Investment along the supply chain: removing barriers to growth for firms in India

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Abstract

This paper studies the importance of high-quality domestic intermediate inputs as a barrier to investment for downstream firms. I show that the staggered repeal of size-based restrictions in product markets in India increases production of high-quality domestic intermediate inputs, stimulating investment among downstream firms. The investment response is explained by easing of financial constraints and lack of close substitutes in import markets. Downstream incumbents upgrade, shift their product mix toward higher-quality ladder products and reduce reliance on imported inputs. In addition, entry into downstream markets increases. Policies to protect small firms may unintentionally constrain firms along the supply chain.

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1 Introduction

Access to high-quality inputs is crucial for improving firm performance (Kugler and Verhoogen, 2012).[1] Much of the literature to date has focused on access to imported inputs, that expand the input basket (Goldberg et al., 2010; Halpern et al., 2015) and are of higher quality (Bas and Paunov, 2021), and while important, are only imperfect substitutes for domestic inputs. Moreover, only a small proportion of firms in developing countries import, with the vast majority sourcing intermediate inputs domestically (as per Annual Survey of Industries (ASI) data in India, 15.4% of establishments import). This paper examines the importance of alleviating supply-side constraints within domestic supply chains and whether limited access to high-quality domestic intermediate inputs serves as a barrier to investment for firms along the supply chain.

A natural experiment in India provides me an opportunity to study this question. I leverage the staggered removal of a policy promoting small firms in certain product markets. Beginning in 1997, India phased out its product reservation policy, which had reserved hundreds of products exclusively for small firm production. Historically, large firms already producing a product when it was added to the reserved list were permitted to continue operating, but their production of the reserved product was capped at existing levels. Products spanned many sectors including chemicals, fabricated metal products, medical instruments, textiles, furniture, products made of leather, rubber, plastic or paper among others. I show that the reform led to an increase in the production of high-quality products in deregulated markets. This improved access to high-quality intermediate inputs in some product markets enables me to examine spillover effects on entry and investment by firms that rely on these products as inputs (downstream firms).

Before studying the spillover effects, I begin by outlining the mechanism. Firms need to pay a fixed cost to acquire capabilities or machinery to produce high quality products. Prior to deregulation, large firms faced caps on producing reserved products. In a segmented market where small firms produce lower-quality products and large firms produce higher-quality ones, this cap translates into a cap on high-

[1] Quality reflects an improvement in the product and is distinct from mere product variety that may simply reflect horizontal differentiation or heterogeneity in preferences of consumers.

quality output. With deregulation and the removal of this cap, firms can realise economies of scale and we expect an increase in production of high-quality products in the deregulated market.

To test for segmentation based on product quality, I rely on reduced form relationships between unit prices and firm size to make inferences about quality without actually estimating it, building on the previous literature that has documented such a relationship across several developing countries (Kugler and Verhoogen, 2012; Atkin et al., 2015; Gupta, 2023). Establishment-level data from ASI, which include information on inputs used and products produced by each establishment, enable me to test my hypothesis. Consistent with the predictions of Kugler and Verhoogen's (2012) heterogenous firm model with endogenous input and output quality, I find positive output price-plant size and input price-plant size correlations. Large firms, also, have a higher probability of importing inputs and exporting their products as compared to small firms in narrowly defined product markets. In addition, the output price-plant size correlation is stronger for industries with a higher scope for quality differentiation.[2] The evidence supports the hypothesis that larger firms produce higher quality goods. My findings are robust to alternative explanations such as supplier market power and purchaser monopsony power. In addition, I conduct several robustness tests and show that the relationship holds for intermediate input producers and for a sample excluding threshold firms (firms close to the regulatory size threshold).

Next, I show that post-reform, there is an increase in the production of high-quality goods. Following de-reservation, small incumbents - and with them, lower-quality production - shrink, while large incumbents and new entrants expand (Martin et al., 2017). Given segmentation by product quality, large incumbents produce high-quality goods. In addition, I find evidence consistent with entrants producing higher quality goods. Overall, the reform leads to increased production of high-quality goods in deregulated markets, implying improved access to high-quality inputs for downstream firms.

Having established the economic channel at play in the de-regulated market, I go

[2]Long quality ladder industries, i.e., industries with a high scope for quality differentiation are defined using Khandelwal's (2010) classification.

on to study the effect of the reform on the downstream market. Since, low and high quality goods are not perfect substitutes, the improved access to high quality inputs may relieve technological constraints for downstream firms, enabling investment and production of higher quality ladder products. This effect is particularly likely for intermediate inputs that lack close substitutes in the import market. Alternatively, if firms substitute high-quality imported inputs with high-quality, lower-priced domestic inputs, this import substitution could ease financial constraints, enabling firms to invest and produce higher-quality ladder products.

I empirically test these predictions using a difference-in-differences analysis. My empirical strategy relies on the timing of de-regulation. The identifying assumption is that the timing of deregulation is unrelated to investment opportunities in the downstream market. I provide evidence by showing, using a proportional hazards model, that downstream industry characteristics do not predict the timing of deregulation for products used as intermediate inputs. Additionally, I find that characteristics of deregulated industries themselves do not predict the timing of deregulation of intermediate inputs. Furthermore, most major reforms were completed prior to the product de-reservation policy (Nataraj, 2011; Martin et al., 2017); tariffs had largely been harmonized, and licensing requirements had been removed for most industries, thus, they do not confound my analysis.

Next, I evaluate how improved access to high-quality intermediate inputs impacts downstream incumbents. Since I observe the inputs used and products produced by each firm, I directly define downstream incumbents as firms that used regulated products as inputs prior to deregulation. My findings indicate that downstream incumbents invest and increase capital employed. The analysis employs granular firm and industry $\times$ year fixed effects that control for time-invariant firm characteristics and common shocks at the industry-year level. My results show that the reform led to a 3.2% increase in capital employed (property, plant and equipment) among downstream firms, which implies an increase of Rs. 5.3 million (USD 117k) per year for the average firm. Since the size threshold for the reform is defined based on balance sheet size of plant and machinery, the reform is likely more binding for capital intensive products.[3] Consequently, we expect downstream incumbents that rely on

[3]Deregulated products are classified as capital intensive if they have above median values of capital employed relative to total value added, according to data from the NBER-CES manufac-

capital-intensive inputs to benefit the most from the reform. Indeed, my analysis reveals that the investment response is stronger for downstream incumbents that use capital intensive inputs. The deregulation of essential inputs - those not easily substitutable and therefore, commonly used across firms as an intermediate input in production - may hold greater importance for a firm. My analysis reveals that the investment response is primarily driven by the deregulation of these essential inputs that are not easily substitutable.

Building on this, I examine how firms tilt their product mix. Access to higher quality intermediate inputs may allow firms to produce products with a higher scope for quality differentiation. The analysis shows that firms shift their product mix towards products with a higher scope for quality differentiation.[4] In addition, downstream firms tilt their product mix towards longer quality ladder products following deregulation of essential inputs. Although not conclusive, the results suggest that firms may be investing to quality upgrade, echoing Kugler and Verhoogen's (2012) notion that firms use high-quality inputs to produce high-quality products and higher scope for quality differentiation provides incentives to firms to quality upgrade. Though, these findings are broadly consistent with this notion, unfortunately, my data do not allow me to draw within-firm conclusions about quality upgrading.

Furthermore, as high-quality domestic intermediate inputs become available, the reform reduces the relative advantage of importing these inputs. Consistent with this, I find evidence of import substitution on both intensive and extensive margins. Importing firms decrease the share of imports in their total inputs, and my results also show a reduced likelihood of firms importing intermediate inputs. Consistent with a Melitz (2003)-type model, where there is a fixed cost of importing in each period, the substitution effect on the extensive margin is stronger for small firms. These findings further corroborate evidence of improved access to high-quality domestic intermediate inputs.

If imports were perfect substitutes for domestic inputs, we would not expect

turing industry survey for US industries.

[4]Khandelwal's (2010) product level measures of length of the quality ladder are mapped to the ASI data with the help of ChatGPT.

the reform to affect downstream firms. However, this scenario is unlikely for small firms, which face higher per-unit import costs due to elevated borrowing costs and limited ability to spread fixed costs like transportation. In such a situation, we would expect import substitution to relieve financial constraints for small firms and enable investment. The results indicate that the investment response for small firms is primarily driven by ex-ante importers. Additionally, the impact is stronger for intermediate inputs with high ex-ante import penetration. Post-reform, small firms switch to high-quality domestic intermediate inputs, reducing financial constraints and enabling investment. I further validate this finding by using a measure of financial constraints - low cash-to-total assets ratio - and find that the investment response is, indeed, driven by financially constrained small firms.

For large firms, the effect differs - easing technological constraints rather than financial constraints seems to drive the investment response. Some products lack close substitutes in the import market or face high trade costs, resulting in low import penetration. Enhanced availability of high-quality domestic varieties for these inputs should enable relatively financially unconstrained large firms to invest. Indeed, the data shows that large firms' investment response is spurred by deregulation of inputs with low ex-ante import penetration. These findings highlight heterogeneous propagation of the reform's effects along the supply chain.

In robustness tests, I explore and find little support for alternative explanations for my results such as hold-up problems, input specificity and trade credit. In addition, my results are robust to excluding industries that underwent foreign capital liberalisation in the early 2000s (Bau and Matray, 2023).

Finally, I examine the effect of the reform on new entry in downstream markets, another margin for firm investment using Micro-Small and Medium Enterprises (MSME) census data. My findings show a post-reform increase in entry in downstream markets that use capital-intensive inputs. The results imply a 2% increase in number of new entrants, i.e., about 161 additional new establishments formed over 3 years. The analysis includes product, district and year fixed effects that control for the business cycle and time-invariant product-specific and local characteristics. The results are robust across specifications, including a Poisson model. I further establish that the new entrants, though smaller, are comparable on observ-

able characteristics to existing firms. First, I assess ex-ante size based on the value of plant and machinery employed at start-up. Second, I analyze the ex-post output distribution. Though smaller at the time of entry, the entrants remain comparable in terms of output distribution, suggesting that the reform doesn't seem to induce worse/subsistence entrepreneurs to start new firms.

A back of the envelope calculation reveals that the policy led to aggregate investment of Rs. 166.2 billion (USD 3.7 billion) in downstream markets over 3 years. The findings underscore the significance of alleviating supply-side constraints in domestic markets to support firm investment and upgrading. The results are particularly striking as they reveal mechanisms by which firms upgrade following enhanced access to high-quality domestic inputs, even when firms had access to the import market. In addition, my results suggest that policies aimed at protecting and promoting small firms can have unintended negative consequences. Such policies may inadvertently harm entrepreneurs and incumbent firms along the supply chain.

My paper contributes to several strands of the literature. First, it relates to the literature on imported inputs as a driver of upgrading, encompassing both quality upgrading (Bas and Paunov, 2021) and product innovation (Goldberg et al., 2010; Halpern et al., 2015) - two forms of upgrading outlined in Verhoogen (2023). My paper highlights the importance of and connects improved access to high-quality domestic intermediate inputs with upgrading. In addition, it establishes a link between capital inputs and upgrading, where firms invest to upgrade - an area with limited evidence (Verhoogen, 2023). In related contemporaneous work, Custodio et al. (2024) highlight the role of credit guarantees for Portuguese firms in quality upgrading and accessing the export market. Different from them, my paper emphasises the importance of relieving supply-side constraints in material inputs in domestic supply chains, drawing attention to two channels for the investment response - easing of financial constraints and lack of close substitutes in import markets.

More generally, my paper is related to the broader literature on drivers of upgrading. In addition, to input side drivers, the literature has identified output side drivers (Atkin et al., 2017a; Hansman et al., 2020) and drivers of know-how such as organisational issues (Atkin et al., 2017b).

Second, it relates to the vast literature on import competition and investment (Frésard and Valta, 2016; Gutiérrez and Philippon, 2017; Hombert and Matray, 2018; Aslan and Kumar, 2021; Martin and Otto, 2023) among others. My setting is similar to these papers in that the main mechanism operates via product market competition. However, in my setting the competition is introduced by the removal of constraints on domestic players rather than international ones. Different from the other papers, I show evidence of import substitution - firms substitute high-quality imported inputs with high-quality, lower-priced domestic inputs.

Next, I contribute to the literature on barriers to entry. The previous literature evaluates the role of specific channels by exploiting within-country regulation changes (Kerr and Nanda, 2009; Mullainathan and Schnabl, 2010; Bruhn, 2011; Branstetter et al., 2014; Hombert et al., 2020; Ersahin et al., 2021). I add to the literature by providing evidence of a new channel for entry namely, access to high-quality domestic intermediate inputs.

In addition, my paper builds on the extensive literature on the role of input-output linkages in the propagation of shocks along the supply chain following the work of Acemoglu et al. (2012). The literature has highlighted the importance of channels such as input specificity (Barrot and Sauvagnat, 2016), financial constraints (Demir et al., 2024), natural disasters (Carvalho et al., 2021) and distortion centrality (Liu, 2019) among others. My paper showcases the trickle down effect of quality along the supply chain and emphasises the role of high-quality intermediate inputs as a barrier to growth for downstream firms.

Lastly, my paper is related to existing work on the repeal of the product reservation policy (Martin et al., 2017; Chiplunkar, 2019; Singh, 2017; Boehm et al., 2022; Galle, 2020; Balasundharam, 2019; García-Santana and Pijoan-Mas, 2014). My work builds on Martin et al. (2017) who show that while small incumbents shrink, entrants and large incumbents drive growth in employment and investment in the de-regulated market. Most of the existing work focuses on the de-regulated market with the exception of Boehm et al. (2022) and Balasundharam (2019). Boehm et al. (2022) show that input capabilities led to a comparative advantage in introducing new products among downstream firms. Balasundharam (2019) computes aggregate productivity following the reform taking into account productivity gains from both

the deregulated market and the linked markets. My paper sheds new light on the mechanism at play, namely, increase in production of high-quality products in the deregulated market. Building on Boehm et al.'s (2022) finding of downstream firms introducing new products, I show that downstream firms, equipped with improved access to high-quality intermediate inputs, tilt their product mix towards higher quality-ladder products.

The rest of the paper is organised as follows. Section 2 describes the reform. Section 3 outlines the data employed in this study and is followed by section 4 that reports the empirical specifications. Section 5 presents the results and finally, section 6 concludes.

2 Background of the reform

India adopted a policy of product reservation in 1967 whereby certain products were reserved for exclusive production by small enterprises. Mohan (2002) notes that this policy was enacted with a view to generate employment in a labour-surplus economy. It was believed that small enterprises make economical use of capital and absorb labour supply whereas large firms are capital intensive and reward only a minority of labour. The policy sought to protect small scale industry from competition by large firms with a view to generate employment. Furthermore, the widespread perception that import of mass-manufactured products affected millions of handloom textile workers in the nineteenth century also contributed to the concern for protecting small enterprises.

The choice of products to be reserved was arbitrary - government documents state that the only criterion was the ability of small firms to manufacture such items. Though, initially, only 47 products were reserved for production by small firms, over the years, products were added to and removed from the list. By late 1970s most reserved items had been added to the list and as of 1991, there were more than a thousand products on the reserved list. Products spanned many sectors including food, chemicals, base metals, machinery, textiles and wood and paper products. Examples include toothpaste, leather, and PVC compounds.

Following trade liberalisation in 1991, small firms in many reserved sectors were subject to import competition. On the other hand, large domestic players were still not allowed to produce these goods. There was also some concern about existing large players in the reserved markets in a position to exercise monopoly power. A special committee was appointed in 1995 to reconsider the list of reserved items. Based on the recommendations of this committee, the process of de-reservation started in 1997. The process and timing of de-reservation is, however, not very clearly understood as is also noted in earlier papers (Mohan, 2002; Martin et al., 2017; Singh, 2017). The path of a product to de-reservation is often lengthy and circuitous. First, a reserved product is identified as a candidate either by a ministry or by industry players themselves. A series of meetings then follow between the affected parties and government officials. The proposal is then subject to review by a chain of bureaucrats before being signed into law. As a result, the removal of products from the reserved list was staggered across time and industry. I will exploit this variation in timing of deregulation in my empirical analysis. As an example, the deregulation of products in the fabricated metal products sector took place over several years with 0% in 2003, 22% in 2004, 0% in 2005, 42% in 2006, 31% in 2007 and the remaining 5% in 2008. In section 4.3, I provide further evidence, using a proportional hazards model, that downstream industry characteristics do not predict the timing of deregulation of intermediate inputs.

In addition, luckily, most other major reforms were completed before de-reservation. The dismantling of the license raj and major changes relating to foreign investment took place in the early 1990s. Tariffs were largely harmonised across industries by the late 1990s (Nataraj, 2011) and by 1998, 93% of industries were no longer subject to licensing requirements (Martin et al., 2017).

In the first major round of de-reservation, which took place in 1997, 15 products were removed from the list. De-regulation took off in 2002 when another 51 products were allowed to be produced by larger establishments, and accelerated from 2003 to 2008 with approximately 100-250 products de-reserved each year. The last 20 products were taken off the list in 2015.

Products on the reserved list were only allowed to be produced by small firms. The definition of 'small' firms has evolved over time. An establishment is defined

as 'small' based on investment in plant and machinery (at historical cost) - balance sheet size of plant and machinery. The limit has been changing over time as can be seen from Figure 2 largely to keep pace with inflation. Establishments above the investment threshold at the time of reservation were allowed to continue production, but their output was capped at current levels. Expansion or entry by large establishments required a commitment to export a majority of the produce. I study the effect of the reform on the downstream market. Some examples of downstream products include detergents, soaps, fertilizers, insecticides and plastic vacuum flasks.

3 Data

This paper explores the effect of improved access to higher quality intermediate inputs on downstream firms. To be able to identify downstream firms one would need firm-to-firm linkages. In the absence of such linkages, detailed data on inputs used and products produced by establishments can be used. One can use these data directly to identify the inputs used by incumbents prior to the reform. On the other hand, in case of entrants, since by definition they are not observable prior to the reform, these data can be used to construct an input-output table. This is how I identify downstream entrants and incumbents in this paper. I employ the MSME census for data on entry and use ASI establishment level data for incumbents. This section describes the datasets in more detail.

3.1 Establishment level data

Establishment level data are from the Annual Survey of Industries (ASI) which is conducted by the Central Statistics Office (CSO). All factories using electricity that employ 10 or more workers and all factories not using electricity that employ 20 or more workers are covered under the survey. The data are anonymous and do not allow either individual firms to be identified or different establishments of the same firm to be linked to each other.[5]

[5]Most establishments in the data are single firm establishments. With a little abuse in terminology, I will use the terms 'establishment' and 'firm' inter-changeably in the paper.

The data are divided into a *census* sample which includes factories that employ 100 or more workers, and a *sample* sample which includes factories that employ less than 100 workers (these are CSO labels). Factories in the *census* sample are surveyed each year whereas a representative sample of factories are surveyed each year in the *sample* sample.

I use ASI data from FY2001-2010 (financial year in India runs from 1 April to 31 March next year, for example, FY2001 is 1 April 2000 - 31 March 2001). The choice of the sample period starting in 2000-2001 is driven by incomplete product coverage in previous years (Martin et al., 2017). The data come in two versions: one version follows an unbalanced panel structure and allows establishments to be tracked over time whereas the other follows a repeated cross-section and does not allow establishments to be tracked over time. The repeated cross-section version of the data, however, contain granular information about the location of the establishment - district in which it operates - that will be useful for my analysis on entry. I follow Martin et al. (2017) and match the two versions to add the information on district of operation of an establishment to the panel version of the data. Similar to Martin et al. (2017), I obtain a high match rate of 94.5%. Additionally, I employ Martin et al.'s (2017) district mapping to ensure consistency across years.

The dataset provides a representative survey of all registered manufacturing establishments. The data includes detailed information on inputs used (including imports) and products produced by each establishment, along with their quantities and total value. This enables me to calculate a unit price. I drop establishments that provide mining, repair/maintenance or other services. I consider negative values of assets or output as data inconsistencies and set them to missing. I require all establishments to have non-missing value of establishment age. All observations with missing labour and total output or total assets are dropped. All variables are winsorised at the 1% level.

The ASI reports products using A Standard Industrial Classification of Commodities (ASICC) product codes. I create a concordance of product codes across years. In addition, I establish a mapping between the product codes from the deregulation circulars and ASICC codes based on several government commissioned reports found on government or government affiliated entity websites. The data

contain information of 5382 distinct products produced. In 2001, 13.6% of firms were producing a reserved product. For the analysis on downstream incumbents, I exclude firms that ever produce a reserved product.

The final sample consists of a firm-year panel with 56,482 distinct establishments, of which 10,453 are downstream incumbents employing 499 distinct reserved intermediate inputs. The average firm in the sample has sales of Rs. 444.4 million and fixed assets of Rs. 165.0 million. The average downstream firm is larger with sales of Rs. 751.9 million and fixed assets of Rs. 287.0 million. Summary statistics are presented in Table 1.

3.2 Entry data

Data on entry are taken from the All India Census of Micro, Small and Medium Enterprises (hereafter MSME census). The fourth round covers the universe of small and medium establishments registered up to 31 March 2007 with their respective state governments or under the Factories Act. Only businesses with a fixed premises and investment in plant and machinery below a threshold of Rs. 10 million are included in the survey.

The dataset contains detailed information on inputs used and products produced including quantities and total value of production for the financial year. These allow me to identify businesses that are directly or indirectly (via input-output linkages) affected by the deregulation. In addition, the data contain current and historical information about the enterprise such as start date, initial value of plant and machinery installed and location that are well suited to study entry decisions of firms. It must be noted, however, that the data are anonymous and do not allow me to follow establishments from one round of the census to the other or to link establishments to firms. The MSME census reports products using extended ASICC product codes. I create a mapping between ASICC codes from the MSME census to ASI to match to the product codes from the reform.

I drop establishments in the mining, electric utilities, repair/maintenance and services sectors. I require them to have positive and non-missing employment and

total output. Only establishments in the manufacturing sector that were formed between 1992 and 2006 are considered for the analysis of downstream entry. Table 1 provides some summary statistics. The average establishment is small and employs 5.5 persons. The sample includes downstream firms and those unrelated to the regulation change. There are on average 6,240 downstream entrants each year. Establishments producing unrelated products are those that do not produce either deregulated or downstream or upstream products. My final sample consists of a balanced panel with 519,765 district $\times$ product $\times$ year observations, with data on entrants in 517 districts, 1357 product markets across 15 years.

3.3 Other datasets

Unorganized manufacturing survey: I use data on inputs used and products produced from National Sample Survey (NSS) Office's 56th round of Unorganized manufacturing survey to complement the data from ASI to construct an ex-ante input-output table. Unorganized manufacturing survey covers a representative sample of manufacturing firms excluding those covered by the ASI.

NBER-CES Manufacturing Industry Database: I employ the National Bureau of Economic Research (NBER) and U.S. Census Bureau's Center for Economic Studies (CES) manufacturing industry database for constructing industry level measures of capital intensity. NBER-CES Manufacturing Industry Database provides annual industry-level data on investment and capital employed for the US.

Horizontally differentiated products: In addition, I employ Rauch's (1999) classification based on proportion of differentiated products (not reference priced or traded on an exchange) in an industry to construct a measure of horizontally differentiated sectors.

3.4 Input-output table

Since a detailed input-output table is not available, I use the data on inputs used and products produced by each establishment to construct one. I combine the

establishment level data from 2000-01 from ASI and the National Sample Survey Office's Unorganized Manufacturing Enterprises Survey from 2000 to construct an ex-ante (beginning of period) input-output table. It may be noted that though, the third round of the MSME census was conducted in the same year, it is not possible to use these data to construct the I-O table as the questionnaire does not contain information on inputs used. Using beginning of period information to construct the input-output table allows me to capture the effect of the reform on the pre-determined I-O network without any confounding effects of the change in the structure of the I-O network itself.

Only single-product establishments are used to construct the input-output table. The rupee value of each input in normalised by the total value of inputs used by the establishment to get a percentage by value. This percentage by value for each input is weighted by the importance of the establishment in producing the product i.e., percentage of production of the product by the establishment to total production of the product in the reference year. This is summed across each input-product pair. Finally, only inputs above a threshold of 1% are considered for identifying the supply chain.

Upstream and downstream products are, then, identified using the input-output table. Thus, a product is a downstream product if at least one of the inputs used in its production by the average firm in the economy, as measured by the input-output table, is deregulated. Similarly, all inputs used in the production, as per the input-output table, of deregulated products are classified as upstream products.

An establishment is classified as a product market firm if at least one of its products is a reserved product. This procedure identifies only one reserved product for most establishments. In cases where an establishment produces more than one reserved product that is deregulated in different years, the earlier year is considered as the year of de-reservation for the establishment.

The input-output table is used to identify downstream products for the results on entry in downstream markets. The results on downstream incumbents, on the other hand, rely directly on observing the inputs used by a firm and are not based on the input-output table.

4 Empirical strategy

4.1 Baseline specification for incumbent downstream firms

The baseline specification for evaluating growth of incumbent downstream firms is as follows:

$$y_{i,j,t} = \beta_1 DownDereg_{i,t} \ + \ \delta_i \ + \ \delta_{jt} \ + \ \varepsilon_{i,t} \tag{1}$$

$$y_{i,j,t} = \sum_{n=-4, n!=-1}^{3} \Gamma_n \mathbb{1}(n)_{i,t} + \delta_i \ + \ \delta_{jt} + \varepsilon_{i,t} \tag{2}$$

where $y_{i,j,t}$ is the outcome variable (for example, log of capital) for firm i that produces product p and operates in industry j in year t. The data are collapsed into a single observation per firm-year. In this way, the data are organised into a firm $\times$ year level panel while still allowing me to identify the main product produced. $DownDereg_{i,t}$ is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. It is worth noting that I observe the inputs used by each firm in the production process including imported inputs. I use information on inputs used by a firm prior to the reform to identify downstream incumbents (firms that were using regulated products as inputs prior to de-regulation). Unlike, the specification on downstream entrants where I rely on the input-output table to identify downstream products and firms, here I directly observe and employ the inputs used by a firm for the analysis. The analysis focuses on unrelated firms and downstream incumbents i.e., those firms that employ regulated products as inputs prior to de-reservation. In the dynamic specification in equation (4), $\mathbb{1}(n)_{i,t}$ is an indicator function that takes the value 1, n years after de-reservation of inputs, and 0 otherwise. Furthermore, treatment and exposure to the regulation is invariant at the firm level. In case a firm uses multiple inputs that are de-reserved in different years, then the year of de-reservation that comes first is assigned to it.

The parameter of interest of the difference-in-differences specification in equation (3) is β_1. β_1 measures the change in the outcome variable for downstream firms after de-regulation compared to a control group of firms unrelated to the reform. δ_i

and δ_{jt} represent firm fixed effects and industry $\times$ year fixed effects respectively.

Firm fixed effects control for both observable and unobservable time-invariant firm characteristics. Estimating a within-firm effect allows me to control for selection that may be induced by a change in composition of firms. Industry-Year fixed effects imply that the coefficient of interest is identified by comparing firms in the same industry-year. They absorb all the variation that may come from common shocks at the industry-year level and hence control for any concurrent regulatory changes at the industry level in any given year. It may be noted that including industry-year fixed effect implies that the identification comes from the variation in $DownDereg$ within industry-years. Since, treatment is not concentrated in certain industries and there is variation within-industries in the treatment status, it is, indeed, possible to include industry-year fixed effects in the specification. The standard errors are clustered at the product level.

While equation (3) presents the average effect, equation (4) estimates the dynamic effect of the de-regulation. ϕ_n is the parameter of interest in equation (4) and measures the change in the outcome variable n years after the de-regulation for downstream firms compared to unrelated firms. δ_i and δ_{jt} represent firm fixed effects and industry $\times$ year fixed effects respectively. The standard errors are clustered at the product level.

4.2 Baseline specification for downstream entry

The empirical specification for entry is a difference-in-differences strategy of the form:

$$y_{p,d,t} = \beta_1 DownDereg_{p,t} + \delta_p + \delta_t + \delta_d + \varepsilon_{p,d,t} \tag{3}$$

$$y_{p,d,t} = \sum_{n=-4, n!=-1}^{3} \Gamma_n \mathbb{1}(n)_{p,t} + \delta_p + \delta_t + \delta_d + \varepsilon_{p,d,t} \tag{4}$$

where $y_{p,d,t}$ is the outcome variable, log(1+number of new firms), for product p in district d with start year t. It is worth noting that I do not need to observe the inputs used for production of each product at this stage as the inputs used by the average

firm (as per the ex-ante input-output table) that produces p are employed for the analysis. $DownDereg_{p,t}$ is a dummy variable that goes from 0 to 1 for downstream products following de-reservation of at least one of their inputs. In the dynamic specification in equation (3), $\mathbb{1}(n)_{p,t}$ is an indicator function that takes the value 1, n years after de-reservation of inputs, and 0 otherwise.

The parameter of interest in equation (1) is β_1. β_1 captures the average effect of de-reservation on firm formation. While equation (1) and (2) present the average effect, equation (3) estimates the dynamic effect of the de-regulation. Γ_n is the parameter of interest in equation (2) and measures the change in downstream firm formation n years after the de-regulation. The identification relies on comparing $y_{p,d,t}$ before and after the de-regulation to a control group of products that are not affected by the change in regulation. A positive β_1 coefficient would imply that de-regulation leads to an increase in downstream entry relative to entry in unrelated product markets on average.

δ_p, δ_t and δ_d are fixed effects for product, start year and district respectively. District fixed effects control for time-invariant determinants of entrepreneurship at the district level, such as size of the district, access to banking and level of education. Start year fixed effects control for aggregate shocks that may cause more or less firms to be formed in any given year. Product fixed effect account for time-invariant product specific characteristics that may cause entrepreneurs to start more or less firms producing a certain product. The standard errors are clustered at the product level.

4.3 Timing of deregulation

The identifying assumption of my analysis is that the timing of the de-regulation is unrelated to investment opportunities in the downstream market. Though, it is fundamentally impossible to test this, I provide evidence in support of the assumption. Previous papers (Martin et al., 2017; Singh, 2017) find that the timing of the de-regulation was unrelated to de-regulated industry conditions. I study the impact of the de-regulation on downstream product markets. Arguably, if the timing of the policy was unrelated to de-regulated industry conditions, it is unlikely to be sys-

tematically related to downstream market conditions. Additionally, only about a third of the de-regulated products are used as intermediate inputs in the production of downstream products and even among these there is variation in the timing of de-regulation. This is reassuring and makes it even more unlikely that the timing of de-regulation is driven by downstream industry characteristics.

In addition, I use a proportional hazards model to investigate the potential determinants of the timing of the de-regulation of intermediate inputs. I model the duration of regulation using a Weibull proportional hazards model that takes the following form:

$$h(t) \;=\; h_0(t)exp(x\beta) \tag{5}$$

where x_t is a vector of time varying covariates; $h_0(t)$ is the baseline hazard rate equal to pt^{p-1} with p as the shape parameter. I have one observation for each intermediate input that is de-regulated between 2000 and 2009 for each year. I test whether the timing of de-regulation is related to downstream industry characteristics, imports or Khandelwal (2010)'s measure of the length of the quality ladder. Table 10 reports the results. None of the variables show significant predictive power for the timing of the de-regulation. Overall, the timing of the reform does not seem to be related to downstream industry conditions.

In addition, I separately test whether the timing of de-regulation is related to deregulated industry characteristics, imports or length of the quality ladder for products used as intermediate inputs. Table A10 reports the results and indicate that deregulated industry characteristics do not seem to predict the timing of the reform.

5 Results

Section 5.1 examines the de-regulated market and investigates the mechanism driving the results. Section 5.2 reports the estimates of the effect of the reform on downstream investment, product mix, import substitution and heterogeneity in propagation of the shock. In addition, it also explores alternative explanations for the findings and presents the results on downstream entry.

5.1 Mechanism

Before studying the spillover effects in downstream markets, I start by examining the mechanism for the increase in production of high quality intermediate inputs following the reform. In line with the previous literature on product quality (Kugler and Verhoogen, 2012; Atkin et al., 2015; Gupta, 2023) among others, I show that small firms produce low quality products and large firms produce high quality products. Then, I present evidence that de-reservation (removing size-based restrictions) in conjunction with segmentation led to an increase in production of high quality intermediate inputs.

First, I present evidence on segmentation of the market based on quality. It may be noted that quality reflects an improvement in the product and is distinct from mere product variety (horizontal dimension) that may simply reflect heterogeneity in preferences of consumers. Since, quality is not observable in my dataset, I use reduced form relationships between unit prices and firm size to draw indirect inferences about quality without constructing explicit measures of quality. Kugler and Verhoogen (2012) develop a heterogenous firm model with endogenous choice of input and output quality to motivate this approach. Firms need to pay a fixed cost to upgrade. In equilibrium, larger, more capable firms take advantage of economies of scale and use higher quality, higher priced inputs to produce higher quality, more expensive outputs. The authors document three key facts using Columbian manufacturing data: larger plants charge higher prices, within narrowly defined product markets; larger firms pay more for their inputs; and, the firm size-output price correlation is stronger for product markets with greater scope for quality differentiation.

I follow the same approach as Kugler and Verhoogen (2012) to show that large firms produce higher quality products. Here, I use firm size to be the regulatory threshold for small firms. Firms with historical investment in plant and machinery above the threshold are classified as large firms. I estimate the following empirical specification:

$$y_{i,p,s,t} = \beta_1 Large\ firm_i\ +\ \delta_{ist} +\ \varepsilon_{ist} \tag{6}$$

where $y_{i,s,t}$ is the outcome variable (log input (output) price) for a firm i that uses input (produces product) p in year t and is located in state s. Large firm is a time-invariant dummy variable that takes the value 1 for firms with balance sheet

size of plant and machinery above Rs. 10 million in the first year that they appear in the data. I conduct robustness tests using an alternative time-varying measure of firm size, log(fixed assets). The specification employs Product × State × Year fixed effects to compare large firms to small firms within narrowly defined product markets in a given year.

The results are reported in Table 2. Column (1) of Panel A confirms that large firms pay a higher price for their inputs compared to small firms in the same narrowly defined input market in a given year in a given state. Column (3) reports the result for intermediate input producers prior to de-regulation. The coefficient is positive and statistically significant implying a positive input price-size correlation. Columns (2) and (4) employ a continuous measure of log(fixed assets) as the independent variable and document a similar relationship.

Panel B presents the results for the output price-size correlation. The coefficients are positive and statistically significant across all specifications and confirm a positive output price-size relation. Next, using Khandelwal's (2010) measure of the length of the quality ladder as a measure of scope for quality differentiation, I find that the output price-size correlation is stronger in longer quality ladder industries.[6] The results are presented in Panel C. The coefficients in columns (1) and (2) are positive and statistically significant. The coefficients of the interaction term in columns (3) and (4), though positive are not statistically significant. It may be noted that this relationship relies on the free entry condition being satisfied. In the intermediate input producer segment prior to the reform, however, entry was restricted and this may explain the slightly weaker relationship.

I conduct several robustness tests. First, I exclude threshold firms - these are firms close to the regulatory size threshold, are explicitly constrained by the reform and respond to deregulation by investing (Martin et al., 2017). These firms are somewhat different from other small firms and I show that the results remain similar upon excluding them. Next, I examine propensity to import and export.

[6]Khandelwal (2010) uses imports to the US to infer quality of a product based on the mean valuation that US consumers attach to an imported product. The intuition is as follows: conditional on price, imports with higher market share are assigned a higher quality. He finds that there is significant heterogeneity in product market scope for quality differentiation and defines quality ladders as the range of qualities within a product market.

Consistent with (Melitz, 2003) type models with a fixed cost of exporting and importing, I find that larger firms have a higher propensity to import within narrowly defined input markets. Similarly, large firms also have a higher propensity to export compared to small firms in narrowly defined product markets. This result further strengthens my finding that large firms produce higher quality products. Last, I show robustness of the price-size correlations to using the full sample, as opposed to the previous results, which employed a subset with "clean" prices following Boehm et al. (2022). Together, these results indicate segmentation of the market based on product quality.

Prior to deregulation, large firms faced caps on producing reserved products. In the presence of segmentation, size-based restrictions effectively translate into a cap on high-quality output. After de-reservation, small incumbents shrink (Martin et al., 2017) and with them the production of low quality goods shrinks. On the other hand, with the removal of size-based restrictions, large incumbents and entrants expand. The reform was pro-competitive in nature (Galle, 2020) - the number of players increased, prices decreased (Balasundharam, 2019) and quantity produced increased in the previously regulated product markets following de-reservation. I have shown evidence in favour of segmentation, implying that large incumbents produce high quality goods. Next, I study whether entrants produce high quality goods. Here, entrants are product market entrants and comprise both new entrants and existing firms that start producing deregulated products post reform. In Table A5, I present evidence that entrants use higher priced, higher quality inputs to produce higher priced, higher quality products. There is a price differential in the inputs used and products produced by entrants and small incumbents within narrowly defined product markets. The coefficient on entrants is positive and statistically significant. This finding suggests that entrants produce high quality goods. In this way, there is an increase in overall production of high quality products post reform.

I interpret my results as an increase in production of high quality domestic products. Note that these results do not have implications for within-firm quality and simply imply an overall increase in supply of high-quality products. Additionally, the decrease in price post reform could reflect a within-firm decrease in quality produced in deregulated markets. The reform increased competition in deregulated

product markets, thereby, reducing markups and prices. With lifting of size-based restrictions, new players enter and firms compete for market share (Singh, 2017). It is unlikely that firms trying to preserve market share will reduce product quality. In addition, in unreported results, I find that large firms continue producing high quality products compared to small firms post-reform. Thus, de-reservation improved the supply of high-quality domestic intermediate inputs for firms in the downstream market.

5.1.1 Mechanism: Alternative explanations

I examine alternative explanations, closely following Kugler and Verhoogen's (2012) analysis, absent a quality dimension, for the positive input price-plant size and output price-plant size correlations. As noted in Kugler and Verhoogen (2012), though, it is difficult to generate these predictions, one such alternative is models with plant-specific demand shocks and imperfect competition in input markets. In Foster et al. (2008), monopolistically competitive firms produce horizontally differentiated goods. There is, however, no vertical differentiation or quality dimension. The demand system is as in Melitz (2008). Plant-specific demand shocks reduce the demand elasticity of the plant. The plant, in turn, raises prices and increases output, thereby generating a positive output price-plant size correlation even in the absence of a quality dimension.

As per the positive input price-plant size correlation, there are two possible explanations with imperfect competition in input markets. First, plants that face demand shocks and hence, have lower demand elasticity may be less sensitive to input prices. In such a scenario, if suppliers have market power, they may charge higher prices to these less price-sensitive plants. This would generate a positive input price-plant size correlation along with a positive output price-plant size correlation. However, it may be noted that this is the case only for input sectors where suppliers have market power. To test this empirically, I construct a Herfindahl index for suppliers of each input (sum of the squares of the market shares of producers of the input). Table 3 reports the result of the regression of log input prices on a firm size dummy and its interaction with HHI in supplier markets. In a supplier market power story, we would expect to see a positive interaction term, i.e., a greater input price-plant

size correlation in sectors where suppliers have higher market power. Column (1) presents the result. The coefficient on the interaction term though positive is economically small and not statistically significant. At the same time, the coefficient on the firm size term (large firm) is positive and statistically significant i.e., there is a positive input price-plant size correlation in sectors where suppliers have zero market power. This is inconsistent with the supplier market power story.

Second, downstream producers may have monopsony power and face upward sloping supply curves. Combined with a plant-specific demand shock, this would generate an increase in derived demand for inputs and cause the firms to move up the input supply curve, thereby paying a higher price for inputs. This would generate a positive correlation between input prices and plant size. Again, it may be noted that this prediction only holds for sectors where downstream firms wield monopsony power. We do not expect a positive correlation for sectors that have no monopsony power and face a relatively flat input supply curve. I construct two measures of monopsony power - 1) a Herfindahl index for purchasers of each input (downstream firms) defined as sum of the squares of the expenditures of purchasers of the input and 2) purchaser share: individual plant's share of total domestic expenditure on a given input. Table 3 presents the results of the regression of log input prices on a firm size dummy and its interaction with HHI in purchaser markets and purchaser share. In a monopsony story, we would expect to see a positive interaction term i.e., a greater input price-plant size correlation in sectors with higher monopsony power. Contrary to this hypothesis, the coefficient on the interaction term(with HHI in purchaser markets) in Column (2) is negative though not statistically significant. Column (3) reports the result of the interaction with purchaser share. The coefficient on the interaction term is positive and statistically significant - plants with a larger share of expenditure on the input pay a higher input price. There is some support for this explanation. But importantly, the coefficient on the firm size term remains positive and statistically significant indicating a positive input price-plant size correlation in sectors with no monopsony power. Column (4) presents a specification that includes all the above measures simultaneously. The result remains robust after controlling for both supplier market power and purchaser monopsony power in the same regression.

In addition, a market power story would not predict a higher price-plant size

correlation for sectors with a higher scope for quality differentiation. Additionally, I conduct further robustness checks by re-estimating the tests for alternative explanations on the sub-sample of intermediate input producers before the reform and find similar results.

Another possibility is that the results are driven by an increase in the quantity produced, without a corresponding quality dimension. However, the mere increase in quantity produced post-reform does not seem to be driving my results. There was free entry in the small firm segment even prior to the reform. If low- and high-quality products were perfect substitutes, several small firms could have produced the desired quantity even prior to the reform. In such a scenario, we would not observe an increase in quantity produced post reform. This, however, is not the case, which suggests that low- and high-quality inputs are imperfect substitutes, evidence consistent with a quality dimension. Overall, my findings are unlikely to be driven by alternative explanations and point towards a quality dimension.

5.2 Effect on downstream firms

The previous section clearly outlined the mechanism at play and presented evidence of increase in production of high-quality intermediate inputs post-reform. In this section, I examine the effect of deregulation on downstream firms.

Since, low and high quality goods are not perfect substitutes, the improved access to high quality inputs may relieve technological constraints for downstream firms, enabling investment and production of higher quality ladder products. This effect is particularly likely for intermediate inputs that lack close substitutes in the import market. Alternatively, if firms substitute high-quality imported inputs with high-quality, lower-priced domestic inputs, this import substitution could ease financial constraints, enabling previously financially constrained firms to invest and produce higher-quality ladder products. Note that both these channels - technological constraints and financial constraints - entail investment and tilting the product mix. Before attempting to shed light on the two channels, I start by documenting the investment response.

5.2.1 Investment by downstream incumbents

The ASI dataset with establishment level data is best suited for this analysis. It is a representative sample and has good coverage of even the smaller firms. I estimate equation (3) and Table 4 presents the results on investment. The analysis focuses on downstream incumbents - downstream entrants and firms that switch to using de-regulated products as inputs after the reform are excluded in this regression.

I evaluate the effect of the reform on capital employed (property, plant and equipment or, PPE) using a difference-in-differences specification. The dependent variable is log of PPE. In line with the hypothesis, downstream firms employ more capital post-reform. The coefficient in column (1) is statistically significant and economically important. It implies a 3.2% increase in capital for downstream firms compared to a control group of firms unrelated to the reform. The magnitude implies an increase in capital of Rs. 5.3 million (USD 117k) per year for the average firm.

Next, I consider various measures of exposure to the reform. The threshold for being considered small is defined based on balance sheet size of plant and machinery. In this way, the reform was particularly binding for capital intensive sectors. We, therefore, expect a stronger effect for downstream firms that employ capital intensive inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. The investment effect is, indeed, stronger for downstream firms using capital intensive inputs as can be seen from Table 4 and Figure 7. The effect of the reform on capital employed by downstream firms is stronger for firms that use (above median) capital intensive inputs. The coefficient on the interaction term for low input capital intensity is statistically insignificant and economically smaller. On the other hand, the coefficient on the interaction term for high input capital intensity is statistically significant and has a higher economic magnitude. It implies a 4.3% increase in capital employed by downstream firms post reform compared to firms that are unrelated to the reform. The dynamic specification is depicted in Figure 7. We can see that the effect of the reform on capital employed by downstream firms is driven by firms that use above median capital intensive inputs. In

addition, there are no pre-trends. There is no statistically significant effect of the reform on capital employed for downstream firms that use below median capital intensive inputs.

The staggered difference-in-differences specification may produce biased results especially in case of heterogenous treatment effects over time (Baker et al., 2022). I re-estimate the results using a stacked difference-in-differences specification using never treated firms as the control group. The results remain robust to this alternative specification and are presented in Figure 8.

Another measure of exposure to the reform is deregulation of essential inputs. Essential inputs are those not easily substitutable and thus, commonly used across firms as an intermediate input in production. To construct a measure of essential inputs, I, first, calculate the percentage of firms, as per ex-ante input-output tables, employing a particular input in the production of a product. Next, to ascertain the substitutability of an input, the highest percentage value is assigned to each intermediate input. The measure is, then, aggregated to the downstream firm level by averaging across deregulated inputs and essential inputs is defined as a dummy variable that takes value 1 for above median values of the measure. Above median values of essential inputs implies that these inputs are not easily substitutable and are, hence, essential. Column (3) reports the result. The investment response is driven entirely by deregulation of essential inputs that cannot be easily substituted.

The results, so far, clearly establish that the reform leads downstream firms to invest. Next, I examine whether firms invest to upgrade and produce longer quality ladder products. Verhoogen (2023) outlines various forms of upgrading in his review of the literature including quality upgrading and product innovation. While I find clear evidence on product innovation, the quality of products produced is fundamentally difficult to observe and the evidence on quality upgrading is suggestive at best. In Kugler and Verhoogen's (2012) model, higher scope for quality differentiation gives firms a higher incentive to produce higher quality output. So, a margin for upgrading would be to shift the product mix towards products with a higher scope for quality differentiation.

Table 5 presents the results. The dependent variable is a weighted average mea-

sure of the quality ladder of products of each firm. It is constructed using Khandelwal's (2010) measure of the length of the quality ladder. Product codes from ASI are mapped to HS0 with the help of ChatGPT. This enables me to develop a measure of the quality ladder for products rather than for industries, facilitating the identification of shifts in the product mix within an industry. The coefficient in column (1) is positive and statistically significant, implying a 3.3% increase in the average length of the quality ladder. Column (2) splits the effect into that coming from downstream firms employing inputs with low vs high input capital intensity. As expected, the tilting of the product mix effect is dominated by downstream firms with high input capital intensity, consistent with the reform being more binding for them. The results imply a 6.1% increase in the average length of the quality ladder for downstream firms employing capital intensive inputs. In column (3), I examine another measure of exposure to the reform - deregulation of essential inputs. The tilting of product mix effect is, indeed, stronger for deregulation of essential inputs. Although not conclusive, the results suggest that firms may be investing to quality upgrade, echoing Kugler and Verhoogen's (2012) notion that firms use high-quality inputs to produce high-quality products and higher scope for quality differentiation provides incentives to firms to produce high-quality. While my data do not allow me to draw within-firm conclusions about quality upgrading, these findings are broadly consistent with firms upgrading after an increase in supply of high-quality domestic intermediate inputs following the reform.

5.2.2 Import substitution

In this section, I study the effect of the reform on imports by downstream incumbents. The reform led to an increase in production of high quality domestic products used as intermediate inputs and, in this way, reduced the relative advantage of importing intermediate inputs. Imports are considered to be of higher quality.[7] Post reform, we expect firms to substitute away from costly imports of de-regulated products as high quality domestic intermediate inputs become available. I estimate the

[7] I present evidence to support this assumption in the appendix in Table A7. As in Kugler and Verhoogen (2009), I find that imported inputs have a higher price compared to domestic ones in narrowly defined product markets. The effect holds even when comparing the prices of inputs used by the same firm.

following difference-in-differences specification:

$$y_{i,p,j,t} = \beta_1 DownDereg_{i,t} \; + \; \delta_{ip} \; + \; \delta_{jt} \; + \; \varepsilon_{i,t} \tag{7}$$

where $y_{i,p,j,t}$ is the outcome variable (for example, proportion of imports to total inputs or an indicator for importing an input) for firm i that uses input p and operates in industry j in year t. $DownDereg_{i,t}$ is a dummy variable that takes the value 1 once input p is deregulated. The sample consists of ex-ante importers - deregulated inputs that were imported by downstream incumbents prior to the reform along with a set of control input-firm-year observations. In case multiple inputs of a firm are deregulated in different years, the inputs deregulated in the earliest year are considered for the analysis. Different from the previous specification, this panel is at the Firm $\times$ Input $\times$ Year level and, I include Firm $\times$ Input FE in estimation. Additionally, I include Industry $\times$ Year FE as in the previous specification. Table 6 presents the results. Consistent with the mechanism, I find that importers reduce the proportion of imports to total inputs used following the reform. Column 1 reports the result. The coefficient is statistically significant and economically large. It implies a 8.6% decline in the proportion of imports relative to the mean of 0.55. Columns 2 and 3 report the results for downstream markets with low and high input capital intensity respectively. Since, the regulation was more binding for capital intensive products, we expect a stronger substitution effect for more capital intensive inputs. The coefficient in Column 3 is indeed larger.

Next, I examine the extensive margin of imports and find that the probability of importing also declines following the reform. The results are reported in Panel B. The magnitude in Column (1) implies a reduction of 16.7% in the probability of importing. The effect is economically large and corresponds to a 50.1% decline relative to the unconditional probability of importing. Columns (2) and (3) present the results for product markets with low and high input capital intensity respectively. The results are similar for both low and high input capital intensity and the magnitude of the coefficient is slightly larger for downstream markets with high input capital intensity.

The extensive margin result is consistent with a Melitz (2003) type model where there is a fixed cost of accessing the import market in each period. As production

of high quality domestic intermediate inputs increases, the relative advantage of importing declines. A prediction of the model would, then, be that the substitution effect on the extensive margin is weaker for the larger firms. I test this in Panel B by interacting *DownDereg* with a dummy variable that takes the value 1 for large firms (as per the regulatory threshold). Column (4) reports the result. The interaction term is, indeed, positive and statistically significant.

Figure 9 presents results for a stacked difference-in-differences specification. The control group is never-treated observations. There are no pre-trends and post-reform, there is a decline in the probability of importing.

The shift toward domestic inputs is likely to generate a general equilibrium effect via a feedback loop impacting firms in the deregulated market. The resulting increase in demand for their products may drive firm growth in deregulated markets. Taken together, the results on import substitution are consistent with improved access to high quality intermediate inputs in the domestic market following the reform.

5.2.3 Heterogeneous propagation by size

Next, I study the propagation of the shock along the supply chain. In this section, I examine and find evidence in favor of two channels - easing technological constraints and easing financial constraints. Low and high quality inputs are imperfect substitutes in production. Improved access to high-quality inputs relieve technological constraints for downstream firms, particularly for inputs that lack close substitutes in the import market. In addition, access to high-quality domestic inputs relieve financial constraints for small, financially constrained firms.

If imports are perfect substitutes to domestic inputs, then we do not expect to see any effect of the reform on downstream firms. This is particularly unlikely to be the case for small firms who face high import costs, be it for lines of credit from the bank or lost economies of scale for search/transportation costs etc. One would expect import substitution to potentially relieve financial slack and enable small firms to invest. I provide evidence consistent with this channel.

Table A4 reports the results. First, the investment response of small firms is stronger for financially constrained firms. I study the interaction of financial constraints with the reform separately for small and large firms. Financially constrained firms are defined as those with a low (below median) cash-to-total assets ratio prior to the reform. Column (1) presents the result. The investment response is stronger for firms with below median cash to total assets prior to the reform for small firms. For large, relatively financially unconstrained firms, this margin indeed doesn't seem to matter for investment as can be seen from the results in column (4). Second, the results indicate that the investment response for small firms is primarily driven by ex-ante importers, consistent with the mechanism of import substitution enabling access to high quality, lower priced intermediate inputs. The results are reported in column (2). Again, for large firms I do not find any statistically significant difference. Third, to further test the hypothesis, I divide the de-reserved intermediate inputs into ex-ante below and above median import penetration. The investment for small firms is stronger for those that use inputs with high import penetration - that is, inputs that firms were already importing. This result is consistent with import substitution, suggesting that financial constraints may play a role in the response among small firms.

I provide further evidence to support this mechanism for small firms. Table A8 presents results on input price heterogeneity. Column (2) depicts that the average price declined for small firms post reform. Column (3) reports the result for the sub-sample of ex-ante importers. The decline in prices is much larger for these firms. Lower prices ease financial constraints for small firms, freeing up cash to invest (potentially to upgrade). Another possible channel for easing of financial constraints could be that foreign suppliers are unlikely to offer trade credit to small importers. These small firms would, instead, have to subscribe to (costly) lines of credit from banks. When these small firms switch to domestic suppliers, they no longer require these lines of credit and in addition, may receive some trade credit from their domestic suppliers. This financial slack enables them to invest. These channels are difficult to pin down with my data. I test the trade credit channel as a possible mechanism for easing financial constraints in Section 5.2.5 and do not find strong evidence for a trade credit channel for small firms.

The results so far provide evidence supporting a financial constraints channel.

Additionally, I use the MSME Act of 2006 for plausibly exogenous variation in access to credit guarantee and loan programs to generate variation in financial constraints. Under the MSME Act of 2006, firms with balance sheet values between Rs. 10 million and Rs. 50 million were re-classified as small firms and became newly eligible for programs that provided support in the form of credit guarantees and loans, easing financial constraints (Rotemberg, 2019). Rotemberg (2019) shows that upon gaining access to the program, newly eligible firms increase their liabilities. I test the financial constraints channel using a sample of small and medium firms (balance sheet size of up to Rs. 50 million). Small firms (balance sheet size of below Rs. 10 million) were already eligible for these credit guarantee programs and serve as a control group. I compare the effect of the product dereservation reform on downstream incumbents and the MSME Act on not-yet deregulated downstream incumbents. Results are reported in Table A3. The investment response following the MSME Act differs by ex-ante import penetration and is driven by inputs with high ex-ante import penetration i.e., firms that could potentially access the import market for high-quality inputs. The results indicate that in the presence of access to high-quality inputs via the import market, easing financial constraints induces an investment response among previously financially constrained firms. In addition, product dereservation continues to affect investment among downstream incumbents. The results highlight the importance of simultaneously easing financial constraints and constraints in access to high-quality intermediate inputs in inducing an investment response among small, financially constrained downstream incumbents. This is consistent with Kugler and Verhoogen (2012), where there is a fixed cost of upgrading and producing high-quality products requires high-quality inputs.

For large firms, which are relatively financially unconstrained, the easing of technological constraints is more likely to play a role. Moreover, certain products have poor substitutes in the import market or incur high trade costs, leading to low import penetration. Improved access to high-quality domestic varieties of these intermediate inputs should, therefore, enable large firms that are relatively financially unconstrained to invest and upgrade. The result is reported in column (6). Indeed, the investment response for large firms is driven by inputs with low import penetration, that have poor substitutes in the international market or have high trade costs.

Overall, the results provide evidence in favour of heterogenous propagation of

the shock along the supply chain and highlight the presence of two channels - easing of financial constraints and lack of close substitutes in the import market.

5.2.4 Discussion

Low and high quality inputs are imperfect substitutes. As in Melitz (2003) type models and Antràs et al. (2017) firms pay a fixed cost to import high-quality inputs. The reform, by increasing production of high-quality domestic intermediate inputs, reduces the fixed cost to access high-quality inputs for downstream firms. This lowers the required productivity threshold for firms to enter downstream markets and leads to firm entry. Incumbents, faced with higher competition from entrants, invest and upgrade. This generates some testable predictions. First, firms in ex-ante more competitive downstream product markets are more likely to invest. In addition, we expect downstream firms with higher productivity to invest. Small, financially constrained firms that face lower fixed cost of accessing high quality inputs invest. Furthermore, we expect that the investment response by large, financially unconstrained firms is driven by downstream firms with improved access to intermediate inputs that lack close substitutes in import markets.

The investment response by ex-ante concentration in downstream markets is reported in Table A6. Downstream markets with below median HHI are categorised as Low HHI and those with above median HHI as High HHI. As predicted, the investment response is driven by downstream markets with low HHI. Next, the table compares the investment response by ex-ante productivity. Firms with below median ex-ante productivity are categorized as having low productivity and those with above median ex-ante productivity as high productivity. In line with the hypothesis, the investment results are stronger for firms with high ex-ante productivity. The financial constraints channel for small firms and the technological constraints channel for larger firms are examined in the previous section.

5.2.5 Robustness tests

In this section, I provide evidence against alternate explanations for my results such as hold up, trade credit, input specificity and liberalisation of FDI. The results are

presented in Table 8.

Hold up: An alternative explanation for my findings could be a hold-up story. An increase in competition in the input market and a reduction in price of inputs could improve the bargaining position of downstream firms and reduce the ability of the upstream suppliers to hold-up their customers ex-post. This would increase the downstream customers incentives to invest ex-ante. If this were true, we would expect the investment response to be strongest for downstream customers with low bargaining power. I use firm size and import status as a proxy for bargaining power. I find mixed evidence. Though, smaller firms invest, I also find that importers invest more. In addition, the investment is driven by downstream firms using standardised inputs as opposed to relationship based inputs. A hold up story would predict a stronger response for relationship based inputs. Overall, the results are not consistent with a hold-up story.

Trade credit: Singh (2017) shows that firms in the deregulated market employed trade credit to protect market power. This would imply that downstream firms have better access to trade credit post-reform and it is this increase in financial slack that is driving the results. For this story to hold, small firms - for whom I have shown the financial constraints channel - must benefit from the increase in trade credit and have higher trade credit received (Payables) post-reform. Column (5) reports the results for trade credit received post-reform for large and small firms. The benefit of the increase in trade credit is entirely concentrated among large, relatively financially unconstrained firms. Therefore, it seems unlikely that trade credit can explain my results.

Input specificity: Barrot and Sauvagnat (2016) emphasise the role of input specificity in propagation of shocks along the supply chain - when suppliers produce specific inputs, making it costly for firms to switch to alternative suppliers of the same input. This is likely to be the case for suppliers operating in differentiated goods industries. However, I find that the investment response is driven by deregulation of standardised inputs as opposed to relationship based inputs. The result is presented in column (3).

Liberalization of FDI: Bau and Matray (2023) show that foreign capital liber-

alization in India led to an increase in overall capital in the liberalizing industries. This might ease financial constraints and confound my analysis. I show that my results are robust to excluding industries subject to foreign capital liberalization during my sample period. The results are reported in Column (6).

5.2.6 Downstream entry

In this section I investigate the effect of the reform on entry in the downstream market which is another margin for investment. I employ Micro-Small and Medium Enterprises (MSME) census data for the analysis as they provide a snapshot of the universe of small and medium sized firms and are well suited to study entry decisions of firms (Naaraayanan, 2019). I employ ex-ante input-output tables to identify downstream products. I estimate equation (1) and (2). Figure 6 reports the results for the dynamics of entry and Table 9 presents the average effect.

The dependent variable in columns (1) and (2) is log (1+ number of new establishments). The number of entrants is defined using percentage by value of product produced and may take fractional values. The coefficient in column (1) is positive but not statistically significant. Column (2) splits the result into downstream markets with low vs high input capital intensity. As discussed in the previous section, the reform was more binding for capital intensive products. We, therefore, expect the effect to be stronger for downstream markets with high input capital intensity. Indeed, the increase in downstream entry is driven by downstream markets with high input capital intensity. The coefficient on the interaction term of the reform with high input capital intensity is positive and statistically significant. The coefficient implies that the reform led to an increase in entry of 2.0% in downstream markets that use capital intensive inputs, i.e., about 54 additional new establishments formed per year. There are approx. 5360 downstream entrants per year prior to the reform. Columns (3) and (4) report robustness tests using a Poisson specification (Cohn et al., 2022).

Figure 6 presents the results for the dynamics of entry for the stacked difference-in-differences specification. The coefficients for the years before the reform are all statistically insignificant and show no pre-trends. The results are reported sepa-

rately for downstream markets that use above and below median capital intensive inputs. The coefficients for years 2, 3 and 3+ are positive and statistically significant for downstream markets using capital intensive inputs. They imply a 2.3%, 5.8% and 4.5% increase in the number of new establishments formed two, three and four or more years after the de-regulation respectively. On the other hand, the coefficients for downstream markets using low capital intensity inputs is negative though not statistically significant. There seems to be some reallocation in entry towards downstream markets that use more capital intensive inputs. Panel B reports the results for downstream markets employing a Poisson model. The results look very similar. Figure 10 reports results with Cohort $\times$ Industry $\times$ Year FE to control for common shocks at the industry-year level. The results remain qualitatively similar.

Having established that the reform led to higher entry, I now examine the characteristics of the entrants. If it were the lower ability entrepreneurs (e.g., those started by life-style or subsistence entrepreneurs) that were constrained from entering prior to the de-regulation then I should observe a deterioration in the characteristics of the new entrants. However, if it is difficult to establish ex-ante which firms will be successes and the reform encourages experimentation by easing certain input market constraints then I should not observe any change in the characteristics of entrants (Hombert et al., 2020). I examine both ex-ante and ex-post measures of firm performance to compare the observable characteristics of entrants.

First, I provide evidence on an ex-ante measure of firm quality, namely, initial value of plant and machinery which I call startup assets. Table A9, Panel A presents the results for the entrepreneurship dataset. The coefficients in columns (1) and (2) though negative are not statistically significant implying that firms created in de-regulated downstream markets post-reform are similar in size to those created before the reform. Columns (3) and (4), by including Industry $\times$ Year fixed effects, compare firms within the same industry-year while controlling for common shocks at the industry-year level. The results reveal that downstream firms created post-reform with high input capital intensity are smaller in size compared to those created prior to the reform.

Next, I examine an ex-post measure of firm characteristics namely, output. This is particularly important since Ayyagari et al. (2017) highlight the importance of

initial starting conditions in influencing the growth trajectory of firms in the initial years of a firm's life cycle in India. Panel B of Table A9 reports the results. The MSME census includes questions on output for 3 years (FY2005-2007). I use these data to understand the dynamics of these small firms. Columns (1) and (2) present results for distribution of output of de-regulated downstream entrants before and after the reform to other unrelated firms. There is no statistically significant observable difference in the distribution of output for these firms. Overall, these results are inconsistent with a deterioration in observable characteristics of new downstream entrants and are consistent with financial constraints precluding entry prior to the reform.

5.2.7 Back of the envelope calculation

I provide a rough back of the envelope calculation of the aggregate investment response in the downstream market. The investment response for the average downstream incumbent is estimated at Rs. 5.3 million per year and the number of downstream incumbents is 10,453. The aggregate investment response for downstream incumbents over 3 years is then 10453 $\times$ 5.3 $\times$ 3 years = 166202.7 million = Rs. 166.2 billion = USD 3.7 billion in 2010 prices.

6 Conclusion

This study highlights the importance of alleviating supply-side constraints in domestic markets to foster firm investment and upgrading. Using a natural experiment, where India phased-out its product reservation policy - that had historically reserved certain products for exclusive production by small firms. The analysis reveals that removing caps on large firms' production facilitated economies of scale and increased production of high-quality products, providing improved access of high-quality intermediate inputs to downstream firms. Larger downstream firms experience eased technological constraints, allowing them to invest in producing high-quality products. Smaller downstream firms, on the other hand, benefit through reduced financial constraints by substituting costly imports with domestic inputs, enabling investment and upgrading.

Additionally, the study underscores that policies designed to protect small firms can have unintended consequences, potentially stifling product innovation and investment in downstream sectors. In aggregate, these results suggest that easing restrictions on domestic production can play a pivotal role in industrial upgrading and development in emerging markets, even when firms have access to imported alternatives.

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Table 1: Summary statistics: ASI data

The table reports summary statistics in 2010 rupees for the final sample and the sample of downstream incumbents (firms using a regulated product as an input prior to the reform). The data are structured as a firm-year panel.

Full sample						
	N	Mean	Median	Std dev	p10	p90
Downstream firms	131,544	0.238	0.000	0.426	0.000	1.000
DownDereg	131,544	0.066	0.000	0.249	0.000	0.000
Sales(Rs mn)	131,544	444.401	50.498	1,468.309	2.690	963.637
Fixed assets(Rs mn)	130,559	165.024	9.655	676.940	0.484	292.318
Profit(Rs mn)	131,544	80.402	3.712	379.846	-1.787	137.775
Capex(Rs mn)	130,569	26.220	0.837	122.865	0.000	35.290
Employment	131,493	158.878	40.000	336.344	8.000	405.000
Profit/assets	130,547	0.335	0.164	0.651	-0.046	0.807
Cash/TA	129,425	0.052	0.017	0.095	0.001	0.134
Bank debt(Rs mn)	113,865	165.349	12.658	552.718	0.684	348.623
Debt/assets	113,266	0.527	0.408	0.584	0.052	0.982
Capex/assets	129,676	0.079	0.017	0.179	0.000	0.199
Downstream firms						
	N	Mean	Median	Std dev	p10	p90
DownDereg	31,352	0.278	0.000	0.448	0.000	1.000
Sales(Rs mn)	31,352	751.875	61.936	2,246.898	4.284	1,595.298
Fixed assets(Rs mn)	31,254	286.987	12.617	1,012.741	0.787	539.574
Profit(Rs mn)	31,352	154.514	6.119	564.088	-0.597	300.492
Capex(Rs mn)	31,257	41.276	1.330	165.023	0.000	59.778
Employment	31,346	181.509	45.000	354.142	9.000	494.000
Profit/assets	31,212	0.333	0.186	0.580	-0.020	0.771
Cash/TA	31,027	0.046	0.015	0.086	0.001	0.119
Bank debt(Rs mn)	28,104	211.155	12.614	698.804	0.693	429.082
Debt/assets	28,026	0.451	0.352	0.503	0.029	0.866
Capex/assets	31,129	0.078	0.023	0.162	0.000	0.194

Table 1: Summary statistics: MSME census

This table presents the summary statistics for the final sample and the sample of downstream markets (identified using an ex-ante input-output table). The data are structured as a product-district-year panel.

Full sample						
	N	Mean	Median	Std dev	p10	p90
Downstream markets	519,765	0.466	0.000	0.499	0.000	1.000
DownDereg	519,765	0.081	0.000	0.273	0.000	0.000
No of entrants	519,765	0.288	0.000	1.131	0.000	1.001
log(1+entrants)	519,765	0.141	0.000	0.373	0.000	0.694
I(entry)	519,765	0.157	0.000	0.364	0.000	1.000
log(entrants)	81,691	0.278	0.006	0.697	0.000	1.154
No of entrants|entry	81,691	1.834	1.006	2.302	1.000	3.172
Downstream markets						
	N	Mean	Median	Std dev	p10	p90
DownDereg	242,430	0.174	0.000	0.379	0.000	1.000
No of entrants	242,430	0.329	0.000	1.223	0.000	1.003
log(1+entrants)	242,430	0.157	0.000	0.397	0.000	0.695
I(entry)	242,430	0.171	0.000	0.376	0.000	1.000
log(entrants)	41,434	0.320	0.008	0.704	0.000	1.386
No of entrants|entry	41,434	1.923	1.008	2.383	1.000	4.000

Table 2: Price-size correlation

The table reports the input price-plant size correlation in Panel A, output price-plant size correlation in Panel B and output price-plant size correlation by length of the quality ladder in Panel B. The outcome variable is log of input price in Panel A and log of output price in Panel B and C. Plant size is defined based on the regulatory threshold for firms to be considered small. Large firm is a time-invariant dummy variable that takes the value 1 for firms with a balance sheet value of plant and machinery above Rs. 10 million in the first year that they appear in the data. log(fixed assets) is a continuous time-varying measure of firm size defined as the log of fixed assets of the firm. Long QL is a dummy variable that takes the value 1 for above median values of Khandelwal's (2010) length of the quality ladder. Standard errors are clustered at the product level.

Panel A. Input price-size correlation				
	All firms		Int. input producers	
	(1)	(2)	(3)	(4)
	ln(Price)	ln(Price)	ln(Price)	ln(Price)
Large firm	0.070***		0.099***	
	(9.402)		(7.299)	
log(fixed assets)		0.019***		0.022***
		(10.061)		(8.031)
Input × State × Year FE	Yes	Yes	Yes	Yes
Observations	617480	617480	123749	123749
R^2	0.960	0.960	0.968	0.968
Years	All	All	Pre-reform	Pre-reform
Panel B. Output price-size correlation				
	All firms		Int. input producers	
	(1)	(2)	(3)	(4)
	ln(Price)	ln(Price)	ln(Price)	ln(Price)
Large firm	0.102***		0.151***	
	(8.363)		(3.896)	
log(fixed assets)		0.031***		0.048***
		(9.204)		(5.416)
Product × State × Year FE	Yes	Yes	Yes	Yes
Observations	263940	263940	25719	25719
R^2	0.961	0.961	0.960	0.960
Years	All	All	Pre-reform	Pre-reform
Panel C. Output price-size correlation by length of quality ladder				
	All firms		Int. input producers	
	(1)	(2)	(3)	(4)
	ln(Price)	ln(Price)	ln(Price)	ln(Price)
Large firm	0.087***		0.135***	
	(6.801)		(3.031)	
Large firm × Long QL	0.043*		0.055	
	(1.751)		(0.637)	
log(fixed assets)		0.029***		0.043***
		(6.945)		(4.128)
Long QL × log(fixed assets)		0.012*		0.017
		(1.722)		(0.925)
Product × State × Year FE	Yes	Yes	Yes	Yes
Observations	194202	194202	24536	24536
R^2	0.961	0.961	0.957	0.957
Years	All	All	Pre-reform	Pre-reform

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Alternative explanations

The table examines alternative explanations such as supplier market power and purchaser monopsony power. The outcome variable is the log of input price. Plant size is defined based on the regulatory threshold for firms to be considered small. Large firm is a time-invariant dummy variable that takes the value 1 for firms with a balance sheet value of plant and machinery above Rs. 10 million in the first year that they appear in the data. log(fixed assets) is a continuous time-varying measure of firm size defined as the log of fixed assets of the firm. HHI (suppliers) is the Herfindahl index for suppliers of each input and is calculated as the sum of the squares of the market shares of producers of the input. It is a measure of supplier market power. The two measures of monopsony power are 1) HHI (purchasers): a Herfindahl index for purchasers of each input (downstream firms) defined as sum of the squares of the expenditures of purchasers of the input and 2) Purchaser share: individual plant's share of total domestic expenditure on a given input. Standard errors are clustered at the product level.

	(1) ln(Price)	(2) ln(Price)	(3) ln(Price)	(4) ln(Price)
Large firm	0.057***	0.059***	0.056***	0.058***
	(6.193)	(5.979)	(7.278)	(5.412)
Large firm × HHI (suppliers)	0.008			0.007
	(0.352)			(0.335)
Large firm × HHI (purchasers)		-0.003		-0.036
		(-0.080)		(-0.943)
Purchaser share			0.139***	0.147***
			(4.182)	(4.360)
Input × State × Year FE	Yes	Yes	Yes	Yes
Observations	565882	565882	565882	565882
R^2	0.962	0.962	0.962	0.962
Years	All	All	All	All

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Downstream incumbents invest

The table reports the effect of de-regulation on downstream incumbents. The dependent variable is the log of capital employed. DownDereg is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Standard errors are clustered at the product level.

	All		Low input cap int	High input cap int	
	(1) log(PPE)	(2) log(PPE)	(3) log(PPE)	(4) log(PPE)	(5) log(PPE)
DownDereg	0.032**				
	(2.089)				
DownDereg × Low input cap int		0.019			
		(0.894)			
DownDereg × High input cap int		0.043**			
		(2.166)			
DownDereg × Non-essential input			0.011		
			(0.490)		
DownDereg × Essential input			0.057***		
			(2.806)		
-4				-0.047**	-0.017
				(-1.969)	(-0.650)
-3				-0.016	0.005
				(-0.870)	(0.250)
-2				-0.022	0.014
				(-1.343)	(0.927)
0				-0.004	0.013
				(-0.214)	(0.746)
1				-0.017	0.076***
				(-0.811)	(3.938)
2				0.009	0.069**
				(0.284)	(2.336)
3				0.032	0.031
				(0.836)	(0.804)
> 3				-0.016	0.049
				(-0.293)	(0.990)
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes	Yes
Observations	102787	100953	99840	88752	90838
R^2	0.966	0.966	0.966	0.965	0.966

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Downstream incumbents tilt their product mix

The table reports the effect of deregulation on the product mix of downstream incumbents. The dependent variable is the average length of the quality ladder of the product mix. DownDereg is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Standard errors are clustered at the product level.

	All		
	(1) QL of prdcts	(2) QL of prdcts	(3) QL of prdcts
DownDereg	0.033*		
	(1.857)		
DownDereg × Low input cap int		0.004	
		(0.156)	
DownDereg × High input cap int		0.061***	
		(2.755)	
DownDereg × Non-essential input			0.017
			(0.720)
DownDereg × Essential input			0.064***
			(2.712)
Firm FE	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes
Observations	54032	52792	51954
R^2	0.762	0.762	0.766

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Import substitution

The table reports the effect of the de-regulation on proportion of imports in Panel A and probability of importing in Panel B. The sample consists of ex-ante importers i.e., inputs that were imported by firms prior to de-regulation. The dependent variable is the ratio of imports to total inputs used. DownDereg is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Large firm is a dummy variable that takes the value 1 for firms with a balance sheet size of plant and machinery above Rs. 50 million. Standard errors are clustered at the product level.

Panel A. Proportion of imports				
	All	Low cap int	High cap int	
	(1) $\frac{Imports}{Total\ inputs}$	(2) $\frac{Imports}{Total\ inputs}$	(3) $\frac{Imports}{Total\ inputs}$	
DownDereg	-0.047*	-0.021	-0.098*	
	(-1.743)	(-0.637)	(-1.762)	
Firm × Input FE	Yes	Yes	Yes	
Industry × Year FE	Yes	Yes	Yes	
Observations	20389	11191	8034	
R^2	0.696	0.667	0.715	
Panel B. Probability of importing				
	All	Low cap int	High cap int	× size
	(1) I(Import)	(2) I(Import)	(3) I(Import)	(4) I(Import)
DownDereg	-0.167***	-0.150***	-0.172***	
	(-19.871)	(-12.891)	(-12.495)	
DownDereg				-0.212***
				(-14.872)
DownDereg × Large firm				0.076***
				(4.296)
Firm × Input FE	Yes	Yes	Yes	Yes
Industry × Year × Large firm FE	No	No	No	Yes
Industry × Year FE	Yes	Yes	Yes	No
Observations	88841	40618	42876	88832
R^2	0.333	0.318	0.352	0.334

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Downstream incumbents: heterogenous effects by size

The table reports the effect of the de-regulation on downstream incumbents. The dependent variable is the log of capital employed. DownDereg is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. Large firms are defined as firms above the regulatory threshold i.e., with fixed assets above a threshold of Rs. 50 million and 0 otherwise. It is defined based on the first time the firm appears in the sample. Importer is a dummy variable that takes the value 1 for downstream firms that import a reserved product prior to the reform. The de-reserved intermediate inputs are divided into ex-ante below and above median import penetration to define low and high import penetration. Standard errors are clustered at the product level.

	Small/medium firms			Large firms		
	(1) log(PPE)	(2) log(PPE)	(3) log(PPE)	(4) log(PPE)	(5) log(PPE)	(6) log(PPE)
DownDereg	0.082***			0.015		
	(3.222)			(0.453)		
DownDereg × High Cash/TA	-0.086***			0.052		
	(-2.804)			(0.824)		
DownDereg × Importer		0.175***			0.042	
		(5.578)			(1.462)	
DownDereg × non-Importer		-0.024			-0.030	
		(-1.171)			(-0.659)	
DownDereg × Low import penetration			0.022			0.064**
			(0.858)			(1.962)
DownDereg × High import penetration			0.049**			-0.035
			(2.262)			(-0.979)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year FE	No	Yes	Yes	No	Yes	Yes
Industry × Year FE × Fin con FE	Yes	No	No	Yes	No	No
Observations	81824	83558	83292	18755	19220	19152
R^2	0.948	0.947	0.947	0.861	0.858	0.858

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Robustness

The table reports robustness tests for the effect of the de-regulation on investment by downstream incumbents. The dependent variable is the log of fixed assets or log of trade credit received. DownDereg is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. Small firm is a time-invariant size dummy that takes the value 1 for firms below the regulatory threshold i.e., with fixed assets below a threshold of Rs. 10 million and 0 otherwise. It is defined based on the first time the firm appears in the sample. Importer is a dummy variable that takes the value 1 for downstream firms that import a reserved product prior to the reform. Relationship based is a dummy variable that takes the value 1 for firms using inputs from horizontally differentiated sectors. It is defined using above and below median values of Rauch's (1999) classification based on proportion of differentiated products (not reference priced or traded on an exchange) in an industry. Standard errors are clustered at the product level.

	(1) log(PPE)	(2) log(PPE)	(3) log(PPE)	(4) log(Payables)	(5) log(PPE)
DownDereg	-0.004			0.112***	0.033**
	(-0.167)			(3.662)	(2.155)
DownDereg × Small firm	0.068**			-0.110***	
	(1.999)			(-2.831)	
DownDereg × Importer		0.090***			
		(4.046)			
DownDereg × non-Importer		-0.013			
		(-0.662)			
DownDereg × Standardised			0.052***		
			(2.837)		
DownDereg × Relationship based			0.014		
			(0.660)		
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes	Yes
Observations	102787	102787	101842	94692	89824
R^2	0.966	0.966	0.966	0.874	0.966
Exclude FDI liberalising industries	No	No	No	No	Yes

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Downstream entry

The table reports the effect of de-regulation on downstream entry. The dependent variable is log(1+ number of new establishments) in columns (1) and (2). Columns (3) and (4) report results for a poisson specification employing number of new establishments as the dependent variable. DownDereg is a dummy variable that goes from 0 to 1 for downstream products (defined as per an ex-ante input-output table) following de-reservation of at least one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Number of entrants is defined using percentage by value of product produced and may take fractional values. Standard errors are clustered at the product level.

	OLS: log(1+ num. of entrants)		Poisson: num. of entrants	
	(1)	(2)	(3)	(4)
DownDereg	0.014		0.058	
	(1.607)		(0.891)	
DownDereg × Low input cap intensity		-0.008		-0.069
		(-0.913)		(-1.121)
DownDereg × High input cap intensity		0.024**		0.138*
		(2.176)		(1.725)
Product FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Observations	519765	519765	519765	519765
R^2	0.097	0.097		

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Timing of deregulation of intermediate inputs

The table reports the results of a Weibull proportional hazards model. There is one observation for each intermediate input in each year. The predictive variables include downstream market characteristics such as employment growth rate in the downstream product market, imports and length of the quality ladder. Log(1+imports) is the rupee value of imports of a given intermediate input in a given year. Quality ladder is the length of the quality ladder of the intermediate input. Standard errors are clustered at the intermediate input level.

	Duration since committee in 1995
	(1)
Fixed assets growth	-0.001
	(-1.053)
Employment growth	-0.003
	(-0.272)
Profit growth	0.000
	(0.236)
log(Fixed assets)	-0.032
	(-0.531)
log(Employment)	0.059
	(0.760)
log(Profit)	0.007
	(0.132)
log(1+Imports)	0.005
	(0.764)
Quality Ladder	0.036
	(0.515)
log(1+no. of entrants)	0.066
	(0.727)
Observations	1610

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 1: Proportion of products reserved by industry

The figure depicts the proportion of products reserved in each industry.

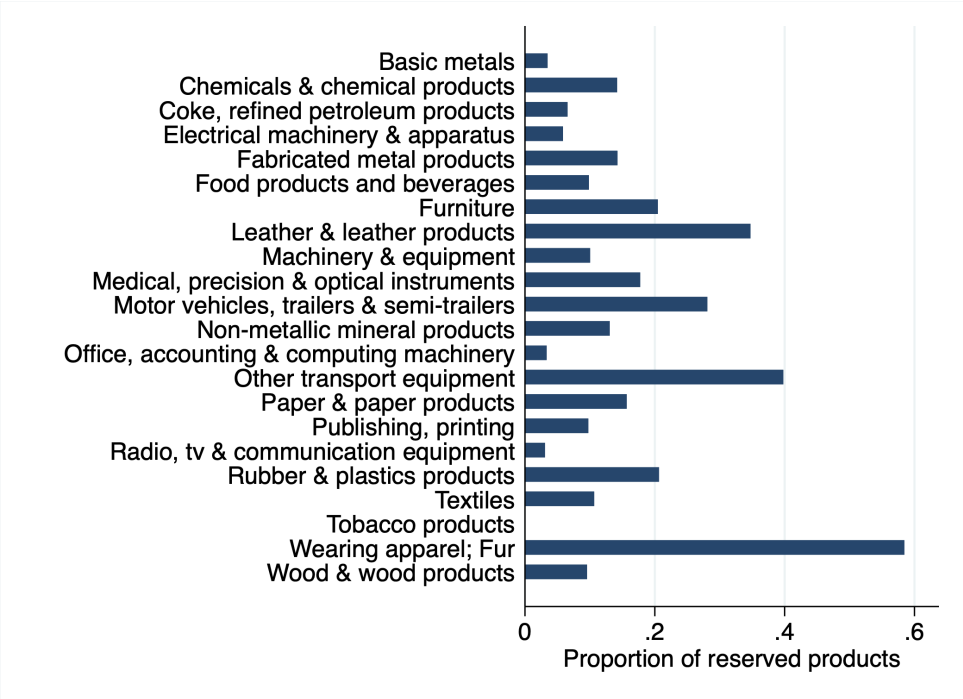


Figure 2: Evolution of definition of small firms

The figure presents the evolution in the size threshold for small firms (based on balance sheet value of plant and machinery).

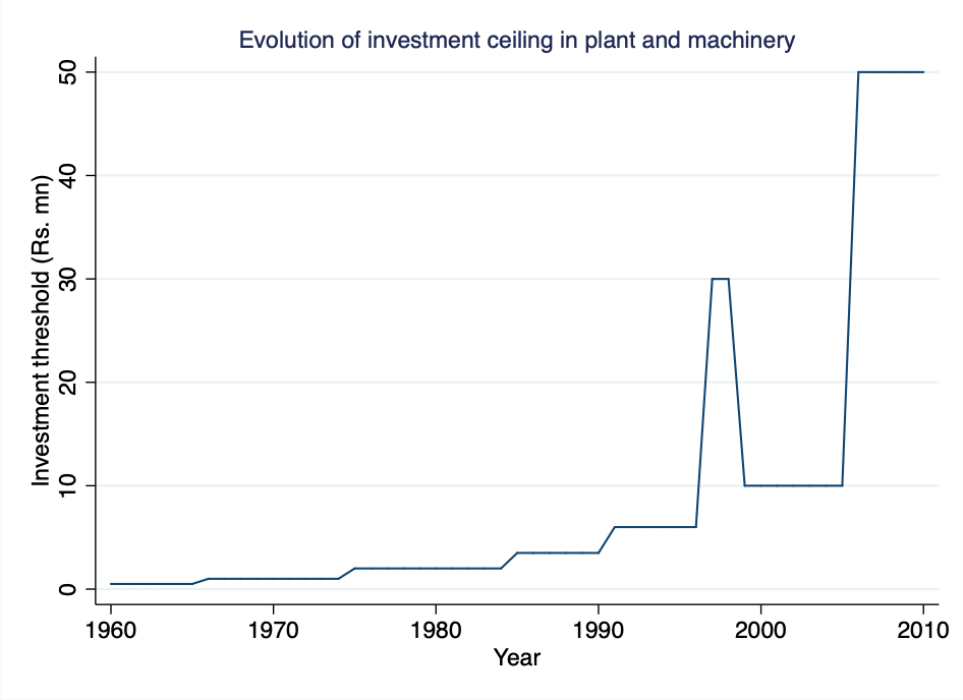


Figure 3: Number of downstream products affected by the deregulation each year

The figure plots the number of downstream products affected by deregulation each year. Downstream products are identified using the input-output table.

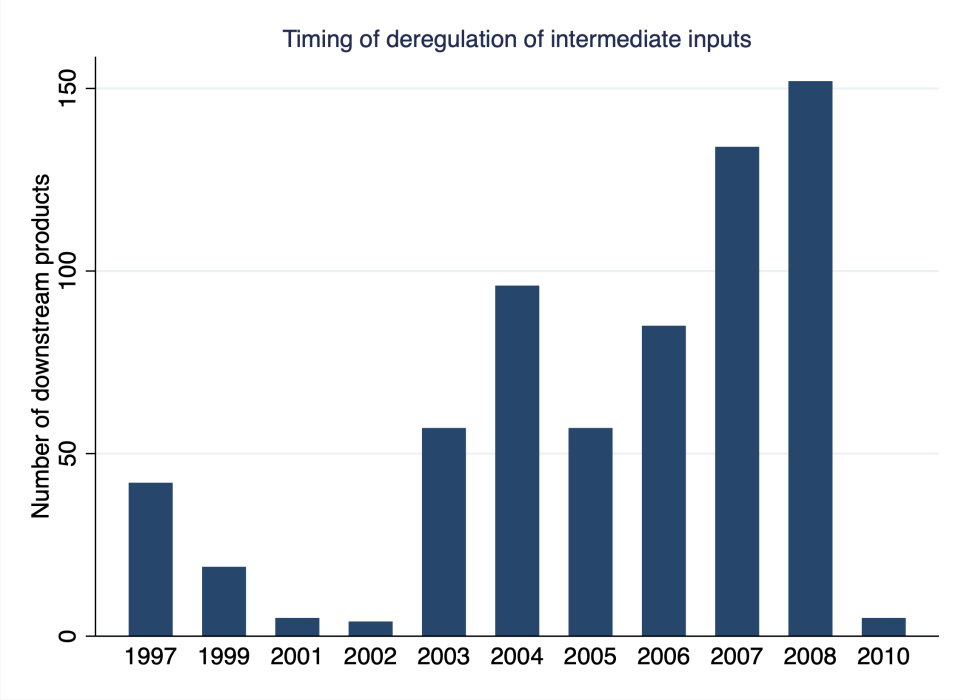


Figure 4: Heterogeneity by industry in large firm price premium

The figure plots the heterogeneity in the large firm price premium (compared to small firms in narrowly defined product markets) for products produced by industry.

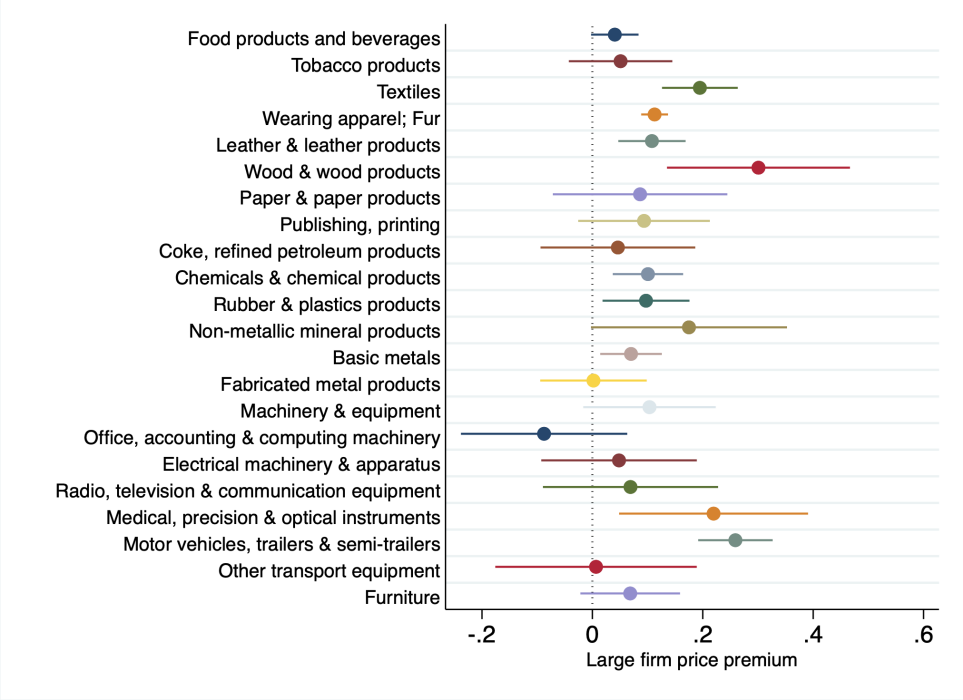
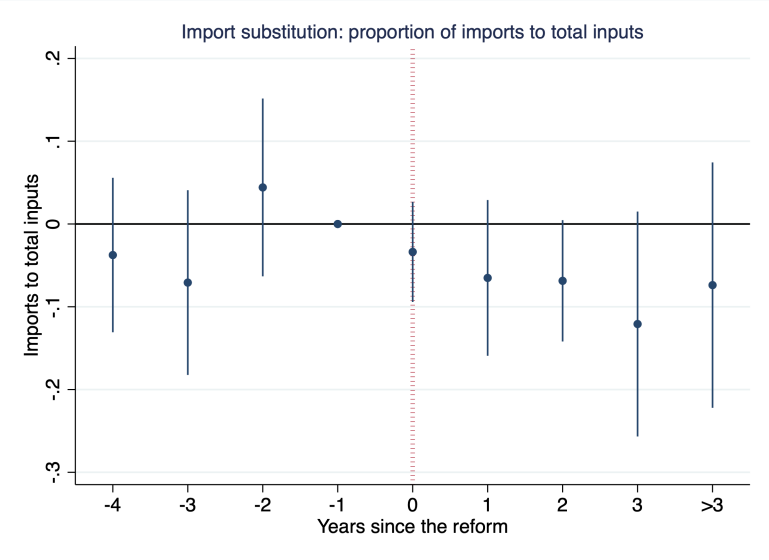


Figure 5: Import substitution

The figure reports the effect of de-regulation on proportion of imports in Panel A and probability of importing in Panel B. The sample consists of ex-ante importers i.e., inputs that were imported by firms prior to de-regulation. The dependent variable is the ratio of imports to total inputs used. DownDereg is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Standard errors are clustered at the product level.

(a) Panel A. Proportion of imports to total inputs



(b) Panel B. Probability of importing

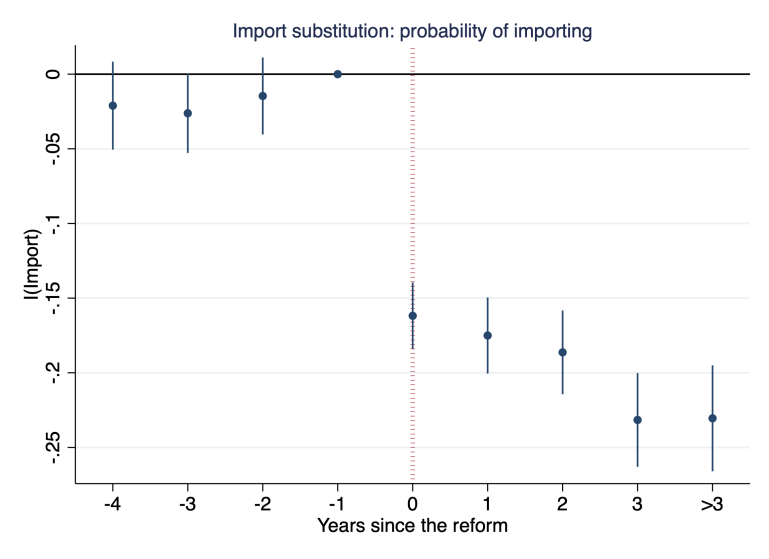
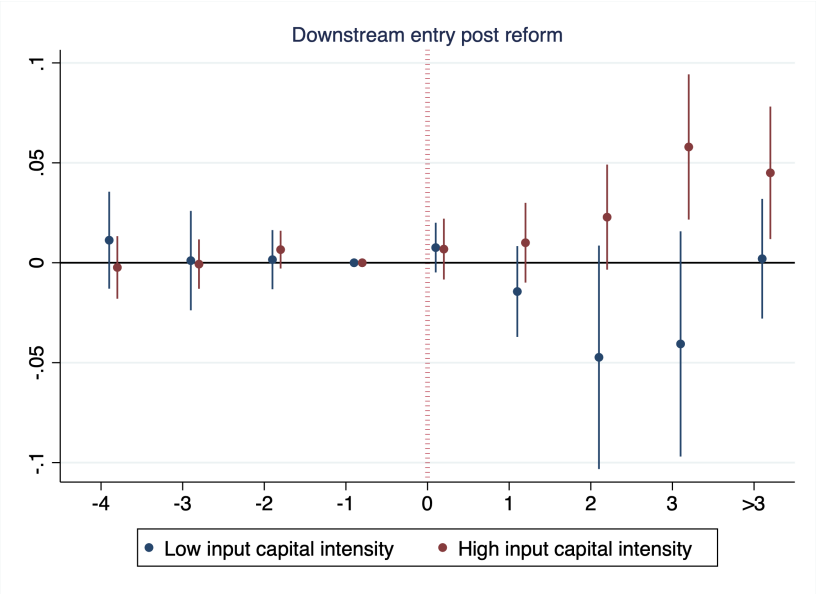


Figure 6: Downstream entry dynamics

The figure presents the effect of the de-regulation on downstream entry using a stacked difference-in-differences specification. The dependent variable is log (1+ number of new establishments) in Panel A. Panel B reports results for a poisson specification employing number of new establishments as the dependent variable. DownDereg is a dummy variable that goes from 0 to 1 for downstream products (defined as per an ex-ante input-output table) following de-reservation of at least one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Number of entrants is defined using percentage by value of product produced and may take fractional values. Standard errors are clustered at the product level.

(a) Panel A.



(b) Panel B.

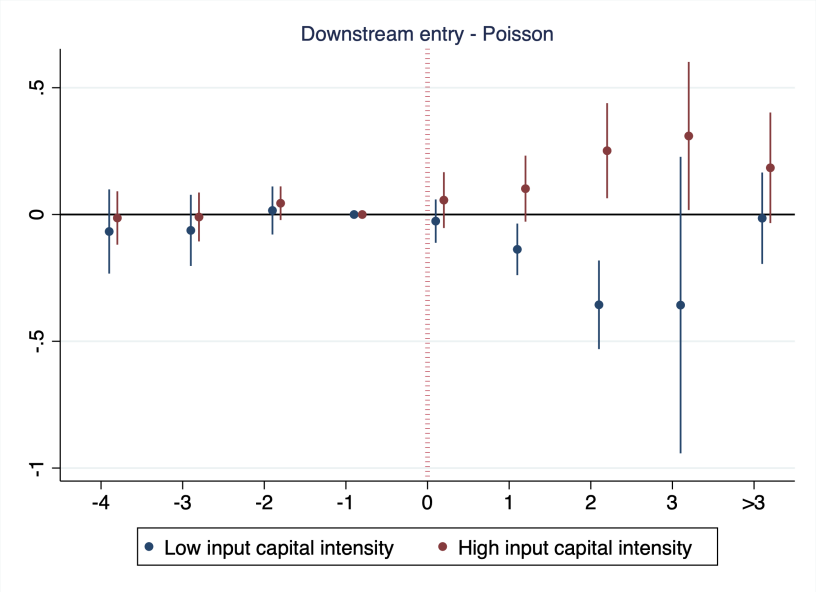


Figure 7: Post-reform dynamics of downstream incumbents

The figure reports the effect of the dynamics of the de-regulation on downstream incumbents (those using de-regulated inputs before the reform). The dependent variable is the log of capital employed. DownDereg is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Standard errors are clustered at the product level.

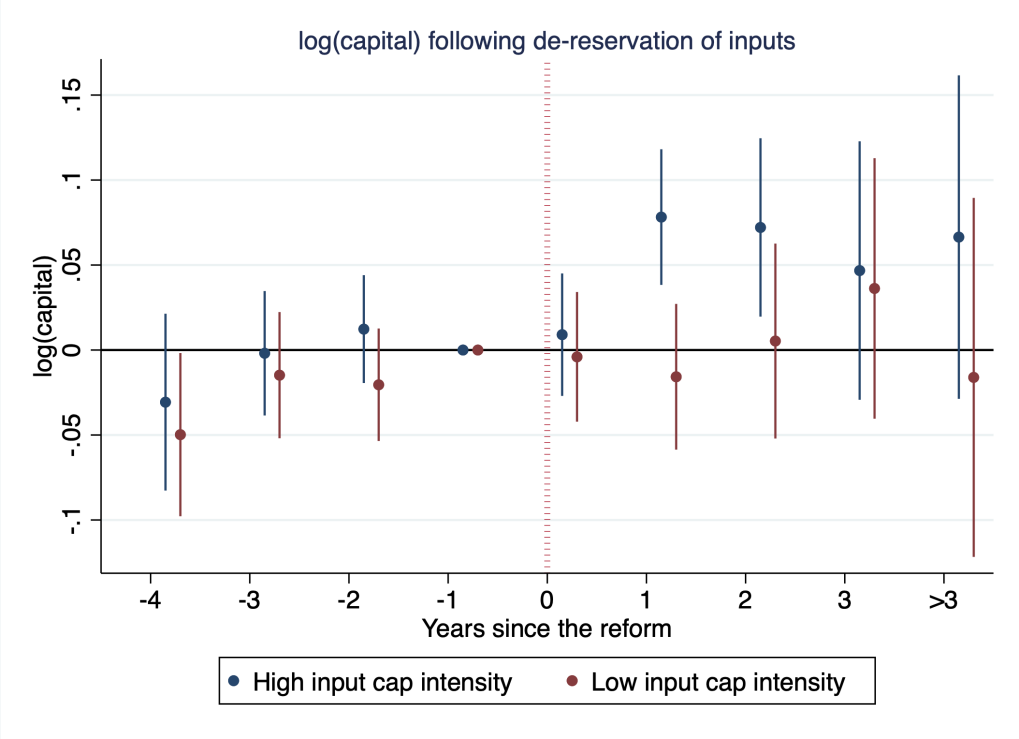


Table A1: Robustness: Price-size correlation

The table reports the input price-plant size correlation in Panel A and output price-plant size correlation in Panel B. The outcome variable is log of input price in Panel A and log of output price in Panel B. Plant size is defined based on the regulatory threshold for firms to be considered small. Large firm is a time-invariant dummy variable that takes the value 1 for firms with a balance sheet value of plant and machinery above Rs. 10 million in the first year that they appear in the data. log(fixed assets) is a continuous time-varying measure of firm size defined as the log of fixed assets of the firm. Standard errors are clustered at the product level.

Panel A. Input price-size correlation						
	Exclude threshold firms		All firms			
	(1)	(2)	(3)	(4)	(5)	(6)
	ln(Price)	ln(Price)	I(import)	I(import)	ln(Price)	ln(Price)
Large firm	0.072***		0.149***		0.337***	
	(9.477)		(25.841)		(21.116)	
log(fixed assets)		0.019***		0.034***		0.087***
		(10.018)		(23.655)		(22.986)
Input × State × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	607318	607318	913374	913374	856983	856983
R^2	0.960	0.960	0.366	0.376	0.722	0.723
Years	All	All	All	All	All	All
Sample	Clean	Clean	Full	Full	Full	Full
Panel B. Output price-size correlation						
	Exclude threshold firms		All firms			
	(1)	(2)	(3)	(4)	(5)	(6)
	ln(Price)	ln(Price)	I(export)	I(export)	ln(Price)	ln(Price)
Large firm	0.103***		0.113***		0.315***	
	(8.361)		(24.777)		(15.903)	
log(fixed assets)		0.030***		0.029***		0.084***
		(9.168)		(24.335)		(15.324)
Product × State × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	259684	259684	83607	83607	397219	397219
R^2	0.961	0.961	0.381	0.389	0.797	0.798
Years	All	All	All	All	All	All
Sample	Clean	Clean	Full	Full	Full	Full

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A2: Alternative explanations: intermediate input producers pre-reform

The table examines alternative explanations such as supplier market power and purchaser monopsony power in regulated markets that produce intermediate inputs prior to the reform. The outcome variable is the log of input price. Plant size is defined based on the regulatory threshold for firms to be considered small. Large firm is a time-invariant dummy variable that takes the value 1 for firms with a balance sheet value of plant and machinery above Rs. 10 million in the first year that they appear in the data. log(fixed assets) is a continuous time-varying measure of firm size defined as the log of fixed assets of the firm. HHI (suppliers) is the Herfindahl index for suppliers of each input and is calculated as the sum of the squares of the market shares of producers of the input. It is a measure of supplier market power. The two measures of monopsony power are 1) HHI (purchasers): a Herfindahl index for purchasers of each input (downstream firms) defined as sum of the squares of the expenditures of purchasers of the input and 2) Purchaser share: individual plant's share of total domestic expenditure on a given input. Standard errors are clustered at the product level.

	(1) ln(Price)	(2) ln(Price)	(3) ln(Price)	(4) ln(Price)
Large firm	0.075***	0.077***	0.077***	0.071***
	(4.766)	(4.580)	(5.624)	(3.992)
Large firm × HHI (suppliers)	0.045			0.039
	(1.084)			(0.905)
Large firm × HHI (purchasers)		0.077		-0.021
		(0.911)		(-0.230)
Purchaser share			0.357***	0.357***
			(4.072)	(4.031)
Input × State × Year FE	Yes	Yes	Yes	Yes
Observations	115306	115306	115306	115306
R^2	0.969	0.969	0.969	0.969
Years	Pre-reform	Pre-reform	Pre-reform	Pre-reform

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A3: Financial constraints matter

The table reports the effect of the de-regulation on investment by small downstream incumbents along with the effect of subsidized credit on not-yet deregulated downstream firms. The dependent variable is the log of capital employed. DownDereg is a dummy variable that takes the value 1 if an input used by a firm is deregulated, 0 otherwise. Post MSME Act is a dummy variable that takes the value 1 for firms newly classified as small (balance sheet size between Rs. 10million and 50million) following the MSME Act of 2006, 0 otherwise. Not-yet DownDereg is a dummy variable that takes the value 1 for downstream incumbents whose inputs have not yet been deregulated. The de-reserved intermediate inputs are divided into ex-ante below and above median import penetration to define low and high import penetration. Standard errors are clustered at the product level.

	(1) log(PPE)
DownDereg	0.037**
	(2.053)
Post MSME Act × Not yet DownDereg × Low import penetration	0.015
	(0.221)
Post MSME Act × Not yet DownDereg × High import penetration	0.101*
	(1.902)
Firm FE	Yes
Industry × Year FE	Yes
Observations	83292
R^2	0.947
Sample	Small/medium

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Downstream incumbents: financial constraints matter for small firms

The table reports the effect of the de-regulation on downstream incumbents. The dependent variable is the log of capital employed. DownDereg is a dummy variable that takes the value 1 if an input used by a firm is deregulated, 0 otherwise. Importer is a dummy variable that takes the value 1 for downstream firms that import a reserved product prior to the reform. The de-reserved intermediate inputs are divided into ex-ante below and above median import penetration to define low and high import penetration. Standard errors are clustered at the product level.

	Small/medium firms			Large firms		
	(1) log(PPE)	(2) log(PPE)	(3) log(PPE)	(4) log(PPE)	(5) log(PPE)	(6) log(PPE)
DownDereg	0.082***			0.015		
	(3.222)			(0.453)		
DownDereg × High Cash/TA	-0.086***			0.052		
	(-2.804)			(0.824)		
DownDereg × Importer		0.237***			0.041	
		(5.546)			(1.079)	
DownDereg × Importer × High Cash/TA		-0.122**			0.012	
		(-2.038)			(0.166)	
DownDereg × non-Importer		0.003			-0.081	
		(0.105)			(-1.299)	
DownDereg × non-Importer × High Cash/TA		-0.052			0.189*	
		(-1.561)			(1.937)	
DownDereg × Low import penetration			0.059			0.028
			(1.598)			(0.654)
DownDereg × High import penetration			0.104***			-0.015
			(3.390)			(-0.346)
DownDereg × Low import penetration × High Cash/TA			-0.073*			0.124
			(-1.674)			(1.618)
DownDereg × High import penetration × High Cash/TA			-0.109***			-0.059
			(-2.659)			(-0.628)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year FE × Fin con dummy FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	81824	81824	81566	18755	18755	18687
R^2	0.948	0.948	0.948	0.861	0.861	0.862

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Price-size correlation for entrants

The table reports the input price-plant size correlation in Panel A and output price-plant size correlation in Panel B. The outcome variable is log of input price in Panel A and log of output price in Panel B. Entrant is a dummy variable that takes the value 1 for firms that enter a product market and include both new entrants and existing firms that switch to producing a new product. Standard errors are clustered at the product level. Standard errors are clustered at the product level.

Panel A. Input price-size correlation		
	(1)	(2)
	ln(Price)	ln(Price)
Entrant	0.031***	0.045***
	(3.407)	(4.797)
Input × State × Year FE	Yes	No
Input × Year FE	No	Yes
Observations	386435	460800
R^2	0.963	0.948
Panel B. Output price-size correlation		
	(1)	(2)
	ln(Price)	ln(Price)
Entrant	0.030	0.047**
	(1.361)	(1.995)
Product × State × Year FE	Yes	No
Product × Year FE	No	Yes
Observations	147007	198601
R^2	0.961	0.943

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6: Downstream incumbents - heterogeneity by concentration and productivity

The table reports the effect of de-regulation on downstream incumbents by ex-ante concentration and productivity. The dependent variable is the log of capital employed. DownDereg is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Standard errors are clustered at the product level.

	Low HHI	High HHI	Low Productivity	High Productivity
	(1) log(PPE)	(2) log(PPE)	(3) log(PPE)	(4) log(PPE)
DownDereg	0.059**	0.018	0.025	0.040**
	(2.095)	(0.998)	(1.243)	(1.965)
Firm FE	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes
Observations	52522	49726	55091	43800
R^2	0.966	0.966	0.964	0.968

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A7: Imports are of high quality

The table compares the prices of imported inputs to domestic inputs. I(Imported input) is a dummy variable that takes the value 1 for imported inputs.

	(1) ln(Price)	(2) ln(Price)
I(Imported input)	0.235***	0.151***
	(14.564)	(14.665)
Input × Firm × Year FE	No	Yes
Input × State × Year FE	Yes	No
Observations	624880	64554
R^2	0.962	0.992

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A8: Input price heterogeneity

The table reports the effect of deregulation on input prices for small and large firms. The dependent variable is the log of input prices. DownDereg is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. Large is a time-invariant size dummy that takes the value 1 for firms above the regulatory threshold i.e., with fixed assets above a threshold of Rs. 50 million and 0 otherwise. It is defined based on the first time the firm appears in the sample. Standard errors are clustered at the input level.

	Small/medium firms		Large firms	
	(1) ln(Price)	(2) ln(Price)	(3) ln(Price)	(4) ln(Price)
DownDereg	-0.059*	-0.178**	0.010	-0.030
	(-1.739)	(-2.042)	(0.150)	(-0.347)
Input × Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	150186	11811	33262	11087
R^2	0.979	0.971	0.978	0.974
Sample	All	Ex-ante importers	All	Ex-ante importers

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A9: Characteristics of downstream entrants

The table reports the effect of de-regulation on observable characteristics of downstream entrants. The dependent variable in panel A is the log of initial value of plant and machinery. The dependent variable in panel B is log of output. DownDereg is a dummy variable that goes from 0 to 1 for downstream products (defined as per an ex-ante input-output table) following de-reservation of at least one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Standard errors are clustered at the product level.

Panel A. Ex-ante measure				
	(1)	(2)	(3)	(4)
	log(startup assets)	log(startup assets)	log(startup assets)	log(startup assets)
DownDereg	-0.028		-0.061	
	(-0.796)		(-1.216)	
DownDereg × Low input cap intensity		-0.012		0.009
		(-0.263)		(0.117)
DownDereg × High input cap intensity		-0.038		-0.096*
		(-0.843)		(-1.853)
District FE	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes
Industry × Year FE	No	No	Yes	Yes
Year FE	Yes	Yes	No	No
Observations	333115	333115	333115	333115
R^2	0.557	0.557	0.560	0.560
Panel B. Ex-post measure				
	(1)	(2)	(3)	(4)
	log(output)	log(output)	log(output)	log(output)
DownDereg	0.006		0.014	
	(0.210)		(0.366)	
DownDereg × Low input cap intensity		0.007		0.064
		(0.162)		(1.206)
DownDereg × High input cap intensity		0.005		-0.022
		(0.138)		(-0.498)
District × Firm age FE	Yes	Yes	Yes	Yes
Product × Firm age FE	Yes	Yes	Yes	Yes
Industry × Year of entry × Firm age FE	No	No	Yes	Yes
Year of entry × Firm age FE	Yes	Yes	No	No
Observations	488841	488841	488838	488838
R^2	0.498	0.498	0.500	0.500

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A10: Timing of deregulation of products: deregulated market

The table reports the results of a Weibull proportional hazards model. There is one observation for each product in each year. The predictive variables include deregulated product market characteristics such as employment growth rate in the product market, imports and length of the quality ladder. Log(1+imports) is the rupee value of imports of a given product in a given year. Quality ladder is the length of the quality ladder of the intermediate input. Standard errors are clustered at the product level.

	Duration since committee in 1995
	(1)
Fixed assets growth	-0.002
	(-0.551)
Employment growth	0.015
	(1.239)
Profit growth	-0.002
	(-0.616)
log(Fixed assets)	0.068
	(1.271)
log(Employment)	-0.059
	(-0.879)
log(Profit)	-0.069
	(-1.440)
log(1+Imports)	0.004
	(0.646)
Quality Ladder	0.052
	(0.768)
Observations	2149

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 8: Post-reform dynamics of downstream incumbents

The figure reports the effect of the dynamics of the de-regulation on downstream incumbents (those using de-regulated inputs before the reform) using a stacked difference-in-differences specification. The empirical specification employs never-treated firms as the control group. The dependent variable is the log of capital employed. DownDereg is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Standard errors are clustered at the product level.

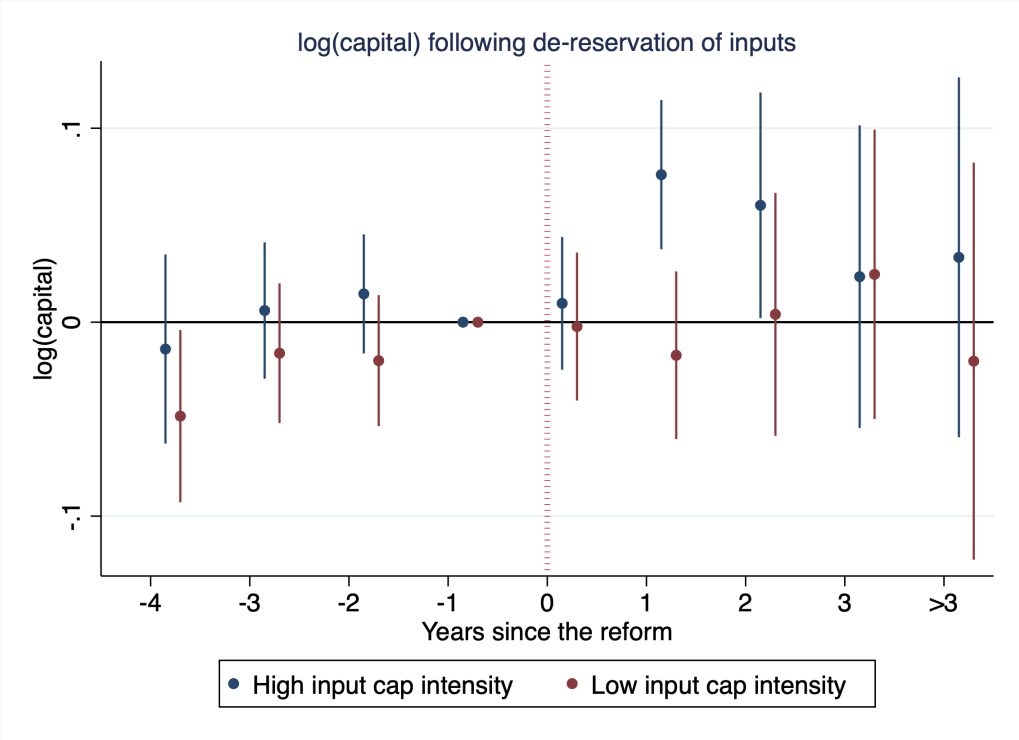


Figure 9: Import substitution

The figure reports the effect of de-regulation on the probability of importing using a stacked difference-in-differences specification. The empirical specification employs never-treated as the control group. The sample consists of ex-ante importers i.e., inputs that were imported by firms prior to de-regulation. The dependent variable is the ratio of imports to total inputs used. DownDereg is a dummy variable that goes from 0 to 1 for downstream firms following de-reservation of one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Standard errors are clustered at the product level.

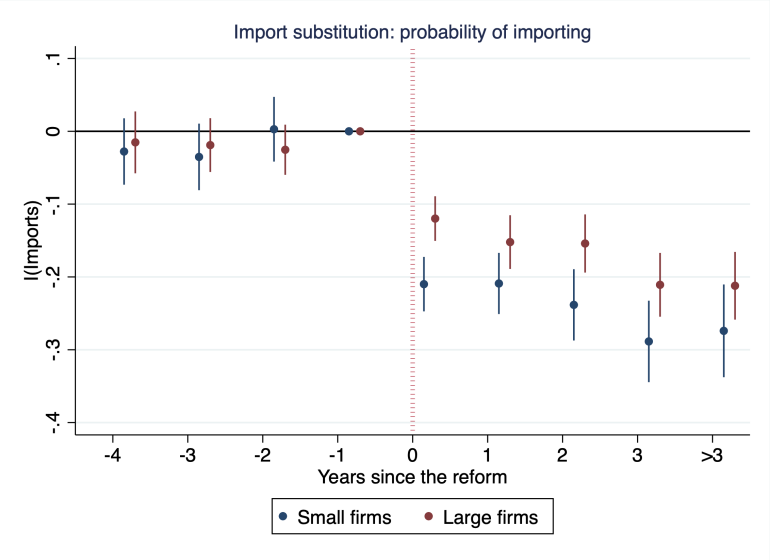
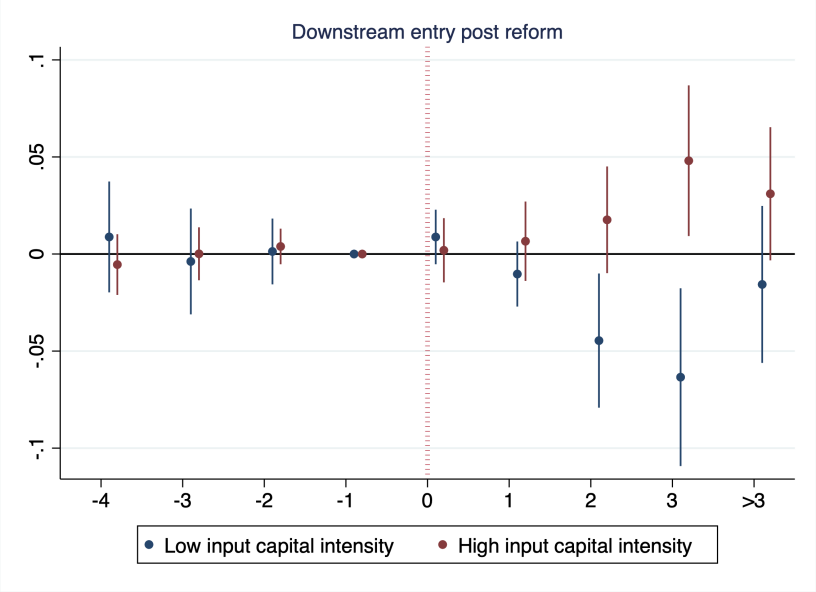


Figure 10: Downstream entry dynamics

The figure presents the effect of the de-regulation on downstream entry using a stacked difference-in-differences specification. The control group comprises of never-treated observations. The dependent variable in Panel A is log (1+ number of new establishments). Panel B reports results for a poisson specification employing number of new establishments as the dependent variable. DownDereg is a dummy variable that goes from 0 to 1 for downstream products (defined as per an ex-ante input-output table) following de-reservation of at least one of their inputs. De-regulated products are classified as low or high capital intensive based on below and above median measures of capital employed relative to total value added for industries in the US in 1995, as per the NBER-CES manufacturing industry survey. Number of entrants is defined using percentage by value of product produced and may take fractional values. In addition to Product × Cohort FE and District × Cohort FE, the specification employs Industry × Cohort × Year FE. Standard errors are clustered at the product level.

(a) Panel A. log(1+ numer of entrants)



(b) Panel B. Poisson: Number of new entrants

