The Supply-Side Effects of India's Demonetization*

Giri Subramaniam†

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Abstract

I study the supply-side effects of a unique monetary shock – the 2016 Indian *demonetization* – that made 86% of currency in circulation illegal overnight. Exploiting cross-sectional variation in firm and industry characteristics that correlate with cash usage and exposure to the informal sector, I find that firms that use cash more and obtain larger shares of labor or material inputs from the informal sector, experienced declines in their labor and material shares after demonetization. I also show that casual laborers were more likely to report being unemployed in the months following demonetization. These findings document a supply channel for demonetization and also show that cash plays an essential role in India's informal sector. Crucially, given that India's formal sector is highly dependent on the informal sector for labor and materials, any shock to the supply of cash is likely to have affected the economy as a whole.

Keywords: Cash, Demonetization, Money Supply, Informal Employment, Informal Sector
JEL Classification: D22, E2, E42, E5, E51, O17

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†Department of Economics, Boston College, 140 Commonwealth Avenue, Chestnut Hill MA 02467 | Email: subramag@bc.edu | sites.google.com/view/giri-subramaniam

1 Introduction

Paper currency is still widely used in both, developed and developing countries alike. Despite repeated calls for moving away from cash (Rogoff, 2015) and having made tremendous technological advances in payment technologies, cash facilitates easy exchange by overcoming financial barriers such as access to banking services. Businesses, even, may hold cash for precautionary motives or transactional purposes in order to pay for certain inputs that are easier to pay for in cash. The latter function of cash is reminiscent of countries with a large informal or unorganized production sector[1] where the formal and informal sector are interdependent. Firms rely on informal employment[2] by hiring temporary workers, usually without a formal contract, involve them in casual yet full-time labor, and typically pay these workers their wages in cash because they do not have or use bank accounts. In such environments, cash plays an essential role in overcoming the transactional friction.

In this paper, I study the importance of cash to firms in India by exploiting industry reliance on cash and, exposure to informal employment and the informal sector. In order to do this, I analyze a unique unanticipated shock to the supply of existing currency in circulation. On November 8th, 2016, the Government of India announced that the two largest denomination currency notes would cease to be legal tender. This was termed as *demonetization* and the policy amounted to rendering 86% of currency-in-circulation illegal tender overnight. Due to additional constraints on printing and distributing new notes to replace the demonetized currency, the policy resulted in a large and abrupt decline in the supply of cash (see Figure 1) in the months that followed. I exploit the unanticipated nature of the episode as a natural experiment to test whether firms in industries that were more reliant on informal employment and more exposed to the informal sector for material inputs, were disproportionately affected by the shock. Unable to pay informal workers their wages and materials suppliers the cost of goods in cash, these firms were forced to lay off part of their work force and procure fewer materials, respectively, in the period immediately after the demonetization announcement.

My analysis proceeds in two steps. *First*, I construct measures of cash usage, reliance on informal employment, and exposure to the informal sector, using a survey of workers, a census of manufacturing, and a survey of informal enterprises. It is key that these measures are taken from data prior to the demonetization episode so that I can identify from the cross-section of industries. I then merge these to a database of quarterly financial statements of firms and estimate the near-term effect of the demonetization shock using a difference-in-differences approach. The sudden and unanticipated nature of the announcement renders itself useful for and provides credence to the identification strategy. Additionally, cross-sectional heterogeneity in industry and firm exposure to informality helps unpack the causal effects of the shock by naturally producing firms that

[1]The "informal sector" or "unorganized sector" comprises of firms that are not registered. The exact definition varies from country to country.

[2]Informal employment is a job-based concept and is defined in terms of the employer-employee contractual relationship and basic protections that are included with the job of the worker (ILO, 2018). Typically, these "casual" workers get their wages in cash, work without a formal contract, and are not covered by regulatory protections (RBI, 2017).

were treated with different intensity. *Second*, I use a household panel to verify whether casual-type workers were more likely to report being unemployed in the months after demonetization relative to formal-type workers.

I find three main results. *First*, I find that firms in industries characterized by greater cash usage hired fewer workers and purchased fewer materials following the demonetization shock. I show this by documenting a relative decline in firms' labor share and materials share in value added for industries with greater cash usage in the quarters during and after the sudden announcement. Firms that hire more informal workers and inputs from the informal sector need to hold more cash. Hence, I measure cash usage in two ways: one, the industry share of cash in current assets, and two, the industry share of cash in total spending on labor and materials. A one standard deviation increase in cash usage, by either measure, translates to a 1.5 percentage point decline in labor share, and a 1.6 percentage point decline in materials share in value added.

Second, I construct measures of industry dependence on informal employment and a measure of exposure to the informal sector for materials. For labor I measure informal employment by the fraction of informal workers in total workforce in an industry, and the fraction of casual-type payments made to workers in an industry. I find that a one standard deviation increase in informal employment, by either measure, is associated with a 0.5 percentage point decline in labor share in value added. For materials, I first construct a firm-level measure of exposure to the informal sector. This measure uses product-level purchase value of materials by firms and the extent of informality at the respective product-mapped industry using value added by informal enterprises vis-à-vis that of total (formal and informal) enterprises. I find that firms that are more exposed to the informal sector by this measure experienced a significant decline in their materials share in value added in the quarter immediately after demonetization.

Third, using a household panel I show that casual or temporary laborers (such as, wage laborers, hawkers, support staff etc.), relative to salaried workers in formal employment (such as, businessmen, organized farmers, industrial workers, white collar clerical employees etc.) were more likely to report becoming unemployed in the months after demonetization. These worker-level findings thus verify my findings from the firm-level analysis that document a decline in the labor share.

My findings highlight that there were significant supply-side effects caused by the large and unanticipated contraction in currency in circulation. Cash plays an essential role in India's informal sector and given that India's formal sector is highly dependent on the informal sector, a large shock to the supply of cash is likely to have affected the economy as a whole. The identification strategy based on the cross-section of industry dependence and exposure to informally-sourced inputs is limited in documenting near term impacts of the episode. My results also indicate that these negative effects are relatively smaller even dissipate in the quarter after the demonetization announcement. Given that available data exclude the informal sector, which was presumably most hurt by the shock, my findings are a conservative lower bound of the total effects.

Aggregate data do not describe the true effects of demonetization for two reasons. One, output

from the informal sector is not measured but estimated as a fixed proportion of formal sector, and that factor is updated every few years by conducting a survey. Hence, measured GDP will understate the effects of demonetization. Second, as there was a shift away from cash to electronic means of payment, many under-the-table transactions were shifted to the measured economy; any assumption that official and black market GDP move together is probably invalid in that moment. Hence, I study the consequences of demonetization in the cross-section of industries and firms.

The rest of this paper is organized as follows: In Section 2, I discuss the contributions of this paper and provide an overview of the related literature. In Section 3, I present a background of the main events surrounding the demonetization episode, provide an account of the events that followed the shock, and describe the legislative framework concerning labor regulation in India that is relevant to my study. In Section 4, I sketch a model of how firms react to the demonetization and summarize main results from the model. I then present the data sources I use in Section 5 and discuss the empirical strategy to test the model implications using the data in Section 6. I present results in Section 7 and conclude in Section 8.

2 Related Literature

This paper contributes to the existing literature in three broad areas. First, the findings in this paper add to the growing list of studies that attempt to unpack the effects of demonetization on the Indian economy. Second, viewing the demonetization episode as a natural experiment, specifically, as a large and an unexpected monetary shock to the economy, the empirical findings in this paper provide support to the literature on identifying the real effects of nominal disturbances. Third, my findings also highlight the link between the formal and informal sectors in developing economies like India where there is a prevalent use of informal employment and a heavy reliance on the informal sector by firms in the formal sector in India.

An evolving number of papers attempt to identify demand-side impacts of demonetization on the real economy[3]. Chodorow-Reich et al. (2018) exploit the geographic distribution of demonetized and new notes in order to identify the impact of the currency supply shock on real economic activity, deposits, credit, and alternative forms of payment technology. This paper also sheds light on the aggregate effects of the demonetization episode. While their paper focuses purely on identifying the demand-side effects from geographical heterogeneity, I am able to identify significant supply-side effects by exploiting cross-sectional heterogeneity across industries. On the household-side, Karmakar and Narayanan (2019) provide additional evidence of households without bank accounts witnessing declines in income and expenditure, and of smoothing behavior by way of increased leverage from informal sources. On the firm-side, Banerjee and Kala (2017) find from surveys that wholesalers and retailers reported 40% lower sales in December and January.

[3]These are in the spirit of Velde (2009) who unpacks the effects of three overnight diminutions of gold and silver coins in eighteenth century France using a narrative approach.

Viewing the demonetization episode as an aggregate coordination device and focusing on adoption dynamics by retailers, Crouzet et al. (2019) document that the episode led to a permanent shift to electronic payments even though the shock was transitory. Focusing on agricultural markets, Aggarwal and Narayanan (2017) estimate the impact of demonetization on arrivals and prices of agricultural commodities, and find reduced trade, arrivals and lower prices in government regulated markets (or *mandis*) in the short-run. This decline in prices appears to have recovered over a period of three months. Taken together, the last two studies provide some evidence for significant supply-side effects along with demand-side effects of demonetization.

Second, my paper also relates to the literature that attempts to identify the real effects of surprise nominal shocks to the economy. Many different approaches have been followed in order to identify these real effects from plausibly exogenous variation in monetary policy (Christiano et al., 2005; Nakamura and Steinsson, 2018). Some approaches include narrative studies such as Romer and Romer (1989) who peruse historical records and select episodes where there were large disturbances in monetary policy that were not driven by the real sector. They then test whether output is unusually low (high) following the negative (positive) shocks of this kind. The Indian demonetization is a well-suited episode for this kind of analysis, in that at least the policy was completely unanticipated and plausibly unrelated to the state of the real economy, in addition to the shock banning 86% of currency-in-circulation. Nakamura and Steinsson (2018) point out that in order to use the controlled experiment method of identification in monetary policy, identification may come from either "natural experiments" where the change in policy is large relative to potential confounding factors, that may be controlled for, or, an approach that focuses on large policy actions for which it can be plausibly argued that potentially confounding factors are drowned out.

My paper also relates to an older strand of literature in monetary theory that asks whether money can be thought of as an input in the production function of firms[4]. Fischer (1974) provides two theoretical arguments that allow for money to be treated as a factor of production, while also admitting that treating money as an input in production is more for the convenience it offers[5]. In his paper, he calls for a deeper explanation of the demand for money by firms. My claim in this paper is that if at least one type of input needs to be paid in cash, this creates a need to firms for holding cash. Nadiri (1969) assumes a model of a firm that minimizes costs subject to a production function which includes cash as an input with an aim to estimate the determinants of real money balances in the U.S. manufacturing sector. My paper can be thought of as an improvement over this approach in terms of identification.

My understanding of this strand of literature is that thinking about money as an input in production provides for a good thought exercise that helps unpack the supply side effects of monetary shocks such as demonetization. Considering money as an input in the production function may proxy for the various uses of money to firms, insofar as the neoclassical production function is

[4]This was also pointed out in the Economic Survey 2016-17 as a thought exercise in order to understand the aggregate supply side effects of demonetization (GOI, 2017).

[5]This is similar to the argument provided by Feenstra (1986), that there is a functional equivalence between treating money as an argument in the utility function and as an input that lower liquidity costs.

itself a supposedly reduced form of an engineering relationship between various inputs and output. In my paper, the function of money to firms is for transaction purposes – firms need to pay for certain inputs in cash, and this is the reason why they hold real money balances. Tax evasion and the speculative motive may very well be other reasons for which firms need to hold cash.

Lastly, my findings highlight the link between informal and formal activity in India, specifically the use of informal employment by formal sector firms. Formal sector firms recruit half of their labor force via informal employment[6] (Narayanan, 2015). Typically, these workers get their wages in cash and are not covered by regulatory provisions (RBI, 2017). Firms hire informal workers to avoid providing for job benefits that come with a contract, and for workers lack of opportunities in the formal economy may make informal employment lucrative. Substituting permanent workers with workers on temporary, or even no formal contract – a term coined as 'flexibilization' of labor – is a global trend, and has increased especially in developing countries (Saha et al., 2013). Strict regulatory provisions and open-ended contracts typically contribute to an increased use of temporary workers (Balakrishnan et al., 2010). A report by the ILO (2018) states that while more than 60% of the world's employed population earn their livelihoods from the informal economy, about 11% of informal workers are in the formal sector. Demonetization was expected to have disrupted the informal economy disproportionately more than the formal economy, as the former is more cash-intensive. However, given the link between informal and formal activity in India, demonetization must have affected firms that were more exposed to the informal economy. Informal economic activity is measured using surveys from time to time, and is estimated using indicators and proxies from the formal economy[7]. To the extent that we have data only for the formal economy, my results will be an underestimate of the true effect of demonetization.

Additionally, given the setting of a removal of currency in a cash-intensive economy, my findings also hint at some of the potential costs of abolishing cash and provide additional support to the the provisions that need to be made by the government before such policies are implemented. For instance, Rogoff (2015) advises that access to free basic debit accounts and basic smartphones must be in place before making the gradual transition to a cashless economy.

3 Background

In this section, I first describe the main events that took place following the announcement of demonetization that document the shortage of cash faced by the economy afterwards. Next, I provide accounts from newspaper reports and anecdotal evidence pertaining to the cash shortage faced by firms focusing on worker layoffs and job losses. Finally, I provide some background of the legislative framework pertaining to labor in India that lead firms to hire temporary, casual,

[6] Informal employment as a share of formal sector employment increased from about 38% in 1999-2000 to more than 50% in 2011-12.

[7] For instance, manufacturing in India is proxied using the Index of Industrial Production (IIP), which includes mostly large establishments. As noted in the Economic Survey 2016-17, the effect of demonetization on informal economic activity will be underestimated (GOI, 2017).

and contract workers.

3.1 Demonetization

On November 8th, 2016, the Prime Minister of India announced via an unexpected nationally televised address, that currency notes of the two largest denominations, the ₹500 and ₹1,000 notes (worth about $7.5 and $15, respectively), would be stripped of their status as legal tender (RBI, 2016). The stated goals of the policy were to eliminate fake currency and impose losses on those who held black money in the form of unaccounted earnings and bribes. These objectives were justified by stating that fake currency was increasingly being used to finance terrorism and that the policy would eventually reduce corruption. In order to achieve the policy's objectives, the policy, including its announcement, had to be kept a secret and very few high-ranking government officials knew about it prior to the televised address.

During the same address, the introduction of new ₹500 and ₹2,000 banknotes with improved security features to replace the old ones was also announced. Holders of the old notes could either deposit them at banks in exchange for lower denomination or newer notes newer notes but could not use them in transactions with effect from November 9th. Withdrawal and deposit limits were placed on individuals and businesses in order to avoid excessive currency withdrawal due to public frenzy or fear and to monitor large deposits, respectively. The deadline to return the old notes was set at December 31st, 2016.

The demonetized notes accounted for about 86% of currency-in-circulation (CIC) in value terms, which was nearly 12% of GDP in 2015-16. Effectively the policy resulted in a sharp decline in total currency in circulation from a pre-demonetization peak of about ₹15,205.65 billions to a post-demonetization trough of ₹7,832.57 billions – which amounted to an actual decline of about 50% . Figure 1 plots total currency with the public and notes in circulation from fortnightly measures of money stock provided by the central bank. It is worth pointing out that this data includes, both, the demonetization and remonetization phase of the policy. The slow replacement of old notes with new ones resulted in a sharp decline in CIC.

First, the new notes were not printed or distributed prior to the policy announcement. The amount of cash that needed to be printed was several magnitudes higher relative to the usual printing activity undertaken by the printing press. This slow process caused additional delays during the printing and distribution process. Second, owing to the extreme secrecy of the operation, retail banks were not informed before the announcement was made and were thereby left unprepared with their capacities not updated to smoothly implement the replacement phase of the policy. One example is during the remonetization process, since the new currency notes differed in size compared to the old ones, in order to put them into circulation ATM machines needed replacing which resulted in delays and slowed down the remonetization process. Third, the general process of introducing new currency into the economy was subject to the existing capacity of the central bank's infrastructure, which could not have been vastly updated prior to the announcement.

Holders of the old notes were forced to turn in their cash, either depositing them in their banks accounts, or exchanging them for lower denomination currency. In addition to the inadequacy of currency supply, various limits were placed on exchange and withdrawal of currency due to the cash shortage. Initially, the exchange of old notes was capped to ₹4,000 ($60) per person per day, cash withdrawals from bank accounts at ₹10,000 ($150) per day and ₹20,000 per week ($300), and ATM-withdrawals were initially capped at ₹2,000 ($30) per day per card. Exceptions were made in the case of purchasing airline or train tickets, paying for utility bills, where old notes could be used. For small-businesses, withdrawals were restricted at ₹50,000 per week. Chodorow-Reich et al. (2018) point out that withdrawal of new notes in an area was determined by the supply of new notes to the same area. This provides evidence of the economy being cash constrained in the short term.

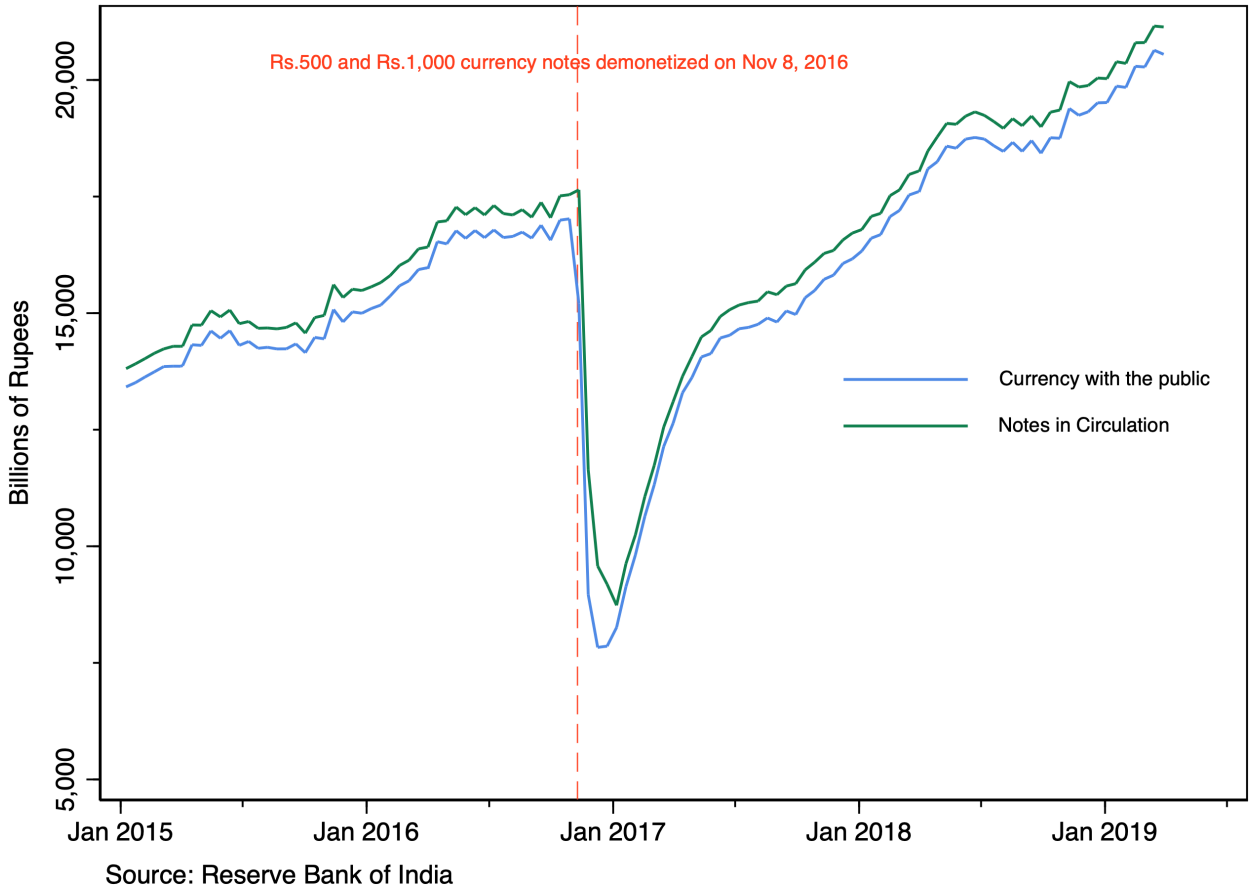

Figure 1: Measures of Currency Supply

Source: Database of Indian Economy, Reserve Bank of india. Notes: Dashed line indicates the date of announcement of demonetization.

3.2 Evidence of Cash Crunch faced by Firms and Job Losses

India is a heavily cash-based economy[8]. The months following the announcement were filled with newspaper accounts of shortages of cash by households and even by firms[9]. These included shortage of liquidity and working capital, leading to worker layoffs, retrenchments, shutdowns, etc. Firms, and contractors employed to hire workers on behalf of firms, who pay their workers in cash reported shortage of liquidity to pay employees their wages (Bhowmick, 2016). Such workers typically do not have bank accounts and are hence paid daily wages in cash[10]. Facing cash flow issues contractors in labor-intensive industries, such as garment manufacturing, were forced to let workers go and some even shut down. Another article reported that the cash shortage had disrupted the supply chain – trucks were left stranded with no money for fuel and goods were not loaded because workers were not being paid (Choudhury and Singh, 2016).

Supply chains even at medium and larger companies broke down, providing evidence of how much the organized corporate sector relied on cash to conduct day-to-day operations. Business owners reported that the legally imposed withdrawal limit of ₹50,000 per week was not sufficient to cover expenses, and that payment of wages to workers and transportation costs were the major problem. Pattanayak (2016) reports that some industry executives demanded a tenfold hike in the cash withdrawal limit of ₹50,000 per week in order to be able to conduct certain necessary business transactions. Formal sector firms that relied on informal, cash-based channels were affected the most, specifically firms in labor-intensive industries such as construction and building materials sectors, where contractors sill pay workers in cash. Dey (2016) reports how an employer at a footwear manufacturing unit asked nearly 150 workers to go on unpaid leave for a month, citing his inability to pay their wages at the time. Likewise contractors and landlords were unable to cover wage expenses and were forced to let workers go, at least until they could lay their hands on the new notes that were meant to remonetize the economy. In the near-term they were severely cash constrained.

The RBI provided some relief by announcing, a month and a half later on December 29th, that banks may provide an 'additional working capital limit' to micro, small, and medium enterprises (MSME) borrowers in order to overcome any cash flow difficulties. This was an ad hoc one-time measure up to March 31st, 2017, after which working capital limits would revert to normalcy.

A study conducted by All India Manufacturers Organisation (AIMO) assessing the impact of first fifty days of demonetization found considerable declines in jobs in the manufacturing sector (Janardhanan, 2017). AIMO found that medium scale industries with a staff strength of 300 to 700

[8] In 2012, 87% of transactions in India were cash based and typically even households with access to formal banking carry a lot of cash, especially in high denomination bills, with them (Mazzotta et al., 2014). Cash to GDP ratio was at 12.04% in 2013. To get a sense of this magnitude, this ratio for comparable countries was 3.93% for Brazil, 5.32% for Mexico, and 3.72% for South Africa.

[9] In Mazzotta et al. (2014), the section on 'Reasons and Attitudes to using cash in India' states that "... more than half (55%) of those who use cash alone are either women engaged in unpaid household work and casual laborers who do not have any regular source of income".

[10] Due to the withdrawal limits placed on households, some laborers who had bank accounts were unwilling to start accepting direct payment out of fear that they may lose their below poverty line status (Pattanayak, 2016).

suffered 3% job losses and 7% loss in revenue. Large-scale industries, with 2,000 to 3,000 employees, experienced 2% job losses and 3% loss in revenue. Indeed, the worst-hit sectors were those dominated by unorganized labor. The Center for Monitoring Indian Economy (CMIE), a private organization that collects and analyzes business and economic data, reported that about one and a half million jobs were lost from January, 2017 through April, 2017 (Vyas, 2017). This includes organized and unorganized sectors, and agricultural and non-agricultural sectors. Despite November being the festive season, labor force participation rate (LFPR) fell to a new low of 44.8% (from 46.4% in the previous month), recovering slightly to 45.2% in the following two months. At the same time, the unemployment rate fell from 6.8% (September-December, 2016) to 4.7% (January-April, 2017). This is most likely due to the increase in working age population (persons greater than 14 years of age) while the number of employed in fact shrank. The recovery in LFPR was only moderate as evidenced from the drop in its average: from 46.9% (January-October, 2016) to 44.3% (January-April, 2017). These findings of long lasting effects are in line with the recently released annual report by the government, the Periodic Labour Force Survey (PLFS), that states that unemployment rate based on *usual status* stood at 6.1% and *current weekly statu*s at 8.9% in 2017-18[11].

3.3 Labor Regulations and Temporary Workers in India

A vast majority of India's labor force comprises of informal workers. Informal employment, including agricultural employment, accounts for 88.2% of total employment (ILO, 2018). Excluding agriculture, more than 12% of these informal workers reside in the formal sector. The ILO (2016) finds that the share of informal workers in the organized sector has increased significantly because of a greater use of contract and other forms of casual labor[12]. Hsieh and Klenow (2014) point out that while nearly 70% of manufacturing output is in the formal sector, a majority of manufacturing employment, nearly 80%, is in the informal sector.

Labor regulation, specifically the Industrial Disputes Act (IDA) of 1947, and its amendments, has been named as one of the primary causes for making firms reliant on contract, temporary, or casual workers (Bertrand et al., 2015; Chaurey, 2015)[13]. The IDA lays out rules and regulations that also govern layoffs, retrenchments, strikes, and lockouts, and resolves labor-related disputes by setting up special bodies to arbitrate them, thereby raising the cost of hiring and firing workers, particularly for large firms. For instance, Section V-A of the IDA states that retrenched workers are entitled to compensation equaling 15 days' average wages for each year of service. A laid off worker is eligible for 50% of wages in addition to a dearness allowance per day (for a maximum of 45 days). The more severe Section V-B of the IDA calls for firms to obtain government permission

[11] Estimates based on *usual status* consider an individual's principal status as well as and subsidiary status in employment. While estimates based on *currency weekly status* provide a picture of unemployment in a short period of seven days during the survey period.

[12] In 2011-12, 79% of non-agricultural wage workers had no written contract and only about 24% were eligible for social security benefits.

[13] The ILO (2018) also finds that in countries characterized by pervasive labor regulation, formal sector firms rely heavily on informal employment.

to lay-off or retrench a single worker[14]. Taken together, these laws make it immensely difficult and costly for firms to hire permanent workers.

However, the IDA does not cover workers hired through contractors, temporary hires without formal contracts, or casual labor[15]. Hence this allows firms to circumvent the law allowing them to expand their workforce by employing these types of non-permanent workers. Firms also hire temporary workers who work full-time because they can afford to pay them a lower wage and can be hired and fired at will[16]. Figure 2 plots the share of temporary workers as a share of total workforce for firms, surveyed in the World Bank Enterprise Survey, 2014, that report employing any temporary workers. While large firms typically hire fewer casual worker, the use of casual labor is widely prevalent across the firm-size distribution.

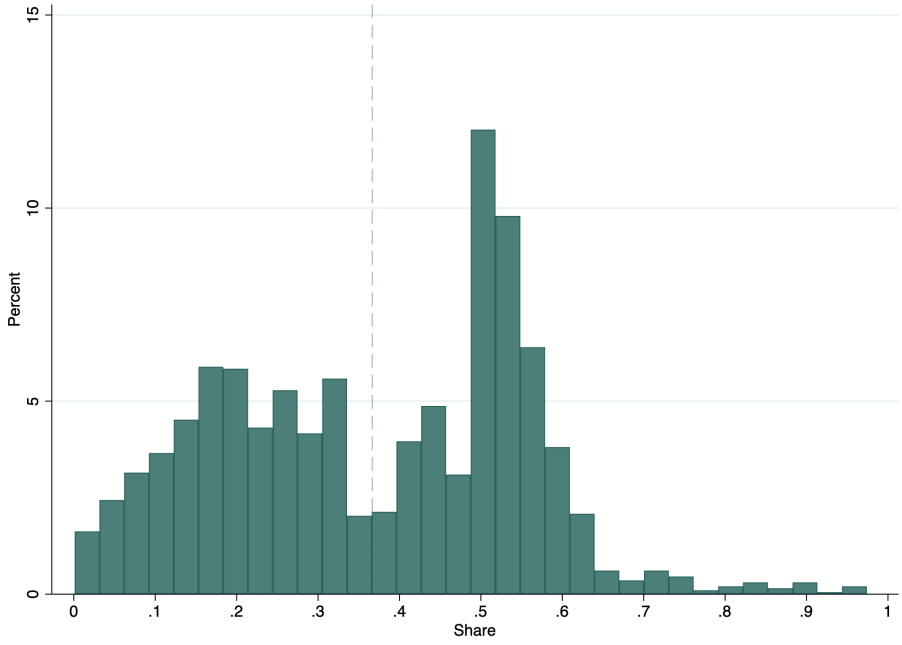

Figure 2: Full-Time Temporary Workers as a share of Total Workforce

Source: Author's calculation using World Bank Enterprise Survey 2014. Notes: For firms that report a non-zero share of temporary workers. Dashed line indicates mean value.

The IDA is legislated by the central government and then amended by the state governments as India follows a federal system of government. These amendments have resulted in some states establishing "pro-worker" or "pro-employer" labor regimes. Many studies have exploited this

[14]Regulations in Section V-A apply for establishments with 50 or more workers and regulations in Section V-B apply for establishments with 100 or more worker (Malik, 1997). These types of firms would potentially be included in the sample I study in this paper.

[15]I use the terms – temporary workers, workers without a formal contract, and casual workers – interchangeably in this paper.

[16]Table B.1 presents the number and share of permanent and full-time workers involved in production for all firms. On average, temporary workers are paid lower wages and work fewer hours. Their share in production stands at about 15-17%.

heterogeneity across states in order to identify the effect of labor market regulation on formal and informal manufacturing (Besley and Burgess, 2004), employment responses to shocks (Adhvaryu et al., 2013), and on contract labor use (Chaurey, 2015).

Apart from geographical variation, there also is considerable heterogeneity across industries in their use of casual labor. Figure 3 plots the share of casual labor employed in the total workforce against the share of labor in value-added for industries as classified in the KLEMS India 2015-16 database. While the two are not tightly linked, there is in general a positive relationship between the degree of labor-intensiveness in production and the share of casual labor used. Possibly labor-intensive industries (such as textiles or manufacturing of wooden products) face the brunt of "pro-worker" labor regulation more, as compared to relatively less-labor intensive industries (such as manufacturing of rubber and plastic products, or manufacturing of transportation equipment) and hence must resort to hiring more casual laborers in order to realize the economies of scale while minimizing firing costs.

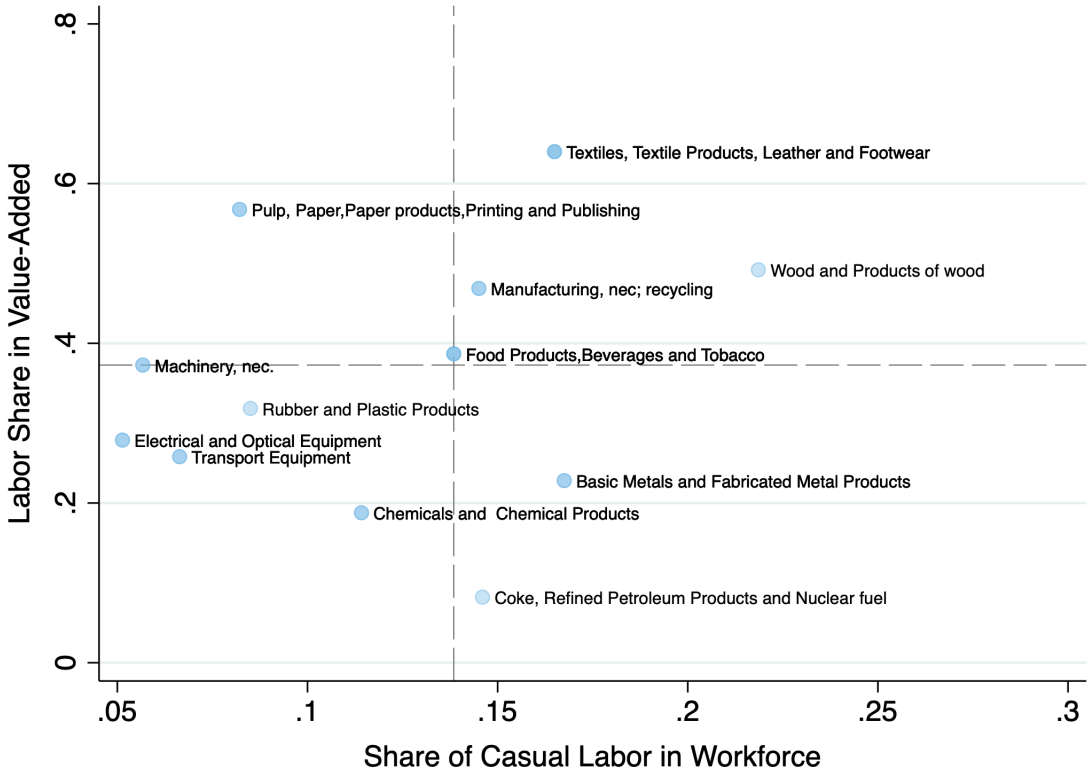

Figure 3: Labor Share in Value-Added and Casual Labor

Notes: Dashed lines indicate median values. Source: Author's calculations using KLEMS India Database 2011-12.

I will exploit various measures of cross-sectional heterogeneity across industries as proxies for industry-exposure to the informal sector and informal employment (for instance, industry use of casual labor) in order to identify the effects of demonetization on firms. What is key is that these

measures are from before the demonetization episode, hence do not vary with time, but vary only across industries.

4 Theory: The Effect of Demonetization on Firms

The goal of this section is to present a simple model of how firms may behave after a demonetization shock that will help motivate the empirical tests that I present later in section 6. To this end I sketch a static model of a production environment characterized by heterogeneous firms that face a need for cash in order to finance some factors of production.

The model consists of firms that use three inputs – capital, labor, and materials, denoted by K, L, and M, respectively. There are two types of labor and materials: formal-type labor (L_F) and formal-type materials (M_F), and casual-type labor (L_C) and casual-type materials (M_C) – in order to produce an industry-specific output (Y). Assume that firms need to pay a sunk cost Ψ before production begins, for instance, installation of machines and setting up factories. Once this sunk cost is incurred, the production function for each firm i in industry s is given by a constant-returns-to-scale technology as follows:

$$Y_{si} = K_{si}^{\alpha_s}(L_{F,si}^{\gamma_s} \cdot L_{C,si}^{1-\gamma_s})^{\beta_s}(M_{F,si}^{\delta_s} \cdot M_{C,si}^{1-\delta_s})^{1-\alpha_s-\beta_s} \tag{1}$$

The model is set in partial equilibrium and all factors are supplied inelastically at their given prices. Note that the shares of these factors are allowed to be different across industries. Assume that inputs of the casual-type may only be paid in cash. I do not explicitly model firms' need for cash. Possibly one could imagine that these workers do not have bank accounts or contractors who hire these workers only accept cash as it eliminates some type of friction. Further assume that firms may enjoy some flexibility in hiring and firing casual-type labor, possibly because they work without a formal contract, and hence firms find a need for this specific type of input.

Timing. The model is completely static but within each period firms act according to the following timeline:

(i) Firms withdraw (or set aside) some cash in order to pay for the casual-type inputs.

(ii) Firms decide how much capital to employ, labor to hire, and materials to procure.

- In normal times, when currency is in adequate supply, firms raise as much cash as their first-best choice of L_C and M_C dictates and the cash constraint will not matter for the optimal solution. In other words, firms' choices mimics the friction-less benchmark.
- After a demonetization shock, firms are now "cash-constrained" in the sense that it is now difficult for them to obtain cash, although they may have funds in less liquid forms[17]. Firms are now forced to hire L_C and procure M_C that are lower than their

[17]My definition of being cash constrained here differs from the usual definition in that it refers to the inability to access liquidity rather than a firm having cash at the bank. In this regard, my definition is similar to that of Karmakar and Narayanan (2019) who define liquidity constrained households as those with access to bank accounts during demonetization.

first-best levels.

(iii) Firms produce and sell their output.

Wage and expense payments to formal-type laborers and formal-type materials suppliers, respectively, can be made using relatively more "sophisticated" payment technology, such as direct deposit or checks[18]. Since casual-type laborers only accept cash[19], firms face the following cash-in-advance constraint for casual-type inputs:

$$w_{C,si}L_{C,si} + p_{C,si}M_{C,si} \leqslant \mathcal{C} \tag{2}$$

Here, $w_{C,si}$ stands for the wage rate paid to casual labor and $p_{C,si}$ stands for the price of casual-type materials expenses. $\mathcal{C}$ stands for the amount of cash firms set aside to fulfill their casual wage-bill. Demonetization in this framework would result in a decline in the supply or value of cash available to firms $\mathcal{C}^d < \mathcal{C}$.

I assume that firms minimize costs subject to (1) and (2). This cost-minimization problem simplifies to:

$$\begin{aligned}\min \mathcal{L} = w_{F,si}L_{F,si} + w_{C,si}L_{C,si} + p_{F,si}M_{F,si} + p_{C,si}M_{C,si} + rK_{si} \\ + \lambda[Y_{si} - K_{si}^{\alpha_s}(L_{F,si}^{\gamma_s} \cdot L_{C,si}^{1-\gamma_s})^{\beta_s}(M_{F,si}^{\delta_s} \cdot M_{C,si}^{1-\delta_s})^{1-\alpha_s-\beta_s}] \\ + \varphi(w_{C,si}L_{C,si} + p_{C,si}M_{C,si} - \mathcal{C})\end{aligned} \tag{3}$$

This leads to a simple solution that says that the ratio of wages of the two types of labor must be proportional to the ratio of its respective marginal products. That is, for a constrained firm (when $\varphi \neq 0$):

$$\frac{w_{F,si}}{(1+\varphi)w_{C,si}} = \frac{\gamma_s}{1-\gamma_s} \cdot \frac{L_{C,si}}{L_{F,si}} \equiv \frac{MPL_{F,si}}{MPL_{C,si}}$$

Similarly for materials, the optimal solution for a constrained firm is:

$$\frac{p_{F,si}}{(1+\varphi)p_{C,si}} = \frac{\delta_s}{1-\delta_s} \cdot \frac{M_{C,si}}{M_{F,si}} \equiv \frac{MPM_{F,si}}{MPM_{C,si}}$$

The only difference between the unconstrained and the constrained solution is that in the latter, the presence of the Lagrange multiplier on the cash constraint, φ, distorts the first order condition for casual-type labor casual-type materials, and introduces a wedge between the optimal choices of the formal-type input vis-à-vis the informal-type input. This multiplier is the shadow value of cash to the firm and comes into play only when the cash constraint binds (periods in which $\mathcal{C}^d < \mathcal{C}$).

[18]Credit may be used in which case, in this static framework, the interest rate on short-term credit would be subsumed under the price of each factor.

[19]This is similar to Banerjee and Duflo (2014) who, in their model of credit constraints, distinguish between inputs that are paid using working capital, that comes from bank credit and market borrowing, and inputs that can be financed using trade credit.

This framework provides me with a way of thinking about how firms may react after a demonetization shock. I summarize the intuition provided by the model below. I then test these results using firm-level data with cross-sectional variation across industries, and worker-level data for casual-type workers.

Result 1. When a firm is constrained on the supply of cash following demonetization, relative to its unconstrained first-best choice of casual-type labor and materials, the constrained firm now employs fewer casual-type workers and purchases fewer casual-type material inputs. Following demonetization, firms in industries that employed more casual-type inputs (characterized by relatively low values for γ_s and δ_s) employed fewer of these inputs.

Assume the wage rate for casual-type labor is lower than that of formal-type labor, so that the MPL-per-rupee for casual-type worker is greater than the MPL-per-rupee for formal-type worker[20]. Assume also that formal-type labor is a fixed factor at some constant optimal level, $L_{F,si} = \overline{L_{F,si}}$, given that firms face significant costs in hiring and firing formal workers. In this case, the shadow value of cash is positive and following a demonetization shock, cash-constrained firms hire fewer casual-type workers.

$$\text{If} \quad \frac{MPL_{C,si}}{w_{C,si}} > \frac{MPL_{F,si}}{w_{F,si}}, \quad \text{then} \quad \Rightarrow \quad \varphi > 0$$

Similarly, for materials, assume the price[21] for casual-type materials is lower than the price for formal-type materials, so that the MPM-per-rupee for casual-type materials is greater than the MPM-per-rupee for formal-type materials. Once again, the multiplier φ is positive, and cash-constrained firms purchase fewer materials for production.

So far I have assumed that the upper bound on the cash constraint is fixed and homogeneous across industry, at some arbitrary level $\mathcal{C}$. However, this need not be the case. If firms were indeed financing part of their wage-bill and materials expenses using cash, their cash holdings prior demonetization may provide information of their use of informal-type inputs

Result 2. Under the assumption that cash holdings may vary across industries depending on the intensity of use of informal-type inputs, firms in industries characterized by greater cash usage (cash relative to cost of inputs, for instance) experienced more severe demonetization.

$$\frac{dL_{C,si}}{d\varphi_s} < 0 \quad \text{and} \quad \frac{dM_{C,si}}{d\varphi_s} < 0$$

[20] Indeed, this result requires that nominal wages are rigid downwards, an assumption that is consistent with the evidence found in Kaur (forthcoming) for wages in India due to which equilibrium employment can be less than inelastically supplied labor. For a dynamic model of demonetization with downward nominal wage rigidity, see (Chodorow-Reich et al., 2018).

[21] As noted by Chodorow-Reich et al. (2018), there was no discernible change in trend in consumer price inflation and rural wage inflation (the only high frequency wage series available), with both remaining positive, which is consistent with wage and therefore price rigidity.

This result states that firms in industries that experienced more severe demonetization will have sharper declines in casual-type inputs.

Given the static nature of the model, I do not explicitly allow for credit to be an option in the case that a firm is cash constrained. However, in reality short-term credit and sundry credit lines may help a firm smooth a liquidity shock such as demonetization, by providing an alternate source of liquidity that is not cash. However, it may be difficult to open such credit lines in the short term that were not open before demonetization[22].

This simple model, under the plausible assumptions mentioned above, provides me with testable implications that I verify using firm-level and worker-level data.

5 Data and Summary Statistics

5.1 Data

I combine data from a few different sources: quarterly data on firm financial statements(income and expenses, and balance sheet items), an employment survey, a census of manufacturing establishments, a survey of informal enterprises, and household panel with information on employment status, occupation, and demographics. All these sources including variables used from each database are summarized in Table 1.

Table 1: Data Sources

Variables	**Source**	**Name**
Standalone interim quarterly financial statements for 2015-17	Centre for Monitoring the Indian Economy (CMIE)	Prowess
Balance sheet items (cash holdings, current assets, cost of production) of formal sector firms within 5-digit industries	Central Statistical Organization (CSO) of India	Annual Survey of Industries (ASI), 2015-16
Share of informal employment in total workforce within 5-digit industries	National Sample Survey Organization of India	Employment and Unemployment Survey, 2011-12
Products and by-products manufactured by 5-digit industries in the informal sector	National Sample Survey Organization of India	Unincorporated Non-Agricultural Enterprises, 2010-11
Employment status of working-age members from a household panel for 2016-2017	Centre for Monitoring the Indian Economy (CMIE)	Consumer Pyramids

[22]Typically, short-term working capital provided by banks are essentially credit lines with a pre-specified limit and an interest rate that is slightly higher than the prime rate (Banerjee and Duflo, 2014). In addition to this, due to mandated lending laws such as "priority sector lending", banks require to lend at least 40% of their net credit to the "priority sector" which includes agriculture, agricultural processing, transport industry, and small scale industries.

5.1.1 Firm-Level Panel Data

I use firm-level data from the *Prowess* database maintained by the Centre for Monitoring Indian Economy (CMIE) from income-expenditure statements and balance sheets[23]. This database covers publicly listed firms in the organized sector that consists of registered companies that submit quarterly financial statements. Although this database may not render a representative sample of Indian firms, it has three main advantages. First, *Prowess* contains detailed information on items in the financial statements at a quarterly frequency, as publicly-listed firms are mandated to report their quarterly financial statements. The availability of data at a high frequency make them well-suited for a study that aims to identify the immediate or near-term effects of the demonetization episode. Second, the availability of data on various items from a firm's financial statement allows for an detailed analysis of the short-run effects of demonetization on firms. Lastly, disclosure requirements for listed firms imply that these data are reliable and comprehensive. The main disadvantage of using this data is that the sample of firms is skewed towards medium and large firms[24]. While the ideal data for a study of firms may be the Annual Survey of Industries (ASI), a census of registered manufacturing plants, these data are available only at an annual frequency and hence render themselves unsuitable for any short-term analysis. *Prowess* classifies firms by 5-digit industry codes according to the National Industrial Classification (NIC-2008) code, the Indian equivalent to the Standard Industrial Classification used in the US and UK. Using this I merge firm-level data with variables from industry-level surveys I describe below.

5.1.2 Industry-Level Data: Measures for Use of Informal Labor

I construct industry-level measures of cash usage, reliance on informal employment, and a indirect measure of firm-level exposure to the informal sector, using data from an employment survey, a census of manufacturing plants, and a survey of informal manufacturing enterprises. These data are all prior to the demonetization episode.

Employment Survey Data. In order to obtain data on workers, the types of jobs they work at, and the way in which they get paid, I use the 2011-12 Employment and Unemployment Survey (EUS), conducted by the National Sample Survey Organization (NSSO) in India every five years. This survey collects information on individual characteristics, the nature of job, conditions of the workplace, and social security benefits. The survey also contains the sector of employment for each working individual according to the NIC-2008 classification. The 2011-12 EUS included 101,724 households that consisted of 456,999 individuals. The data are representative at the level of regions as defined by the NSSO. I construct two measures of informal employment using the

[23]The Prowess database has been used in many other studies, such as Asker et al. (2014), Bertrand et al. (2002), and Alfaro and Chari (2014), to name a few. Companies in *Prowess* together account for more than 70% of industrial output, 75% of corporate taxes, and more than 95% of excise duty collected by the Government of India (Shah et al., 2008).

[24]I test for the effects of firm size in all my specifications using fixed effects based on size deciles provided in *Prowess* and size fixed effects based on plant and machinery. I discuss other shortcomings of this dataset in detail in Appendix A.

nature of employment (formal or casual) by looking at the worker's principal activity status, and the nature of payment of wages to these workers (cash versus non-cash).

Manufacturing Survey Data. In order to observe the use of cash by firms across different industries, I use the Annual Survey of Industries (ASI) 2014-15, which is a cross-sectional survey and census of manufacturing establishments that is conducted by the Central Statistical Organization of India (CSO). These data also contain information on the sector in which a factory belongs using the NIC-2008 code. The combined ASI census and survey are representative of all factories in India and are repeatedly used to estimate the performance of the industrial sector, both regionally, as well as nationally. I construct two measures of cash usage: one, the industry share of cash in current assets, and two, the industry share of cash in total spending on labor and materials. The first measure captures the extent of cash holdings as a fraction of liquid assets of the firm, and the second measure captures cash used as a fraction of flow of expenses.

Informal Sector Manufacturing Data. I compute net value added by informal enterprises at the 5-digit industy level, for which I use the Survey of Unincorporated Enterprises (Excluding Agriculture) from the 67^{th} round of NSSO's enterprise survey. I match products used by firms to their respective industries, as explained in Section 6, in order to distinguish between informally-sourced and formally-sourced raw materials.

5.1.3 Employment Status

Household Panel Data. In order to verify my firm-level findings, I use worker-level survey data from Consumer Pyramids (CP), also maintained by CMIE, for the period starting from May, 2016 through April, 2017. In recent times, the CP has been widely used in the study of employment conditions in India, a few papers include Chodorow-Reich et al. (2018); Crouzet et al. (2019); Karmakar and Narayanan (2019), since India does not have an official monthly household survey or a survey of establishments conducted by the government until very recently in April 2018 with data going back to September 2017. Abraham and Shrivastava (2019) show that the CP unemployment survey and the NSS Employment rounds are comparable in terms of individual employment status.

The unemployment module in the CP survey closely resembles the questions asked in the Current Population Survey (CPS) in the United States with regard to employment status. An individual is counted as employed if, on the day of or the day prior to the survey, the individual: (i) did any paid work, (ii) was on paid or unpaid leave, (iii) was not working because his/her workplace was temporarily shut down for maintenance or labor dispute but expected to resume work within fifteen days, (iv) owned a business in operation, or (v) assisted in a family business. The survey covers nearly 110,000 adults (persons aged 15 and above) per month. The module also contains information on an individual's primary occupation which is defined as "the occupation which is undertaken for maximum time during the day by a member". Although the scope of

its definition is quite wide to ensure that everyone is associated with an occupation, it contains some information on the nature of work undertaken by the individual. I use this variable to define workers as casual-type workers and formal-type workers. See Appendix A for further information on how this variable is coded. The data have very few individuals who change their occupation during the period of study. I exclude individuals in the self-employed category.

5.2 Summary Statistics

Table 2 reports summary statistics for the sample covering the pre-demonetization period, that is 2015Q1 to 2016Q2. Labor's share in value added, as measures by net sales, is 10% for the average firm, while materials share is close to 60%. Only about 4% of net sales is the value of cash balances in the bank while sundry credit stands at a little above 50%. Since the Prowess sample is skewed towards medium and large firms, these firms maintain very little cash in hand. The large standard deviation possibly suggests that firms in some industries need to hold more cash in order to conduct transactions. Possibly, most firms maintain as much cash as is needed to conduct transactions and may decide to withdraw if more is needed.

Table 2: Summary Statistics

Variable	Mean	Std. Dev.	Median	N
Share of Wage Bill in Value Added	0.10	0.09	0.08	2,250
Share of Materials in Value Added	0.62	0.84	0.61	2,230
Net Sales	4,887	37,138	558	2,250
Wage Bill	263	1,110	41	2,250
Operating Expenses	4,161	30,008	519	2,250
Operating Income	4,161	30,008	572	2,250
Plant and Machinery (A)	8,289	54,572	672	2,165
Sundry Creditors (A)	2,578	18,232	229	2,150
Cash Balances at Bank (A)	20	177	1	1,998
Cash in Hand (A)	3	12	1	7,950

Notes: Data correspond to the pre-demonetization period (2015Q1 to 2016Q2). Data are in millions of rupees, apart from the share variables. Variables denoted by "A" in parentheses indicate that those variable are from firms' annual financial statements. All other variables are at a quarterly frequency from the firms' quarterly financial statements.

6 Empirical Strategy

The empirical analysis in this section derives directly from the simple model of heterogeneous firms outlined in Section 4 where some production inputs need to be paid for using cash. The basic intuition is that following a demonetization shock, firms are unable to conduct cash-based transactions, due to the reduced aggregate supply of currency and their inability to immediately

substitute with credit, and are hence unable to hire and acquire labor and materials, respectively. Firms in industries that typically hire more casual-type labor and use inputs predominantly from the informal sector are more dependent on informal employment and are more exposed to the informal sector. Following demonetization, firms in these industries were treated with greater intensity and were plausibly more cash constrained.

Exploiting cross-sectional heterogeneity of industry-exposure to informal employment and the informal sector, I uncover the causal short-run effects of demonetization. The unanticipated nature of the announcement provides more credence to this method of identification. To the extent that these industry and firm characteristics were uncorrelated with other shocks to the economy during the period surrounding the episode, I can uncover the causal impact of demonetization. Using representative data from worker-level and firm-level surveys, I construct proxies of industry dependence on informal employment and firm exposure to the informal sector. In the context of my empirical analysis, I use a difference-in-differences approach to causally identify the effect of this inability to transact on two margins – the share of labor and the share of material expenses in production. I focus on the financial years 2015 and 2016 in order to uncover the short-term effects. Specifically, the sample begins on April 1st, 2015, and ends on March 31st, 2017, thereby avoiding the implementation of a new sales tax collection system from April 2017, another major policy enactment.

6.1 Firm-level regressions

Labor. Exploiting variation in industry-dependence on casual labor and on workers without formal contracts, I investigate whether being heavily reliant on informal employment causes firms to hire fewer workers following demonetization by looking at firms' labor share in value added. To do this I regress the firm's quarterly wage bill as a share of net sales for a firm i in industry j on quarter dummies t for the periods following demonetization interacted with measures that proxy for industry-dependence on informal employment given by z_j. For outcome y_{ijt}, the baseline specification is[25]:

$$y_{ijt} = \beta_0 + \beta_1(\text{During}_t \times z_j) + \beta_2(\text{Post}_t \times z_j) + \gamma z_j + X'_{it}\Gamma + \mu_i + \lambda_t + \varepsilon_{ijt} \tag{4}$$

where z_j is either the fraction of workers with no formal contract or the fraction of casual workers in industry j, During_t is an indicator for the quarter during which demonetization was announced (2016Q3) and Post_t is an indicator for the quarter immediately after demonetization was announced (2016Q4), λ_t are quarter dummies, μ_i are firm fixed effects. Other controls include quarter fixed effects, firm-level controls for size, demand and profitability, and firm fixed effects. Robust standard errors are clustered at the industry level.

[25]The identification procedure followed here is similar to Rajan and Zingales (1998), who study the effect of financial development on growth by looking at whether industrial sectors that were relatively more in need of external finance developed faster in countries with more-developed financial markets.

The dependent variable is the firm's wage bill as a share of net sales. The use of this dependent variable warrants some explanation. First, for labor input I use the firm's wage bill because firms in Prowess do not report employment in their financial statements. The wage bill is arguably a better measure for labor as it contains information on hours worked and human capital. Furthermore, with respect to my analysis on informal employment, firms may underreport the number of employees to evade labor regulation but this is less likely to be the case with the wage bill. I take care to appropriately deflate the wage bill and net sales measures using 2-digit industry deflators. Second, revenue-based measures for labor share are used in other studies such as Hsieh and Klenow (2009) that study misallocation by looking at wedges in the first order conditions of firms. Third, Asker et al. (2014) uses net sales as a proxy for value added using the Prowess dataset.

The coefficients of interest, β_1 and β_2, uncover the short-term effects of exposure to the informal sector on the firm's labor share due to the demonetization shock. The specification also helps control for other confounding shocks or policies that may have impacted demand and supply similar to the argument provided by Chodorow-Reich et al. (2018). This method relates well with other empirical studies in the literature that use similar *pre* and *post* treatment periods and implement a difference-in-differences (DID) estimation strategy to uncover the impact of a policy across treatment groups. I also follow the DID estimation literature and cluster standard errors at the level of treatment as suggested by Bertrand et al. (2004), which in this case would be at the industry level j. I also estimate heteroskedasticity-robust standard errors and find similar results.

Materials. Most firms use a combination of intermediate inputs in production. Each of these inputs are sourced from various different industries, some are sourced from the informal sector and some from the formal sector. Firms in Prowess provide information on their material inputs expenditure annually. I exploit this information and compute firms' exposure to the informal/formal sector sector for a given mix of materials used in production. In order to do this, I proceed in three steps:

1. First, I compute the share of each material input l in a firm's material expenditure bill. Prowess contains information on specific products used by firms and the expense incurred thereof. These data are from firms' annual financial statements from 2015. Later, for robustness, I calculate averages of these shares for five years prior. Material expense incurred by a firm i in industry j using an input l that is produced by industry j' is denoted by $m^l_{ij:j'}$. For any firm i, the share of this intermediate input in total expenditure on intermediate inputs is given by:

$$\forall l \quad \frac{m^l_{ij:j'}}{\sum_{l=1}^{L} m^l_{ij:j'}}$$

   where $l = 1, 2, ..., L$.
2. Next, for each input I map product codes (for material inputs) to their relevant 5-digit NIC industry codes. For each of the J industries, I compute the share of value added by the

informal sector in that industry over total value added (sum of formal and informal sectors).

$$\frac{y_{C,j'}}{y_{C,j'} + y_{F,j'}}$$

where $y_{F,j'}$ ($y_{C,j'}$) denotes total value added by the formal (informal) sector and $j' = 1, 2, ..., J$.

3. Lastly, I multiply the firm i's material input share (calculated in point 1) by the respective industry's informal sector share in production (in point 2) for each product used by the firm, and sum across all L materials used. This measure gives me a measure of the firm's *total exposure to the informal sector* for a given mix of materials used in production. For firm i in industry j, I define:

$$\text{Exposure}_{ij} = \sum_{l=1}^{L} \left(\frac{m^l_{ij:j'}}{\sum_{l=1}^{L} m^l_{ij:j'}} \cdot \frac{y_{C,j'}}{y_{C,j'} + y_{F,j'}} \right) \tag{5}$$

where $j, j' = 1, 2, ..., J$.

Using this as a source of variation at the firm-level, I test whether differences in greater exposure to the informal sector for intermediate inputs caused firms to procure fewer inputs in the periods after demonetization. Similar to the specification in equation (4), I regress the firm's quarterly total materials expenditure as a share of value added for a firm i in industry j on quarter dummies t for the periods following demonetization interacted with Exposure_{ij} as defined in point 3. The dependent variable is the materials expenditure share in value added (using net sales as a proxy for value added). For outcome y_{ijt}, the baseline specification is:

$$y_{ijt} = \beta_0 + \beta_1(\text{During}_t \times \text{Exposure}_{ij}) + \beta_2(\text{Post}_t \times \text{Exposure}_{ij}) + \gamma\text{Exposure}_{ij} + X'_{it}\Gamma + \mu_i + \lambda_t + \varepsilon_{ijt} \tag{6}$$

where all variables are as defined in the specification in equation (4) and Exposure_{ij} is as defined in (5). Other controls include quarter fixed effects, firm-level controls for size, demand and profitability, and firm fixed effects. Robust standard errors are clustered at the industry level.

6.2 Worker-level regressions

In order to investigate whether casual-type workers were relatively more likely to become unemployed following demonetization, I estimate the following specification:

$$u_{idt} = \beta_0 + \beta_1(\text{Post}_t \times \text{Casual Worker}_i) + \gamma(\text{Casual Worker}_i) + X'_{it}\Gamma + \theta_d + \lambda_t + \varepsilon_{idt} \tag{7}$$

where u_{idt} takes on a value 1 if individual i in district d is unemployed on date t of the survey. The indicator variable CasualWorker_i equals 1 for individuals who are either casual or temporary

workers, and zero otherwise[26]. Post_t equals 1 for the months following demonetization. The sample runs from May, 2016 through April, 2017 – six months before and after demonetization. Individual-level controls X'_{it} include age, age-squared, education, literacy and caste. θ_d stands for district fixed effects and λ_t stands for month fixed effects. The coefficient of interest is β_1. Owing to the specification and the structure of the survey I cannot distinguish between contemporaneous and lagged effects.

7 Results

In this section, I first present the results for firm-level regressions for labor and materials as specified by equations (4) and (6), respectively. Then I present results from the household panel for worker-level regressions as specified by equation (7). I present the firm-level regressions with and without firm fixed effects, with firm-level controls measured contemporaneously with the outcome, as well as one year lagged controls also with and without firm fixed effects in order to account for variation that is unobserved at the firm-level. Contemporaneous controls are unfortunately also contaminated by the shock and to this end I use the previous year's variables as controls. I also control for quarter fixed effects in all specifications.

7.1 Labor and Informal Employment

Use of Cash: I begin by testing the premise that firms that used more cash were disproportionately affected by demonetization in their ability to pay for labor. The mechanism at play is the following: after the demonetization shock firms that typically make more cash payments were left cash-constrained and were hence unable to pay wages to informal workers who would only accept payment in the form of cash. To test whether this was the case I examine whether firms in industries with a greater share of cash in current assets and total costs[27], prior demonetization, witnessed relatively larger declines in their labor share in net sales in the periods immediately after demonetization. The results of these regressions are reported in Tables 3 and 4. We see a decline in the labor share of firms in industries with greater cash usage in the quarter of and after the shock that is consistent across all specification. Columns 1 and 2 in Table Tables 3 capture the main effects of the shock on firms' labor share, and I control for firm fixed effects in the latter. When I control for firm size, demand, and profitability using contemporaneous controls, in columns 3 and 5, the size of the coefficients of interest decline sharply. Using lagged controls in columns 4 and 6 increases the magnitude of the effect and this is statistically significant in both quarters. In Table 4, the magnitude of the coefficients of interest remain fairly stable. A one standard deviation increase in share of cash in current assets is associated with a 3% decline in the mean of labor's share in net sales. This translates to a 0.3 percentage point decline in the labor share.

[26] See Appendix for A for how this variable is coded.

[27] Total costs here is defined as the cost of inputs involved in production, namely wage payments and raw materials expenses.

Table 3: Labor Share and Industry Share of Cash in Current Assets

	(1)	(2)	(3)	(4)	(5)	(6)
2016Q3 × Industry *j*'s share of Cash in Current Assets	-0.0848***	-0.0848***	-0.0616**	-0.0994***	-0.0555**	-0.1004***
	(0.0291)	(0.0291)	(0.0293)	(0.0328)	(0.0266)	(0.0324)
2016Q4 × Industry *j*'s share of Cash in Current Assets	-0.0897**	-0.0897**	-0.0504	-0.1007**	-0.0689	-0.1035**
	(0.0449)	(0.0449)	(0.0446)	(0.0480)	(0.0431)	(0.0482)
Industry *j*'s share of Cash in Current Assets	0.5417***		0.4431***	0.5162***		
	(0.1357)		(0.1260)	(0.1317)		
Observations	10,264	10,264	9,593	9,409	9,593	9,409
Clusters	248	248	247	246	247	246
Mean of Dependent Variable	0.1008	0.1008	0.1009	0.1011	0.1009	0.1011
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	No	Yes	Yes
Contemporaneous Firm Controls	No	No	Yes	No	Yes	No
Lagged Firm Controls	No	No	No	Yes	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors, reported in parentheses, are clustered at the industry level. This table reports the impact of demonetization on labor's share in the quarter *during* (2016Q3) and the quarter *after* (2016Q4) the announcement of the policy corresponding to the specification in Equation (4). Controls for firm size (measured by fixed assets), demand, and profitability include log(capital), log(sales), and PBIT/Capital ratio, respectively. The wage-bill is deflated using the WPI and and net sales are deflated using industry-specific deflators.

Table 4: Labor Share and Industry Share of Cash in Cost of Production

	(1)	(2)	(3)	(4)	(5)	(6)
2016Q3 × Industry *j*'s share of Cash in Costs	-0.0001**	-0.0001**	-0.0001**	-0.0002***	-0.0001	-0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
2016Q4 × Industry *j*'s share of Cash in Costs	-0.0002**	-0.0002**	-0.0003***	-0.0003***	-0.0000	-0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Industry *j*'s share of Cash in Costs	-0.0014***		-0.0009***	-0.0011***		
	(0.0003)		(0.0004)	(0.0003)		
Observations	10,264	10,264	9,593	9,409	9,593	9,409
Clusters	248	248	247	246	247	246
Mean of Dependent Variable	0.1008	0.1008	0.1009	0.1011	0.1009	0.1011
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	No	Yes	Yes
Contemporaneous Firm Controls	No	No	Yes	No	Yes	No
Lagged Firm Controls	No	No	No	Yes	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors, reported in parentheses, are clustered at the industry level. This table reports the impact of demonetization on labor's share in the quarter *during* (2016Q3) and the quarter *after* (2016Q4) the announcement of the policy corresponding to the specification in Equation (4). Controls for firm size (measured by fixed assets), demand, and profitability include log(capital), log(sales), and PBIT/Capital ratio, respectively. The wage-bill is deflated using the WPI and and net sales are deflated using industry-specific deflators.

Dependence on Informal Employment: In order to verify the mechanism, I examine whether firms that are more reliant on informal employment were disproportionately affected by demonetization. I find large declines in firms' labor share in the quarters after the shock that were relatively more dependent on informal employment, suggesting that these firms were possibly cash constrained, hence unable to pay for temporary labor in cash, and were thereby forced to let go of their temporary workforce. Using firm-level surveys conducted prior to demonetization, I construct proxies for informal employment such as the share of casual workers in total workforce in an industry and the fraction of casual-type wage payments made to workers in an industry. The construction of these variables are relegated to the appendix. Table 5 reports results when informal employment is measured as the fraction of casual workers in total workforce in an industry j. The magnitude of the coefficient of interest is larger for the quarter after relative to the quarter during demonetization. This is unsurprising as the policy was enacted in November, 2016, which falls right in the middle of 2016Q3, hence only about half of Q3 was "treated". Table 6 reports results when informal employment is proxied by the fraction of casual-type payments made to workers in an industry j. Here the coefficient of interest is significant at the 10% level only in 2016Q4, while the coefficient for 2016Q3 is only significant for the specifications that include contemporaneous controls, it is consistently negative and smaller in magnitude. In line with previous results for cash usage, a one standard deviation increase in exposure to informal employment is associated with nearly a 3% decline in the mean labor share in the quarter of the shock and a 3.5% decline in the quarter immediately after the shock.

Table 5: Labor Share and Industry Share of Share of Casual Workers in Workforce

	(1)	(2)	(3)	(4)	(5)	(6)
2016Q3 × Share of Casual Workers in Industry j	-0.0134*	-0.0134*	-0.0111*	-0.0200***	-0.0112*	-0.0192**
	(0.0076)	(0.0076)	(0.0062)	(0.0075)	(0.0062)	(0.0075)
2016Q4 × Share of Casual Workers in Industry j	-0.0237*	-0.0237*	-0.0176*	-0.0235*	-0.0207**	-0.0233*
	(0.0131)	(0.0131)	(0.0100)	(0.0128)	(0.0090)	(0.0129)
Share of Casual Workers in Industry j	0.0096		-0.0295	-0.0012		
	(0.0389)		(0.0388)	(0.0378)		
Observations	7,752	7,752	7,261	7,156	7,261	7,156
Clusters	135	135	134	134	134	134
Mean of Dependent Variable	0.0979	0.0979	0.0984	0.0980	0.0984	0.0980
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	No	Yes	Yes
Contemporaneous Firm Controls	No	No	Yes	No	Yes	No
Lagged Firm Controls	No	No	No	Yes	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors, reported in parentheses, are clustered at the industry level. This table reports the impact of demonetization on labor's share in the quarter *during* (2016Q3) and the quarter *after* (2016Q4) the announcement of the policy corresponding to the specification in Equation (4). Controls for firm size (measured by fixed assets), demand, and profitability include log(capital), log(sales), and PBIT/Capital ratio, respectively. The wage-bill is deflated using the WPI and and net sales are deflated using industry-specific deflators.

Table 6: Labor Share and Industry Share of Fraction of Casual-Type Payments made

	(1)	(2)	(3)	(4)	(5)	(6)
2016Q3 × Fraction of Casual-Type Payments made in Industry *j*	-0.0071	-0.0071	-0.0102*	-0.0093	-0.0117**	-0.0088
	(0.0065)	(0.0065)	(0.0053)	(0.0070)	(0.0051)	(0.0071)
2016Q4 × Fraction of Casual-Type Payments made in Industry *j*	-0.0167**	-0.0167*	-0.0138*	-0.0167*	-0.0182**	-0.0165*
	(0.0085)	(0.0085)	(0.0076)	(0.0087)	(0.0072)	(0.0089)
Fraction of Casual-Type Payments made in Industry *j*	0.0147		-0.0062	0.0097		
	(0.0292)		(0.0283)	(0.0286)		
Observations	7,848	7,848	7,331	7,203	7,331	7,203
Clusters	142	142	141	140	141	140
Mean of Dependent Variable	0.0977	0.0977	0.0979	0.0978	0.0979	0.0978
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	No	Yes	Yes
Contemporaneous Firm Controls	No	No	Yes	No	Yes	No
Lagged Firm Controls	No	No	No	Yes	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors, reported in parentheses, are clustered at the industry level. This table reports the impact of demonetization on labor's share in the quarter *during* (2016Q3) and the quarter *after* (2016Q4) the announcement of the policy corresponding to the specification in Equation (4). Controls for firm size (measured by fixed assets), demand, and profitability include log(capital), log(sales), and PBIT/Capital ratio, respectively. The wage-bill is deflated using the WPI and and net sales are deflated using industry-specific deflators.

7.2 Materials and the Informal Sector

Use of Cash: Next, I examine whether firms that used cash to purchase intermediate inputs were disproportionately affected in their ability to pay for these inputs following demonetization. The mechanism is similar to that for labor, in that firms may be paying for some inputs in cash, and due to the shortage of cash, were left cash-constrained and could not pay for these inputs. Similar to the procedure implemented for labor and informal employment, I examine whether firms in industries with larger shares of cash in current assets and total costs, prior demonetization, faced relative reductions in their materials expenses after the shock. The results of these regressions are reported in Tables 7 and 8. The main effects presented in columns 1 and 2 in Table 7 are negative but not statistically significant, while in columns 3-6 the coefficient on the interaction term for 2016Q3 is stable and significant at the 10% level. Similarly in Table 8, the coefficient is negative and significant at the 10% level, and is stable across columns 1 through 6. A one standard deviation increase in share of cash in current assets is associated with a 2.6% decline in the mean of materials share in net sales which translates to a 1.6 percentage point decline in the materials share in net sales. The stability of the coefficient's magnitude to the inclusion of fixed effects and lagged controls suggests that while firms did face some reduction in their materials expenses, these were not as large as that of labor. This may potentially be a result of the fact that firms purchase a variety of intermediate inputs from suppliers not all of which are paid for using cash. This suggests an approach that takes into account the different types of products that a firm purchases and the degree of informality of the industry that supplies the respective products. I present the results for this exercise below.

Table 7: Materials Share and Industry Share of Cash in Current Assets

	(1)	(2)	(3)	(4)	(5)	(6)
2016Q3 × Industry *j*'s share of Cash in Current Assets	-0.5339	-0.5339	-0.6478*	-0.5377*	-0.6281*	-0.5218*
	(0.3388)	(0.3387)	(0.3708)	(0.3008)	(0.3712)	(0.3061)
2016Q4 × Industry *j*'s share of Cash in Current Assets	-0.6930	-0.6930	-0.7208	-0.6710	-0.6975	-0.6398
	(0.5222)	(0.5221)	(0.5257)	(0.5191)	(0.5301)	(0.5126)
Industry *j*'s share of Cash in Current Assets	0.4847		0.3929	0.3366		
	(0.3543)		(0.3061)	(0.2997)		
Observations	9,936	9,936	9,298	9,138	9,298	9,138
Clusters	245	245	244	243	244	243
Mean of Dependent Variable	0.6091	0.6091	0.6096	0.6109	0.6096	0.6109
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	No	Yes	Yes
Contemporaneous Firm Controls	No	No	Yes	No	Yes	No
Lagged Firm Controls	No	No	No	Yes	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors, reported in parentheses, are clustered at the industry level. This table reports the impact of demonetization on labor's share in the quarter *during* (2016Q3) and the quarter *after* (2016Q4) the announcement of the policy corresponding to the specification in Equation (4). Controls for firm size (measured by fixed assets), demand, and profitability include log(capital), log(sales), and PBIT/Capital ratio, respectively. The wage-bill is deflated using the WPI and and net sales are deflated using industry-specific deflators.

Table 8: Materials Share and Industry Share of Cash in Cost of Production

	(1)	(2)	(3)	(4)	(5)	(6)
2016Q3 × Industry *j*'s share of Cash in Costs	0.0006	0.0006	0.0004	0.0006*	0.0004	0.0006
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
2016Q4 × Industry *j*'s share of Cash in Costs	-0.0010*	-0.0010*	-0.0010*	-0.0011*	-0.0009	-0.0013**
	(0.0005)	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Industry *j*'s share of Cash in Costs	-0.0126***		-0.0116***	-0.0119***		
	(0.0008)		(0.0010)	(0.0009)		
Observations	9,936	9,936	9,298	9,138	9,298	9,138
Clusters	245	245	244	243	244	243
Mean of Dependent Variable	0.6091	0.6091	0.6096	0.6109	0.6096	0.6109
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	No	Yes	Yes
Contemporaneous Firm Controls	No	No	Yes	No	Yes	No
Lagged Firm Controls	No	No	No	Yes	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors, reported in parentheses, are clustered at the industry level. This table reports the impact of demonetization on labor's share in the quarter *during* (2016Q3) and the quarter *after* (2016Q4) the announcement of the policy corresponding to the specification in Equation (4). Controls for firm size (measured by fixed assets), demand, and profitability include log(capital), log(sales), and PBIT/Capital ratio, respectively. The wage-bill is deflated using the WPI and and net sales are deflated using industry-specific deflators.

Exposure to the Informal Sector: Exploiting the availability of information on intermediate inputs purchased by firms, I construct a measure of indirect exposure to the informal sector (unregistered enterprises) at the level of the firm by merging product codes of inputs to their respective industries, both, in the formal and informal sector. This *Exposure* measure takes into account firms' input mix and the extent of value added by informal enterprises vis-à-vis total (formal and informal enterprises) value added as outlined in Section 6.1 in equation (5). Using this I test whether firms that were more dependent on the informal sector for intermediate inputs were hurt more by demonetization. More informally-produced inputs are likely to be paid for in cash and we would expect firms that purchase more of these inputs to witness relatively larger declines in their materials share in value added, as they may have been unable to pay for them. The results of these regressions are reported in Table 9. In columns 1 and 2, the coefficient for the interaction term for 2016Q3 is statistically significant at the 10% level and is stable to the inclusion of firm fixed effects. In specifications that include contemporaneous controls that are potentially also treated, columns 3 and 5, the coefficient of interest is negative but not significant. In columns 4 and 6, the specifications that include lagged controls for firm-level shocks and characteristics, the coefficient for the interaction term for 2016Q3 is statistically significant. A one standard deviation increase in *Exposure* is associated with a 0.4 percentage point decline in materials share in net sales.

Table 9: Materials Share and Exposure to Informal Sector

	(1)	(2)	(3)	(4)	(5)	(6)
2016Q3 × Exposure of Firm's Materials to Informal Sector	-0.0155*	-0.0155*	-0.0125	-0.0179*	-0.0130	-0.0175*
	(0.0086)	(0.0086)	(0.0092)	(0.0095)	(0.0097)	(0.0097)
2016Q4 × Exposure of Firm's Materials to Informal Sector	-0.0177	-0.0177	-0.0178	-0.0176	-0.0173	-0.0188
	(0.0130)	(0.0130)	(0.0130)	(0.0130)	(0.0130)	(0.0134)
Exposure of Firm's Materials to Informal Sector	-0.0459**		-0.0425**	-0.0405**		
	(0.0192)		(0.0187)	(0.0183)		
Observations	7,656	7,656	7,331	7,246	7,331	7,246
Clusters	237	237	237	236	237	236
Mean of Dependent Variable	0.6017	0.6017	0.6013	0.6037	0.6013	0.6037
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	No	Yes	Yes
Contemporaneous Firm Controls	No	No	Yes	No	Yes	No
Lagged Firm Controls	No	No	No	Yes	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors, reported in parentheses, are clustered at the industry level. This table reports the impact of demonetization on materials expenses in the quarter *during* (2016Q3) and the quarter *after* (2016Q4) the announcement of the policy corresponding to the specification in Equation (6). Exposure to the informal sector is proxied by the measure constructed in Equation (5). Controls for firm size (measured by fixed assets), demand, and profitability include log(capital), log(sales), and PBIT/Capital ratio, respectively. Materials expenses are deflated using the WPI and and net sales are deflated using industry-specific deflators.

7.3 Effects on Employment by Worker Type

I verify my results from the firm-side with worker-level regressions using the CP survey data. In order to test my findings, I look at whether casual and temporary workers were more likely to be unemployed in the months following demonetization. Table 10 presents results from the regression in Equation (7). The sample consists of observations running from May, 2016 to April, 2017, thus providing for six months before and after demonetization. In column 1, I control for month fixed effects, and in column 2 I control for district fixed effects. Additional controls in columns 3 and 4 include age, age-squared, education, caste, and literacy. Column 4 also controls for the individual's lagged employment status. In all specifications, I uncover a positive and statistically significant coefficient for β_1, the coefficient of interest on the interaction term. I find that in the months following demonetization, the unemployment rate for casual or temporary workers was 0.20% higher than formal or full-time workers. These results, taken together with the firm-level results, complete the story that the cash contraction had sharp negative effects on employment possibly because firms were unable to pay their workers in cash. It seems plausible that it may be virtually costless for the firm to let these workers go in the face of an adverse shock and hire temporary workers back again later.

Table 10: Employment Status and Worker Type

	(1)	(2)	(3)	(4)
Post × Casual Worker	0.0019***	0.0019***	0.0020***	0.0018***
	(0.0006)	(0.0006)	(0.0007)	(0.0007)
Casual Worker	0.0006*	0.0005	-0.0000	0.0002
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Observations	461,620	461,620	461,620	331,400
Clusters	421	421	421	419
Mean of Dependent Variable	0.0032	0.0032	0.0032	0.0026
Month FE	Yes	Yes	Yes	Yes
District FE	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
Lagged Employment Status	No	No	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is the individual's labor market status at the time of the survey, zero if currently employed and one if unemployed. *Post* is a dummy variable that equals one for all the months after demonetization was announced. Robust standard errors are clustered at the district level. This table reports the impact of demonetization on an individual's employment status by worker type in the months following the demonetization announcement corresponding to the specification in Equation (7). Controls include Age, Age^2, Education, Caste, and Literacy. The sample consists of observations running from May, 2016 to April, 2017 (six months before and after demonetization). Casual Worker is a dummy that equals one for workers whose occupation can be categorized as temporary or casual workers. See Appendix A for how this variable is coded.

8 Conclusion

This study documents the supply-side effects of a large unanticipated currency contraction. I exploit the 2016 Indian demonetization that rendered 86% of currency in circulation illegal overnight as a natural experiment to identify the real effects of a nominal liquidity shock. Due to the high use of cash in India, the presence of a large informal sector and the prevalence of informal employment, even among formal sector firms, the Indian environment provides a good experimental setting for this study. Using cross-sectional variation in usage of cash, exposure to the informal sector and reliance on informal employment I study whether firms in industries that were more exposed were disproportionately affected by the shock. These industry measures proxy for the extent of informal employment (casual/temporary workers), the use of cash, and exposure to the informal sector in the cross-section of industries. The sudden and unanticipated nature of the announcement provides credence to this identification strategy and helps unpack the causal effects of the demonetization shock by naturally producing firms that were treated with different intensities.

I find significant supply-side effects of demonetization in the period immediately after demonetization. Firms that use cash more and were more exposed to the informal sector witnessed significant declines in their labor share and materials share in value added after the unanticipated shock. In order to identify this effect, I construct various measures of cash usage, reliance on informal employment, and exposure to the informal sector using surveys of workers, industries, and informal enterprises. On the worker-side, I find that casual-type workers were more likely to report being unemployed in the months after demonetization relative to formal-type workers. Taken together these findings highlight the near term effects of demonetization. Similar to the approach followed by Chodorow-Reich et al. (2018), my identification strategy based on the cross-section of industries and firms best serves for near term analysis.

Indeed my findings were to some extent anticipated as documented in the preliminary macroeconomic assessment of demonetization by the Reserve Bank of India (RBI). RBI (2017) points out that due to the limited access of currency following the announcement, workers who get paid wages in cash experienced temporary loss of work[28]. More specifically, the report mentions that labor-intensive sectors that engage casual/migrant workers relatively more must have been disproportionately adversely affected. This essentially sums up the identification strategy that I adopt in my paper: some industries were treated more by the shock relative to others as they face a greater need to transact in cash. Furthermore, the Economic Survey 2016-17, produced by the Government of India (GOI, 2017), points out that one of the three broad channels through which demonetization affects the economy was as an aggregate *supply* shock, to the extent that economic activity utilizes cash as an input (for example, agricultural labor is traditionally paid in cash; some companies may pay their employees' salary in cash). The report also admits that in India the informal and formal economies are *"inextricably entwined, so that problems in one in-*

[28]See pp. 2-3 from the cited report.

evitably affect the other", providing the example that many firms in the formal economy depend on suppliers from the informal economy (including labor).

My results also indicate that these negative effects are relatively smaller or even dissipate in the quarter after the demonetization announcement. However, given that available data exclude the informal sector, which was presumably most hurt by the shock, these findings are a conservative lower bound of the total effects. There may be eventual gains from moving towards a cashless economy, however my paper focuses on the immediate real impacts felt by firms, suppliers and workers due to the liquidity crunch.

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Appendix

A Data

A.1 Main Data Sources

Consumer Pyramids. Coding of Casual Type Worker:

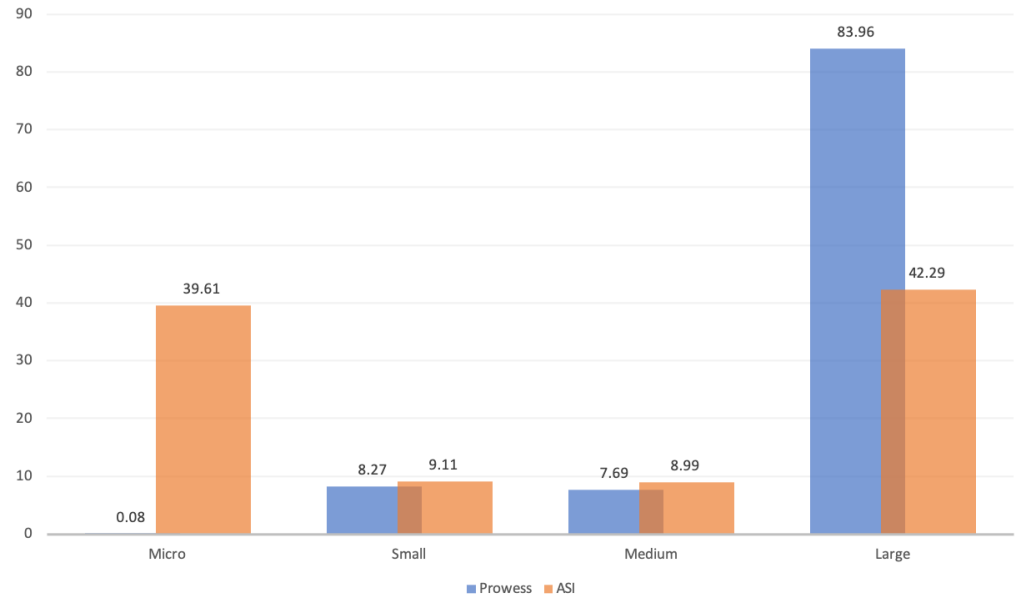
- Individuals with the following occupations are classified as "casual or temporary workers": Agricultural Labourer, Small Farmer, Small Trader/Hawker/ Businessman without Fixed Premises, Support Staff, and Wage Labourer.
- Individuals with the following occupations are classified as non-casual or non-temporary workers: Businessman, Industrial Workers, Legislator/Social Worker/ Activists, Manager, Non-Industrial Technical Employee, Organised Farmer, White Collar Clerical Employees, and White-Collar Professional Employees and Other Employees.
- Individuals with the following occupations are not included in either classification: Home Maker, Home-based Worker, Self Employed Entrepreneur, Self employed professional, Self Employed Entrepreneur, Unoccupied, Student, NonSchooling Child, and Qualified Self Employed Professionals.

Prowess. The *Prowess* database has been used in many other studies, such as Asker et al. (2014), Bertrand et al. (2002), and Alfaro and Chari (2014), to name a few. Companies in *Prowess* together account for more than 70% of industrial output, 75% of corporate taxes, and more than 95% of excise duty collected by the Government of India (Shah et al., 2008).. While *Prowess* is not, strictly speaking, a panel, since data may be missing for certain time periods for various reasons, I construct a non-missing panel of firms by dropping firms that have missing observations for the years 2015 and 2016. Additionally, the sample of firms in Prowess is skewed towards medium to large firms. Figure A.1 compares the firm size distribution in the sample of firms from Prowess that I use in this study with that from the Annual Survey of Industries. Prowess has virtually no micro enterprises. Restricting the firm size distribution to small, medium, and large firms, it is clear that the sample is skewed towards large firms. To the extent that small and medium sized firms faced a greater inability to smooth the demonetization shock, my results in this study are an underestimate of the true effects representative of the entire firm size distribution.

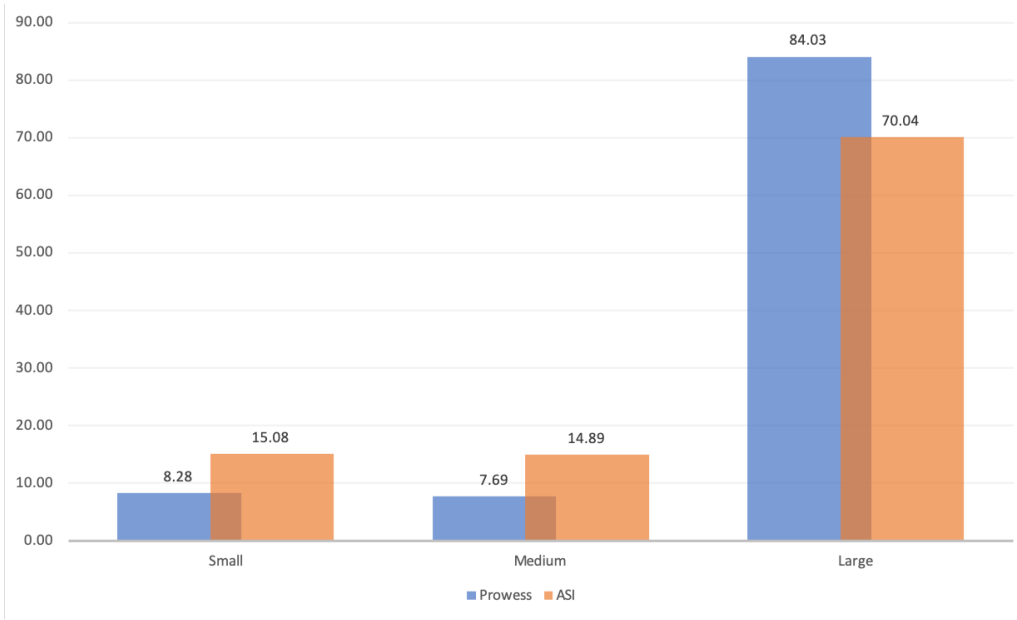
A.2 Supplementary Data Sources

The supplementary data used in this paper come from a range of sources. The main data sources used in the empirical analysis are presented in 5. In addition to those I use the India KLEMS Database 2015-16 maintained by the World KLEMS Initiative in order to create some of the figures. I map industries in the KLEMS database to their 2-digit counterparts using the RBI's Data Manual.

I also use wholesale price indices to deflate all nominal variables. The data on wholesale prices are obtained from the Ministry of Commerce Industry website maintained by the Department



(a) Firm Size Distribution – Including "Micro" enterprises



(b) Firm Size Distribution – Excluding "Micro" enterprises

Figure A.1: Sample Composition

Source: Author's calculation using Prowess and Annual Survey of Industries 2014-15. Notes: This definition of firm size is based on the value of plant and machinery for manufacturing enterprises as per the Micro, Small & Medium Enterprises Development Act, 2006 (MSMED Act).

for Promotion of Industry and Internal Trade (DPIIT). I map industries in the WPI data to the two-digit industry codes from the NIC-2008 classification.

B Tables

Table B.1: Permanent and Temporary Full-Time Workers

	Permanent		**Temporary**
	Skilled	Unskilled	
No. of workers	56	34	54
Hourly wage (₹)	231.09	210.33	139.62
Hours worked (per week)	47.61		23.9
Share in total workforce	.85		.15
Share (hours worked)	.83		.17

Source: Author's calculation using World Bank Enterprise Survey 2005. Notes: Includes only production workers and excludes management, administrative, and sales staff.