margin becomes much stronger, as presented in columns (6) and (7). The effect on the number of products and destinations accounts for approximately 61%, and the effect on the average exports per product and destination becomes 39%, and is not statistically significant at conventional levels.

D.7 Aggregate Effect

Our results speak only to the relative change in exports between more and less affected firms based on accounts receivable to sales. The use of micro-level data helps to pin down the exact mechanism through which monetary policy affects exports but does not allow us to quantify the aggregate effect of demonetization.

We conduct a back-of-the-envelope calculation for the aggregate demonetization effect on exports using our reduced form estimates. Table 1 shows that the median exporter has .178 accounts receivable to sales, and the estimated coefficient in Table 3 is approximately 0.3. Considering two economies where one economy only features exporters with 0 receivables and the other with median receivables, an economy with the median receivables experiences an approximately 5.34% (.178 $\times$ 0.3) decrease in exports.[32] Since the aggregate value of exports in 2015 was approximately 264.44 billion USD, the total loss in exports after demonetization is approximately 14.13 billion USD (264.66 $\times$ 0.0534). The effect is likely a lower bound as we have abstracted away from the exit of exporters by focusing on those who survived during demonetization and excluded small exporters not included in the Prowess data (abstracting away from the other general equilibrium effects).

[32]Note that this number is also comparable to the estimated effects based on the district-level demonetization shocks reported in Table 2.