

# The impact of input-trade liberalization on firms’ borrowings \*

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## Abstract

Trade liberalization creates incentives for firms to upgrade domestic and foreign technology, embodied in imported intermediate and capital goods, which play a central role in the economic growth of developing countries. Firms require access to financial resources to pay the fixed cost of technology upgrading and sourcing foreign inputs from abroad. This paper investigates the micro-economic effects of input-trade liberalization on firms’ demand of external finance. Relying on firm-level data during India’s trade liberalization episode in the early 1990s, we present novel evidence on the relationship between exogenous changes in input tariffs across industries over time and within-firm changes in borrowings. We demonstrate that firms sourcing inputs from abroad and producing in industries that have experienced greater input tariff reductions experienced a higher increase in borrowings. This empirical finding is robust to alternative specifications that control for other reforms, and industry and firm characteristics.

*Keywords:* Input-trade liberalization, firms’ borrowings, technology upgrading, firm-level data.

*JEL classification:* F10, F12, F41.

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\*Very preliminary, please do not quote.

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# 1 Introduction

A large number of developing countries went through major phases of trade liberalisation during the 1990s and early 2000s. A vast literature has documented positive effects of trade liberalization, through both foreign competition and access to imported inputs, on within-firm productivity (Pavcnik, 2002, Amiti and Konings, 2007, Topalova and Khandelwal, 2011, Brandt et al., 2017, Bas and Paunov, 2021a). Other works provide evidence on the effects of input-trade liberalization on firms' product innovation (Goldberg et al., 2010), foreign technology adoption (Bas and Berthou, 2017) and quality upgrading (Fan et al., 2015, Bas and Strauss-Kahn, 2015, Bas and Paunov, 2021b). These works show that access to foreign inputs allows firms to invest in productivity enhancing investments.

Sourcing intermediate and capital goods from abroad as well as upgrading technology and quality involves fixed costs that firms have to finance. Thereby, we expect that trade reform induce firms to increase their borrowings to finance productivity-enhancing technological investments. The aim of this paper is to investigate the impact of input-trade liberalization on firms' borrowings in India. Sourcing inputs from abroad involve a fixed cost of importing (Kasahara and Lapham, 2013a, Amiti and Davis, 2011). This fixed cost is related to the expenditures to find foreign suppliers and find and hire workers with specific expertise and connections with the sourcing markets. Moreover, having access to foreign inputs allowed firms to innovate and upgrade the quality of their final goods. Technology and quality upgrading also involve a fixed investment cost (Sutton, 1998, Sutton, 2007 Kugler and Verhoogen, 2012). As a consequence, firms need to finance both the fixed cost of importing and the fixed cost of technology/quality upgrading by external finance. Another reason borrowings might increase is due to the productivity gains arising from access to foreign inputs. These gains create incentive for firms to invest in new R&D projects that need external financing.

In order to empirically examine this relationship, we rely on Indian firm-level data from the period 1989-1997. India is an interesting case of study since the country underwent a unilateral trade reform at the beginning of the 1990's, as a part of the "Eighth five-year plan", and it provides us with a natural experiment which we use in our empirical analysis. We use the Indian firm-level data from the Centre for Monitoring the Indian Economy (CMIE). This database provides balance sheet information and distinguishes the imports of three types of goods: raw materials, intermediate goods (which we call input throughout the paper) and capital goods. Our empirical strategy

to identify the causal effect of input-trade liberalization on within firms' borrowings, relies on the exogenous variation in input tariffs across 3-digit industries over time driven by the unilateral trade reform that happened in India at the beginning of the 1990's, as a part of the "Eighth five-year plan". We first provide evidence that our tariff measures are not correlated with initial industry and firm level characteristics. This evidence suggest that tariffs are exogenous to firm performance. Our identification strategy regresses firms' borrowings on input tariffs including firm and year fixed effects. Thereby, we compare within-firm borrowings evolution of firms producing in industries with higher input tariff cuts relative to firms producing in industries with lower input tariff reductions during the period of trade reform.

Our findings show that firms producing in industries witnessing larger input tariff cuts borrow more. On average, a 10 percentage points decrease in input tariffs is associated with almost 1.6 percent increase in the borrowings of firms that source inputs from abroad. Our results are robust and stable to several alternative explanations. First, we control for foreign demand shocks by including an average of the tariffs India face when exporting to its top trading partners. Second, we control for other reforms that took place in India during the period by adding region-year fixed effects. Finally, we exclude foreign owned firms and state owned firms in order to make sure they are not driving our results.

Then, we go one step further and disentangle between the impact of input tariff and capital goods tariff reduction on firms' borrowings. We find that both tariff reductions matter. Our results suggest that a 10 percentage points reduction in capital goods tariffs is associated with 0.1 percent increase in importers of capital goods' borrowings. Finally, we provide evidence that Indian firms' have upgraded their technology thanks to input-trade liberalization. We show that both input and capital goods tariffs cuts induce importing firms to increase their probability of investing in R&D, R&D intensity (measured by the share of R&D investments) as well as the probability of importing capital goods from abroad.

This paper contributes to three strands of literature. First, it is related to the literature on trade liberalization and firm performance in developing countries. Several theoretical studies emphasize the gains from access to imported inputs (Kasahara and Lapham, 2013b; Bøler et al., 2015; Kasahara and Lapham, 2013a; Fan et al., 2015). The empirical literature backs up these theoretical predictions. Several studies has focused on India's trade liberalization episode in the early 1990s and found positive effects of input-trade liberalization on different measures of

firm performance. Topalova and Khandelwal (2011) showed that input-trade liberalization has a larger impact on firm productivity with an increase of 4.8% compared to 0.32% for output tariffs. Moreover, Goldberg et al. (2010) find that 31% of the new products introduced by Indian domestic firms are due to input tariff reduction. De Loecker et al. (2016) find lower output prices as a result from pro-competitive effects and lower marginal costs from input tariffs cuts. They also showed that there is an incomplete pass-through due to higher markups. In addition, Bas and Berthou (2017) prove that input trade liberalization increases the probability of adopting foreign technology measured by imports of capital goods.<sup>1</sup>

Second, our paper is also related to the literature on technology, financial development and growth. At the country level, Aghion et al. (2005) develop a Schumpeterian growth model that shows that countries above a certain level of financial development converge to the world technology frontier. By taking into account the financial constraints every country face, they explain why technology transfers are not enough for convergence. Empirically, they find that the financial development resulting from banks reform in India increased firms' growth in terms of value added and capital used, especially for larger and more productive firms. Several other studies find positive impacts of financial markets development on technology dependence and growth at the industry level (Maskus et al., 2012) and at the firm level (Fafchamps and Schündeln, 2013; Léon, 2020; Bond et al., 2003).

Third, our paper adds to the literature on international trade and financial constraints of heterogeneous firms. Chaney (2005) proposes a theoretical model including heterogeneous firms and liquidity constraints. He argues that the selection into the export market is based on how constrained is the firm in terms of liquidity. Peters and Schnitzer (2015) develop a model that shows that firms need external finance to pay the fixed cost of the advanced technology and can not fund it internally. In a two-country model with different levels of financial market development setting, they show that trade liberalization increases technology adoption for firms in both countries. However, this effect is larger for firms in the more financially developed country. Similarly, Manova (2013) shows that, in presence of credit constraints, firms in vulnerable sectors are more likely to export if they are in a financially developed country. Several empirical studies provide evidence that the financial health of the firm is crucial for exporting (Berman and Héricourt,

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<sup>1</sup>Several studies for other developing countries showed that input-trade liberalization is associated with positive effects on firm' productivity, wages, markups, product scope, input and output quality, exporting status (Amiti and Konings, 2007; Amiti and Davis, 2011; Bas and Paunov, 2021a,b). Other studies focus solely on the foreign competition channel and find positive effects of trade reform on within-firm productivity (Pavcnik (2002)).

2010; Greenaway et al., 2007; Manova, 2008, 2013) and importing (Bas and Berthou, 2012). Our paper contributes to the literature on heterogeneous firms, trade and access to finance. To our knowledge, we are the first to provide causal evidence on the impact of trade liberalization on firms' borrowings, disentangling the effects of both output and input tariff cuts.

This paper is organized as follows. Section II presents a review of the theoretical literature that motivates our empirical analysis. Section III describes the firm-level data and the tariff data. Section IV presents the historical context of India's trade liberalisation and some stylized facts. Section V describes our identification strategy. Section VI presents baseline results and several robustness tests. Section VII describes the channels through which input trade liberalisation may affect firms' borrowings. Last, Section VIII concludes.

## 2 Theoretical Motivation

This section describes the main theoretical mechanisms that rationalize the relationship between trade liberalization, firm's technology investments and its financial health.

Trade liberalization creates incentives for firms to upgrade their technology or the quality of their goods through different mechanisms. The main theoretical channel that motivates our empirical analysis is a supply mechanism related to the access to foreign inputs thanks to the reduction of trade variable costs on intermediate goods that allows firms to upgrade their technology or quality paying a fixed cost. Kasahara and Lapham (2013b) develops a heterogeneous firms model allowing firms to import intermediate inputs incurring a variable cost (input tariffs) and a fixed cost. Trade liberalization through reductions of input tariffs allows firms to reduce their marginal costs and have more revenues to pay the fixed cost of importing. Bøler et al. (2015) proves complementarity between R&D and imported inputs implying that input-trade liberalization is likely to directly increase imports and indirectly increase technology upgrading. Similarly, Bas and Berthou (2017) develop a heterogeneous firms' model with endogenous technology choice and imported inputs that predicts that input-trade liberalization encourages firms' foreign technology adoption embodied in imported capital goods. Other related models focused on endogenous quality and show that access to high quality inputs leads to the production of high quality outputs (Hallak and Sivadasan, 2013; Kugler and Verhoogen, 2012; Fan et al., 2015).

Another channel through which trade liberalization allows firms to invest in technology/quality

is related to expansion of export opportunities (foreign demand channel). Reductions of trade variable costs faced by exporters in their destination markets increase export revenues allowing firms to have internal funds to pay the fixed costs of technology/quality upgrading. Yeaple (2005) develops a trade model of heterogeneous skills and endogenous technology choice. This model predicts that a reduction in variable trade costs provides more incentive for firms to pay the fixed costs of technology upgrading and hire more skilled workers. Kugler and Verhoogen (2012) introduce a model of heterogeneous firms and endogenous quality. One of the variants of their model shows that firms have to bear a fixed cost of quality upgrading. Higher revenues from trade liberalization allows more firms to pay this fixed cost. Lileeva and Trefler (2010) extend Melitz (2003) by adding heterogeneity in productivity investment along with initial productivity. They show that an increase in exports will encourage firms to innovate. Bustos (2011) develops a heterogeneous firms model where firms have to pay a fixed cost for technology adoption to increase their productivity. She proves that trade liberalization, by increasing exporters' revenues, allows more firms to innovate. Bas and Ledezma (2015) introduce an additional stage of technology-investment to Melitz (2003) model proving that liberalization increases export profits and technology investment.

All these models assume that firms will finance the fixed costs of importing and of technology/quality upgrading relying on internal financial resources such as domestic or export revenues. They do not examine the role of the capacity of firms to get access to external financial resources in order to bear those fixed costs. Chaney (2005) proposes a theoretical model including heterogeneous firms and liquidity constraints. This model predicts that the selection into the export market is based on how constrained is the firm in terms of liquidity to finance the fixed export cost. Manova (2013) digs deeper proving that, in presence of credit constraints, firms in vulnerable sectors are more likely to export if they are in a financially developed country. Another strand of theoretical literature related to this study is the one on financial development, growth and trade. Aghion et al. (2005) develop a Schumpeterian growth model and proves that countries above a certain level of financial development converge to the world technology frontier. By taking into account the financial constraints every country face, they explain why technology transfers are not enough for convergence. The model that motivates our empirical research is the work of Peters and Schnitzer (2015) who introduce a new channel through which trade liberalization effects can cause divergence between countries, which is credit constraints. They build a heterogeneous firms' model with endogenous markups à la Melitz and Ottaviano (2008), add technology adoption to

the framework and allow firms to be financially constrained. In their model, firms need external finance to pay the fixed cost of the advanced technology. In a two country with different levels of financial market development setting, they show that trade liberalization increases technology adoption for firms in both countries. However, this effect is larger for firms in the more financially developed country, widening the gap.

In the next sections, we test for the particular supply channel through which input-trade liberalization generates incentives for firms to upgrade domestic and foreign technology for which they require to increase their borrowings in order to pay the fixed costs associated to the technology investments. Trade liberalization can also impact firms' decision to demand external finance through a demand channel based on expansion of export opportunities. We control for this alternative explanation.

## 3 Data

### 3.1 Firm-level data

The Indian firm-level dataset is compiled from the Prowess database by the Centre for Monitoring the Indian Economy (CMIE).<sup>2</sup> This database contains information from the income statements and balance sheets of listed companies comprising more than 70 percent of the economic activity in the organized industrial sector of India. Collectively, the companies covered in Prowess account for 75 percent of all corporate taxes collected by the government of India. The database is thus representative of large and medium-sized Indian firms. This dataset was already used in several studies on the performance of Indian firms.<sup>3</sup>

The dataset covers the period 1989–1997, and the information varies by year. It provides quantitative information on sales, capital stock, income from financial and non-financial sources, consumption of raw material and energy, compensation to employees (wage-bill), ownership group, location of industrial plants factories and incorporation year. The prowess dataset contains information on firms' borrowings, which we use as our main dependent variable. Moreover, it provides detailed information on imports by category of goods: finished goods, intermediate goods and capital goods. It allows us to identify importers of inputs and importers of capital goods In our

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<sup>2</sup>The CMIE is an independent economic center of India. For more information see: <https://www.cmie.com/>.

<sup>3</sup>See, for example, Topalova (2004), Topalova and Khandelwal (2011), Goldberg et al. (2009), Goldberg et al. (2010), Alfaro and Chari (2009), Bas and Berthou (2012), Bas and Berthou (2017).

main empirical specification and mechanisms.

We restrict the analysis to the manufacturing sector. The final sample contains information on 3744 firms in organized industrial activities from manufacturing sector for the period 1990 - 1997. Since our main independent variables and controls are lagged, our estimation sample starts in 1989 with 14,680 observations firm year pairs. Tables A1 and A2 in the appendix represent descriptive evidence of the main variables used in the econometric analysis from the firm level dataset and the number of firms in all the period, in the first and the last year in the sample respectively.

## 3.2 Tariff data

To identify the impact of trade liberalization on firms' borrowings, we use input tariffs at the three digit NIC industry level. Data on tariffs comes from WITS database (World Bank) and corresponds to India's effectively applied most favorite nation (MFN) import tariffs with respect to the Rest of The World at the industry level ISIC (rev 2).<sup>4</sup> In order to empirically study the impact of input trade liberalization on firms' borrowings, we construct many tariff measures disentangling the impact of capital goods liberalization and variable intermediate goods liberalization.

In our main empirical specification, we generate an input tariff measure (capital goods and variable intermediate inputs) at the three digit industry level,  $s$ , as a weighted average of tariffs on inputs used in the production of final goods of that three digit industry, where the weight is the share of the input industry in the final good industry's total expenditure on other inputs using India's input-output matrix in 1993. Due to the possible endogeneity issues between the variation in input weights and the firm performance, We use a fixed input weights in pre-sample year. In order to disentangle the impact of variable intermediate goods and capital goods, we build a similar tariff measure for each good type separately. For each three digit industry level,  $s$ , we construct a weighted average of tariffs on variable intermediate goods (capital goods) used in the production of final goods of that three digit industry, where the weight is the share of the variable intermediate good (capital good) industry in the final good industry's total expenditure on other variable intermediate goods (capital goods) using India's input-output matrix in 1993.

We construct each tariff measure as  $\tau_{st} = \sum_z \alpha_{zs} \tau_{zt}$ , where  $\alpha_{zs}$  is the value share of inputs (variable intermediate input, capital goods and both of them according to the definition of the tariff

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<sup>4</sup>We use correspondence tables to convert tariffs into ISIC rev 3.1. that matches almost perfectly with NIC three-digit classification.



$\tau_{st}$ ). Using a disaggregated input-output matrix, 14 from a total of 52 industries are classified as capital goods. <sup>5</sup>Finally, in order to control for the import competition channel, we include output tariffs at the three digit industry level,  $s$ , of each final good.

### 3.3 The exogeneity of the tariff variations

A common challenge for empirical studies using tariffs as a measure to capture trade protection is to prove the exogeneity of the variation in tariffs. First, possible reverse causality between firms' borrowings and tariffs variations at the industry level is likely to exist, which could lead to biased estimates. Karacaovali (2011) proves, theoretically and empirically, that productivity affects tariffs at the four-digit ISIC industry level. It is possible that industries who have certain characteristics lobby for more protection.

Accordingly, we follow Topalova and Khandelwal (2011) and regress changes in input tariffs between 1990 and 1997 on industry borrowings and several politically important characteristics such as industry size proxied by sales, wages, capital stock and imports of capital goods and inputs in the initial year 1990. The results, reported in Table A3 in the appendix, show that there is no significant correlation between input tariff variations and industry characteristics in 1990, which means that firms producing in certain industries were not able to lobby for more protection.

Second, it is possible that certain firms (the largest ones for example) influence the trade policy making process. The literature on the political economy of trade policies have highlighted the role of industries in lobbying since the work of Grossman and Helpman (1994). More recently, Bombardini (2008) explored the point of view of the firm. She proved, theoretically and empirically, that the size distribution of the firm matters for the lobbying process.

Following Goldberg et al. (2010), we regress firm characteristics in 1990, such as borrowings, importer status, imports of capital goods, capital intensity and total factor productivity, on the variation in input tariffs at the three-digit NIC industry level between 1990 and 1997. The results, reported in Table A4, show that there is no significant correlation between input tariff variations and firm characteristics in the initial year. The evidence in Tables A3 and A4 show that the Indian government was not influenced by pre-reform performance of certain industries or firms

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<sup>5</sup>Capital goods industries are tractors and agriculture machinery, industrial machinery, industrial machinery (others), office computing machines, other non-electrical machinery, electrical industrial machinery, communication equipment, other electrical machinery, electronic equipment, ships and boats, rail equipment, motor vehicles, motorcycles, and other transport equipment.

during the process of reducing tariffs in the early 1990s.

## 4 A first glance at the data

### 4.1 Trade liberalization in India

India's post-independence development strategy was inward-looking and highly dependent on government intervention. Its import substitution based trade policies consisted of high tariffs and non-tariff barriers such as industrial and import licensing. During the second half of the 1980's, India shifted its policies from import protection to export-led growth, beginning a process of gradual trade liberalization. However, its trade regime remained restrictive (Cerra and Saxena, 2002). This process was parallel to a widening in India's current accounts deficit.

After a balance of payments crisis <sup>6</sup>, India undertook major structural reforms as a part of the IMF assistance program in 1991. Trade reforms consisted of industrial and import delicensing and greater trade liberalization. Trade liberalization was among the reforms that took place in the "Eight five-year plan" between 1992 and 1997. Under this plan, gradual tariff cuts were applied in all sectors at the same time that non-tariff barriers and licenses were removed.

The main feature of India's trade liberalization phase was that tariff cuts were not targeted towards specific industries and were not the result of lobbying. Topalova and Khandelwal (2011) provide evidence that output and input tariffs were not correlated with firm and industry pre-reform characteristics. However, in the "Ninth five-year plan", they prove that the tariff reduction was not uniform, indicating possible political influence resulting in potential endogeneity of trade protection. Accordingly, we restrict our analysis to the 1989-1997 period.

During this period, India also becomes a member of the WTO (World Trade Organization) in 1995. One of the commitments of India when it decides to join WTO is to continue the process of trade liberalization started in the early 1990s. From 1995, India starts implementing Uruguay Round commitments that were completed in 2005 (see India's Trade Policy Review by WTO in 2007). According to Bas and Strauss-Kahn (2014), average input tariffs have decreased by 27 percentage points during the period while capital goods tariffs only slightly decreased by ten

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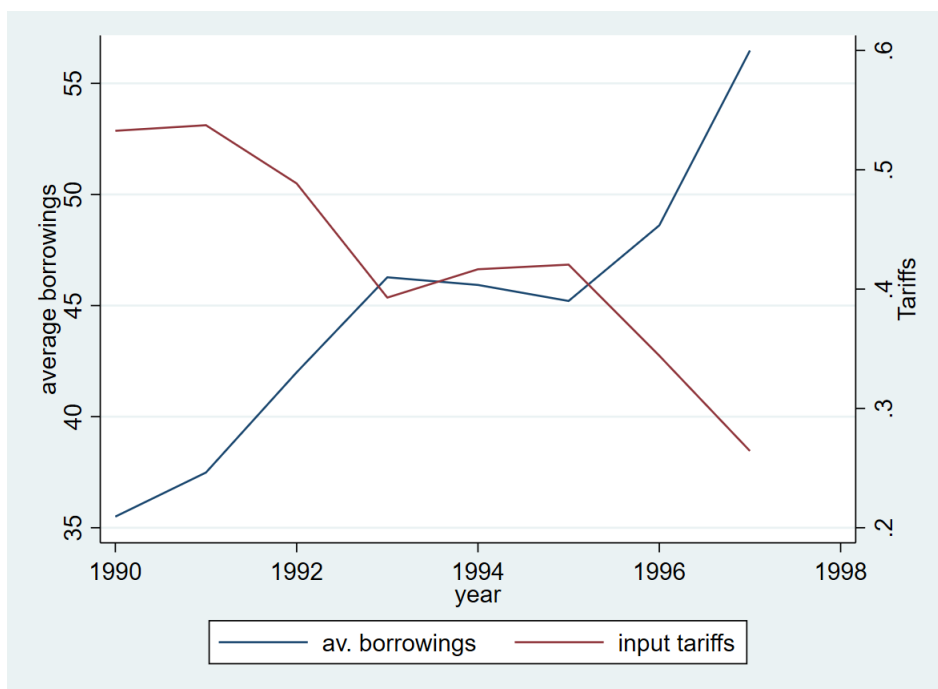
<sup>6</sup>India's crisis is the culmination of several events: the Middle East crisis which raised the world prices of oil and reduced remittances from Indian workers living in the Gulf countries, slow growth of major trading partners and political uncertainty that reached its peak with the assassination of Rajiv Gandhi in 1991, resulting in loss of investor confidence and capital outflows (Cerra and Saxena, 2002).

percentage points. They highlight that this descriptive evidence proves that changes in variable inputs and capital goods tariffs were heterogeneous and weakly correlated. There is also significant variation in movements in input tariffs by industry over the 1989–1997 period.

## 4.2 Stylized facts

Before empirically investigating how input trade liberalization affects firms’ borrowings, we motivate our question with some descriptive evidence. Figure 1 presents average borrowings and input tariffs over the period 1990-1997. There is an increasing trend of borrowings over the years as input tariffs decrease.

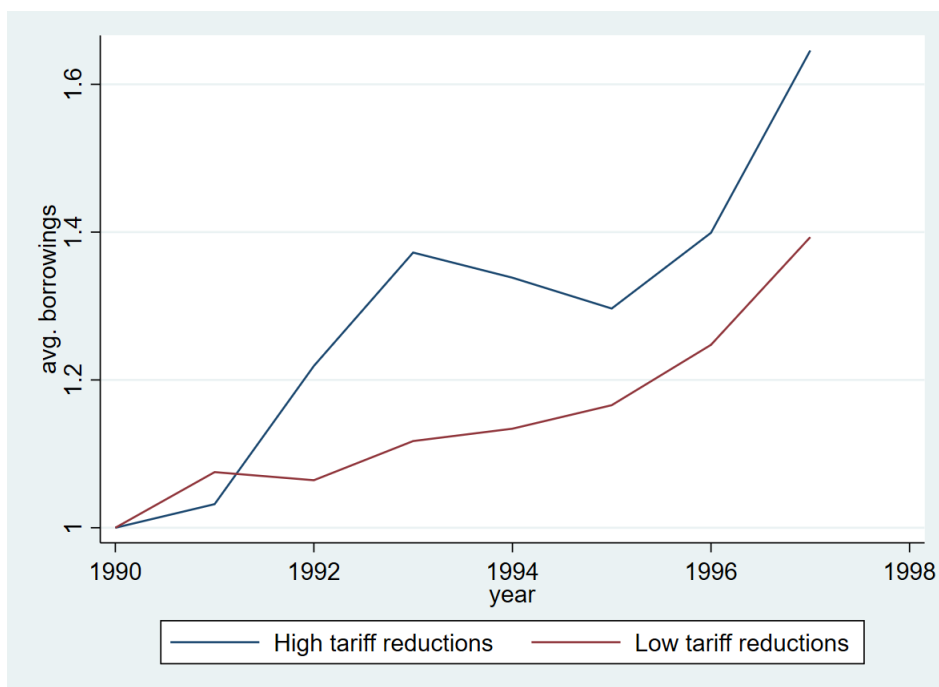
Figure 1: Average borrowings and input tariffs per year



*Notes:* Inputs are defined as variable intermediate goods, excluding capital goods. Source: Authors’ calculation based on the prowest dataset and the WITS tariff data.

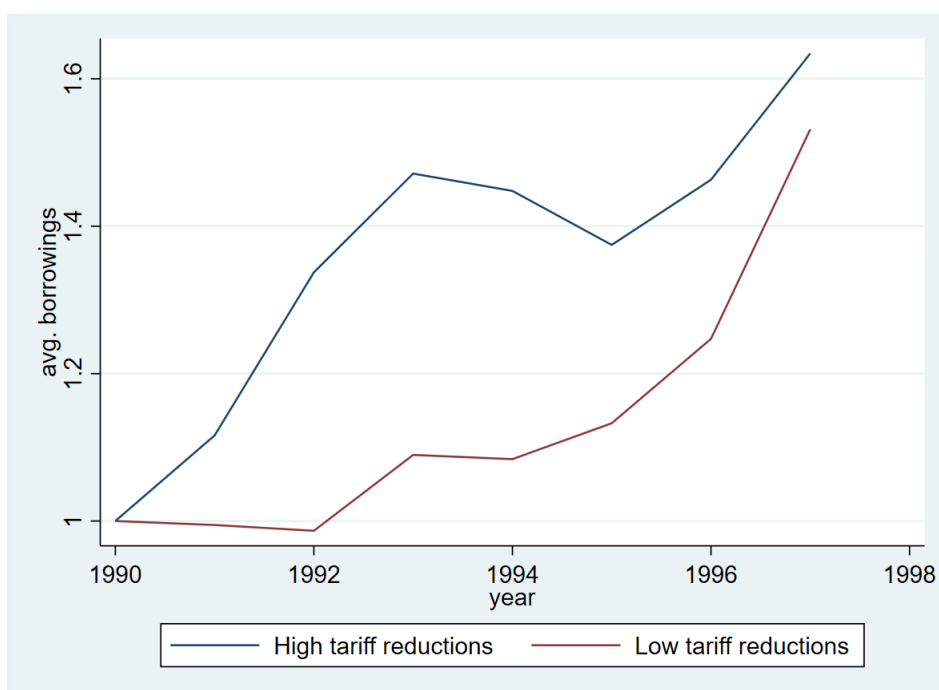
Figures 2 and 3 present average borrowings per year over the period 1990-1997 by the level of reduction in input and output tariffs respectively. The threshold determining low and high input (output) tariff reductions is the median of the input (output) tariff change, calculated as the difference between input (output) tariffs in 1997 and 1989. These figures show that firms in industries where there is high tariff reduction borrow more than firms in industries where there is low tariff reduction.

Figure 2: Average borrowings per year by variation in input tariffs



Notes: Inputs are defined as variable intermediate goods, excluding capital goods. Source: Authors' calculation based on the prowest dataset and the WITS tariff data.

Figure 3: Average borrowings per year by variation in Output tariffs

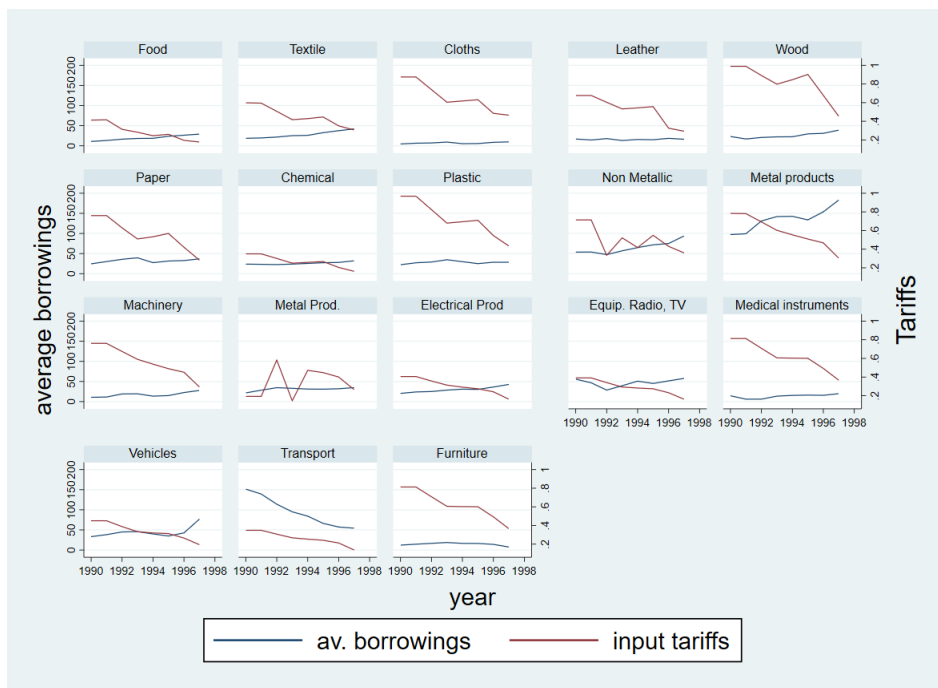


Source: Authors' calculation based on the prowest dataset and the WITS tariff data.

Figure 4 presents average borrowings and input tariffs per year over the period 1990-1997, by

two-digit industry. It shows the same inverse relationship depicted by Figure 1 by industry. In other words, within each two-digit industry, the highest borrowings happen when there is more input liberalization.

Figure 4: Average borrowings and input tariffs per year by industry



*Notes:* Inputs are defined as variable intermediate goods, excluding capital goods. Source: Authors' calculation based on the prowest dataset and the WITS tariff data.

In sum, a first glance at the data highlights three main facts over the period of our sample. First, there is an inverse relationship between input tariffs and borrowings. Second, this relationship exists within each two-digit industry. Third, firms in industries characterized by higher input and output tariff reduction tend to borrow more.

## 5 Identification strategy

We investigate the impact of input-trade liberalization on firms' borrowings, by exploiting exogenous tariff changes across industries over time during the the first wave of trade liberalization that took place in India in the early 90s. Our identification strategy compares the evolution of within-firm borrowings over time of firms producing in industries that faced largest input tariff cuts relative to firms producing in industries with lowest input tariff changes during the period. We estimate the following equation:

$$\ln B_{ist} = \beta_1 \tau_{I,s,t-1} + \beta_2 \tau_{I,s,t-1} \times \text{Importer}_{is,t-1} + \beta_3 \text{Importer}_{is,t-1} + \beta_4 Z_{s,t-1} + \beta_5 X_{i,t-1} + \gamma_i + \delta_t + \epsilon_{ist} \quad (1)$$

where  $\ln B_{ist}$  is the logarithm of total borrowings of firm  $i$ , producing in 3-digit NIC industry  $s$  in year  $t$ .  $\tau_{I,s,t-1}$  is the input tariffs of industry  $s$  in year  $t - 1$ , calculated as explained in section III. In order to deal with possible endogeneity problems of tariffs changes, we showed in section III that they are not correlated with either initial firm characteristics nor industry characteristics during the period 1989-1990. Additionally, we use lagged tariffs values since firm decisions in  $t$  cannot affect changes in tariff in  $t - 1$ .  $\tau_{I,s,t-1} \times \text{Importer}_{is,t-1}$  is an interaction term between input tariffs and a dummy variable indicating whether firm  $i$  producing in 3-digit NIC industry  $s$  is an importer of inputs in year  $t - 1$ .

We control for other observable changes across 3-digit industries over time that might be correlated with the input tariffs cuts.  $Z_{s,t-1}$  is a vector of industry level control variables. First, we include in all estimations the tariff on final goods. The output tariffs control for the foreign competition channel through which trade liberalization affect firm productivity and technology adoption highlighted in the literature. If foreign competition induce firms to upgrade technology to improve productivity gains to stay in the market, we should also observe that output tariff cuts affect firms' borrowings to finance productivity enhancing technological projects. Second, we also control for domestic competition by including the Herfindhal index in 3-digit industry  $s$  in year  $t - 1$ . Our estimations also take into account differences across firms that change over time.  $X_{it-1}$  is a set of firm level control variables varying over time. The Prowess data includes the year of the creation of the firm, which allows us to calculate the age of the firm and control for the logarithm of firm age. We also control for the logarithm of firm' capital intensity measured by the ratio of capital stock of the firm over the wage-bill. We expect that firms that are more capital intensive invest more in technology upgrading and thereby, have a larger demand for external finance. Finally, all our estimations include firm-fixed effects ( $\gamma_i$ ) in order to control for unobserved firm characteristics that do not vary over time. These firm fixed effects allow us to capture the causal effects of exogenous input tariff cuts on within-firm external finance over time. Moreover, we include year-fixed effects ( $\delta_t$ ) in order to control macroeconomic shocks that could affect all firms. Additionally, in some specifications we add industry-year fixed effect along with the firm fixed effects in order to control for all other industry reforms that happened at the same time as the trade liberalization and unobservable time varying shocks across industries

that might be correlated with input tariff changes. The error term is clustered at the 3-digit NIC industry-year level because tariffs vary by industry year.

We expect  $\beta_2$  to be negative and significant. Lower input tariffs can increase firms' borrowings in order to finance the fixed cost of sourcing inputs from abroad or to finance new investment projects due to productivity increases. We expect that those effects are driven by firms that import inputs. We expect  $\beta_3$  to be positive and significant, indicating that importing inputs increase firms' borrowings. In this setting,  $\beta_1$  captures the effect of input tariff cuts on firms that do not source inputs from abroad. Thereby, if  $\beta_1$  is negative and significant, it means that there are some indirect effects of imported inputs spilling from importers to non-importers. It could be some productivity spillovers motivating non-importers to engage in new projects for which they need more funding. Moreover, lower input tariffs can push non-importers that produce the domestic inputs to be more productive to face the foreign competition which can require more borrowings for new projects.

## 6 Input trade liberalization and firms' borrowings

### 6.1 Baseline results

In this section, we present the results of estimating equation (1). The estimations reported in Table 1 are for an unbalanced panel from the period of trade liberalization in India from 1990 till 1997. Column (1) shows the effect of trade liberalization through output tariffs cuts on within-firm borrowings. The coefficient is negative and significant at the 1% confidence level. This result shows that foreign competition increases firms' demand of external finance, which could be explained through the productivity channel. Foreign competition leads to within-firm productivity increases (Pavcnik, 2002; Amiti and Konings, 2007; Bas and Paunov, 2021a) creating incentives for firms to invest in new technological projects and spend more on R&D for which they need external financing.

Next, we disentangle the different channels through which trade liberalization affects firms' external finance between output tariffs (foreign competition) and input tariffs (access to imported inputs). We add input tariffs, imports of inputs status dummy and our main variable of interest, an interaction term between both in column (2). As expected, the coefficient of the interaction term is negative and significant. This result indicates that input tariffs reduction increases firms'

borrowings for firms that source intermediate goods from abroad. This finding can be explained by the need of importers of inputs to borrow in order to finance fixed cost of importing. Moreover, the literature has shown that firms that rely on foreign inputs increase their productivity (Kasahara and Lapham, 2013b; Amiti and Konings, 2007; Topalova and Khandelwal, 2011; Bas and Paunov, 2021a). These productivity gains allow firms to engage in new projects and invest more in R&D and therefore, depend more on external borrowings. The coefficient of the importer status dummy is positive and significant suggesting that importing inputs increases borrowings. The coefficient of the input tariff variable alone is insignificant, which shows that there are no effect of input tariffs reductions on non-importers' borrowings. Then we gradually add firm and industry level controls from columns (3) till (5). As expected, firm age and capital intensity increase firms' borrowings. However, Herfindhal index is insignificant which means that domestic market concentration does not affect firms' borrowings.

In the last column, we explore if our results are robust when we take into account all the unobservable shocks at the industry level varying over time by including 3-digit NIC industry-year fixed effects. In this setting, the variation of input tariffs is captured by the industry-year fixed effects and thereby the estimation only includes the interaction term between input tariffs and importer of inputs status. This specification allows us to control for all the other reforms that took place in India during this period affecting industries differently that could be correlated with input-trade liberalization such as FDI liberalization and industrial liberalization.<sup>7</sup> Results in column (6) show that our previous findings on the effects of input tariff cuts for firms sourcing inputs from abroad on borrowings is robust and stable when we control for other reforms and unobservable shocks across industries over time.

Our coefficient of interest on the interaction term between input tariffs and importers of inputs remain robust and stable across the different specifications. Table A5 in the appendix proves that our results still hold when using the importer of inputs dummy in the initial year of 1990. Even though the number of observations is greatly reduced, we benefit from the fact that the sample is balanced since all the firms included are the ones who appeared at least in 1990. Moreover, holding the importer status constant proves that the variation explaining our main result is coming from the input tariff reduction for importers in 1990.

Estimates in our preferred specification (column 5) show that a reduction of 10 percentage

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<sup>7</sup>Industrial liberalization in India started in the mid-1980s till begging of the 1990s. with the dismantling of the "License Raj".



points in input tariffs increases firms borrowings by almost 1.6 percent for firms sourcing inputs from abroad compared to non-importing firms. Foreign competition also induce firms to increase their demand for external finance: a 10 percentage points decrease in output tariffs is associated with 1.8 percent increase in firms' borrowings.

Table 1: The impact of input-trade liberalization on firms' borrowings

| Dependent variable                              | logarithm of borrowings of firm $i$ in sector $s$ in year $t$ |                      |                      |                      |                      |                      |
|---|---|----------------------|----------------------|----------------------|----------------------|----------------------|
|   | (1)   | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  |
| Input tariffs( $s,t-1$ )                        | -0.057<br>(0.138)   | -0.015<br>(0.135)    | 0.035<br>(0.131)     | 0.045<br>(0.124)     | 0.041<br>(0.124)     |                      |
| Importer ( $i,t-1$ )                            | 0.162***<br>(0.037)   | 0.164***<br>(0.037)  | 0.169***<br>(0.037)  | 0.165***<br>(0.038)  | 0.165***<br>(0.038)  | 0.173***<br>(0.039)  |
| Input tariffs( $s,t-1$ ) x Importer ( $i,t-1$ ) | -0.164**<br>(0.071)   | -0.170**<br>(0.072)  | -0.196***<br>(0.071) | -0.206***<br>(0.070) | -0.206***<br>(0.070) | -0.223***<br>(0.073) |
| Output tariffs( $s,t-1$ )                       |   | -0.243***<br>(0.083) | -0.240***<br>(0.082) | -0.178**<br>(0.076)  | -0.179**<br>(0.076)  |                      |
| Age( $i,t-1$ )                                  |   |                      | 0.282***<br>(0.045)  | 0.408***<br>(0.042)  | 0.409***<br>(0.042)  | 0.403***<br>(0.041)  |
| Capital intensity( $i,t-1$ )                    |   |                      |                      | 0.193***<br>(0.012)  | 0.193***<br>(0.012)  | 0.186***<br>(0.012)  |
| Herfindhal index( $s,t-1$ )                     |   |                      |                      |                      | 0.065<br>(0.074)     |                      |
| Firm FE   | YES   | YES                  | YES                  | YES                  | YES                  | YES                  |
| Year FE   | YES   | YES                  | YES                  | YES                  | YES                  | NO                   |
| Industry-year FE                                | NO  | NO                   | NO                   | NO                   | NO                   | YES                  |
| Observations                                    | 13,899  | 13,899               | 13,899               | 13,899               | 13,899               | 13,876               |
| R-squared                                       | 0.926   | 0.926                | 0.926                | 0.930                | 0.930                | 0.934                |

*Notes:* The dependent variable is the logarithm of borrowings of firm  $i$  in sector  $s$  in year  $t$ . Output tariffs( $s, t-1$ ) are applied MFN import tariffs on final goods at the 3-digit industry level from WITS (WB) in year  $t-1$ . Input tariffs( $s, t-1$ ) is the weighted average of output tariffs using constant input weights from India's 1993 IO Table at the 3-digit industry level in year  $t-1$ . Importer ( $i, t-1$ ) is an indicator variable equal to one if the firm  $i$  reports positive expenditures in imported inputs in year  $t-1$ . Age is the logarithm of the year of creation reported by the firm. Capital intensity( $i, t-1$ ) is the logarithm of capital stock over wagebill of the firm in year  $t-1$ . Herfindhal index( $s, t-1$ ) is the concentration index at the 3-digit industry level in year  $t-1$ . Heteroskedasticity-robust standard errors clustered by 3- digit industry-year level are reported in parentheses.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## 6.2 Alternative explanations

This section presents a series of tests for other possible explanations for the increase in Indian firms' borrowings over the period 1990-1997. The additional explanations we examine are: foreign demand shocks, other reforms that took place in India during the same period and firm ownership type. We discuss why these alternative explanations are relevant and we also present the results of different specifications in Table 2. After taking into account each of these explanations, we show that our results remain robust. Accordingly, even though input-trade liberalization is not

the only explanation of the increase in firms' borrowings, it remains an important one.

### **Foreign demand shocks**

The literature has showed another channel through which trade liberalization might affect firms' technology investments besides the imported input and foreign competition mechanisms. This third channel is related to tariff reductions faced by exporting firms in their destination market (market access). Export tariff reductions increase foreign demand for exporting firms raising their export revenues and allowing exporting firms to upgrade their technology (Bustos, 2011; Bas and Ledezma, 2015). An expansion of export opportunities, from higher foreign demand, is also associated with investments in quality upgrading (Verhoogen, 2008).

Thereby, we investigate if input tariff cuts are picking up the effect of foreign demand shocks caused by more export opportunities. To make sure our results are robust, we add to our estimation an export tariff computed as the average of the tariffs applied by India's main trading partners to India at the 3-digit NIC industry level from 1989 till 1997 from the WITS database. We also add a dummy variable indicating a firm's export status and an interaction term between both variables. Columns (1) and (2) of Table 2 show our results for the baseline estimation and the estimates including 3-digit industry-year fixed effects when we take into account the role of foreign demand shocks. Firms' export status is positive and significant suggesting that exporting firms increase their demand for external finance. This finding could be explained by the fact that exporting firms faced fixed costs to adapt their products to their destination markets that they need to finance (Chaney, 2016). The export tariffs variable is not significant, but the interaction term between export tariffs and export status is negative and significant at the 5% confidence level after adding firm and industry level controls. For a 10 percentage points reduction of export tariffs, exporting firms increase their borrowings by 2.5 percent. Our coefficient of interest of input tariff for importing firms is robust and stable. Even after controlling for the foreign demand channel, input tariffs reduction plays an important role in increasing firms' borrowings.

### **Other reforms in India**

During the 90s and the late 80s, India has undergone several economic reforms other than trade liberalization. Even though we control for the other reforms that vary by industry by including industry-year fixed effects, some of these reforms varied by state such as the labor market reforms.

Each Indian state could modify the Industrial Disputes Act established in 1947 generating a variation in labor market regulation that can affect each state's economic performance (Besley and Burgess, 2004). In order to make sure that our main results are not picking up unobservable characteristics that vary by state and year, we include in columns (3) and (4) in Table 2 region-year fixed effects. Our coefficient of interest is still negative and significant, which proves that our results are robust after controlling for other state-level reforms in India.

### **Firm ownership type**

This section discusses the role played by firm ownership and studies if different type of firm ownership can be driving our results. There is a broad literature that showed that foreign affiliates of multinational firms are more productive, bigger and invest more in technology than domestic firms. It has also been showed that the presence of foreign affiliates might increase productivity of domestic firms through technological spillovers (Javorcik, 2004; Bernard et al., 2009; Keller and Yeaple, 2009; Haskel et al., 2007). Therefore, more productive and larger foreign-owned firms have higher collateral and better access to external finance than their domestic counterpart. In order to check if foreign-owned firms are driving our results we exclude them from the estimating sample in columns (5) and (6) of Table 2. Our variable of interest capturing the effect of input tariff changes on firms' borrowings for importers is negative and significant and the coefficient is statistically similar to the one in the baseline estimation presented in column (5) of Table 1. This finding suggests that input-trade liberalization induces domestic firms to increase the demand of external finance.

The historical context on India's reforms gives a particular privilege for state-owned firms. Alfaro and Chari (2009) use the same firm level data from India and claim that the dominance of state-owned firms in India did not decrease after the liberalization reforms. Since some industries in India still remain concentrated by state-owned firms, one can expect that they use their power to lobby for liberalization of the sectors producing the intermediate goods they use in production to reduce their costs. In order to ensure that our results are not driven by this possible scenario, we exclude state-owned firms from the sample. The results are reported in columns (7) and (8) of Table 2. Our coefficient of interest remains robust and stable suggesting that state-owned firms are not driving our results.

Table 2: Alternative explanations

| Dependent variable                              | logarithm of borrowings of firm $i$ in sector $s$ in year $t$ |                      |                     |                      |                      |                      |                      |                      |
|---|---|----------------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|   | (1)   | (2)                  | (3)                 | (4)                  | (5)                  | (6)                  | (7)                  | (8)                  |
|   | Foreign demand  |                      | Other reforms       |                      | Foreign              |                      | State                |                      |
|   | <b>Excluding firms:</b>                                       |                      |                     |                      |                      |                      |                      |                      |
| Input tariffs( $s,t-1$ )                        | 0.019<br>(0.127)  |                      | -0.035<br>(0.116)   |                      | 0.184*<br>(0.106)    |                      | 0.048<br>(0.127)     |                      |
| Importer ( $i,t-1$ )                            | 0.142***<br>(0.037)   | 0.151***<br>(0.038)  | 0.152***<br>(0.038) | 0.164***<br>(0.039)  | 0.205***<br>(0.035)  | 0.210***<br>(0.036)  | 0.170***<br>(0.038)  | 0.177***<br>(0.039)  |
| Input tariffs( $s,t-1$ ) x Importer ( $i,t-1$ ) | -0.173**<br>(0.069)   | -0.196***<br>(0.072) | -0.180**<br>(0.070) | -0.204***<br>(0.073) | -0.284***<br>(0.070) | -0.293***<br>(0.073) | -0.220***<br>(0.072) | -0.236***<br>(0.076) |
| Output tariffs( $s,t-1$ )                       | -0.169**<br>(0.078)   |                      | -0.130*<br>(0.078)  |                      | -0.137*<br>(0.075)   |                      | -0.176**<br>(0.077)  |                      |
| Export tariffs( $s,t-1$ )                       | -0.028<br>(0.088)   |                      |                     |                      |                      |                      |                      |                      |
| Exporter( $i,t-1$ )                             | 0.107***<br>(0.017)   | 0.110***<br>(0.016)  |                     |                      |                      |                      |                      |                      |
| Export tariffs( $s,t-1$ ) x Exporter( $i,t-1$ ) | -0.226**<br>(0.111)   | -0.243**<br>(0.106)  |                     |                      |                      |                      |                      |                      |
| Age( $i,t-1$ )                                  | 0.394***<br>(0.042)   | 0.385***<br>(0.042)  | 0.422***<br>(0.044) | 0.410***<br>(0.044)  | 0.448***<br>(0.042)  | 0.441***<br>(0.041)  | 0.417***<br>(0.042)  | 0.410***<br>(0.042)  |
| Capital intensity( $i,t-1$ )                    | 0.196***<br>(0.012)   | 0.189***<br>(0.012)  | 0.190***<br>(0.013) | 0.184***<br>(0.013)  | 0.186***<br>(0.012)  | 0.180***<br>(0.013)  | 0.193***<br>(0.012)  | 0.187***<br>(0.013)  |
| Herfindhal index( $s,t-1$ )                     | 0.039<br>(0.078)  |                      | 0.047<br>(0.072)    |                      | 0.081<br>(0.070)     | -0.007<br>(0.088)    | 0.024<br>(0.072)     |                      |
| Firm FE   | YES   | YES                  | YES                 | YES                  | YES                  | YES                  | YES                  | YES                  |
| Year FE   | YES   | NO                   | NO                  | NO                   | YES                  | NO                   | YES                  | NO                   |
| Industry-year FE                                | NO  | YES                  | NO                  | YES                  | NO                   | YES                  | NO                   | YES                  |
| Region-year FE                                  | NO  | NO                   | YES                 | YES                  | NO                   | NO                   | NO                   | NO                   |
| Observations                                    | 13,669  | 13,653               | 13,638              | 13,614               | 12,537               | 12,519               | 13,497               | 13,474               |
| R-squared                                       | 0.931   | 0.934                | 0.933               | 0.936                | 0.934                | 0.938                | 0.925                | 0.929                |

*Notes:* The dependent variable is the logarithm of borrowings of firm  $i$  in sector  $s$  in year  $t$ . Output tariffs( $s,t-1$ ) are applied MFN import tariffs on final goods at the 3-digit industry level from WITS (WB) in year  $t-1$ . Input tariffs( $s,t-1$ ) is the weighted average of output tariffs using constant input weights from India's 1993 IO Table at the 3-digit industry level in year  $t-1$ . Importer inputs( $i,t-1$ ) is an indicator variable equal to one if the firm  $i$  reports positive expenditures in imported inputs in year  $t-1$ . Export tariffs( $s,t-1$ ) is the average of the tariffs applied by India's main trading partners to India at the 3-digit industry level in year  $t-1$ . Exporter( $i,t-1$ ) is an indicator variable equal to one if the firm  $i$  reports positive exports in year  $t-1$ . Age is the logarithm of the year of creation reported by the firm. Capital intensity( $i,t-1$ ) is the logarithm of capital stock over wage bill of the firm in year  $t-1$ . Herfindhal index( $s,t-1$ ) is the concentration index at the 3-digit industry level in year  $t-1$ . Heteroskedasticity-robust standard errors clustered by 3-digit industry-year level are reported in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## 7 Testing the channels

### Financial development and external dependence

In this section, we study if the effect of input-trade liberalization on firms' borrowings depends on the different access to finance that firms have. First, we investigate if our previous findings depend on the degree of financial development of the state where the firm is located. We proxy for the level of financial development of a state by the ratio of total borrowings over total assets in a state during the period of analysis. Then we split the sample between firms located in states with high-financial development (below the median of this measure) and firms located in states with low-financial development (above the median). States with low ratio of total borrowings over total assets are characterised with higher level of financial development since the firms in those states suffer less from credit constraints.

Results are reported in columns (1) to (4) of Table 3. Columns (1) and (2) report baseline estimations and estimates including industry-year fixed effects for firms located in states with high-financial development and columns (3) and (4) present evidence on firms located in states with low-financial development. The estimates show that the previous results on the effects of input-trade liberalization on firms' borrowings for firms importing inputs is driven by firms that have access to external finance located in states with a high degree of financial development.

Next, we compare firms operating in industries with low-external financial dependence with firms operating in industries with high-external financial dependence using the index built by Rajan and Zingales (1998). This index is defined as the share of capital expenditures not financed with internal cash flows from operations. It captures intrinsic features of the manufacturing process. It is constructed using US data so it is not endogenous to a country's level of financial development. Moreover, since the US financial market is considered advanced, this index reflect the optimal financing needed in a financially unconstrained environment. As shown in columns (5) to (8) of Table 3, our results only hold for firms operating in industries with low external dependence. The firms that will be able to borrow to pay the fixed cost of importing and of technology/quality upgrading in order to benefit from the trade liberalization are the ones which are less credit constrained. These findings provide evidence of the the complementarity between trade reforms and financial markets development.

Table 3: Financial development and external dependence

|   | (1)                   | (2)                  | (3)                      | (4)                       | (5)                  | (6)                  | (7)                 | (8)                 |
|---|-----------------------|----------------------|--------------------------|---------------------------|----------------------|----------------------|---------------------|---------------------|
|   | High Fin. Dev (state) | Low Fin. Dev (state) | Low ext. dep. (industry) | High ext. dep. (industry) | ln(borrow)           | ln(borrow)           | ln(borrow)          | ln(borrow)          |
| Input tariffs(s,t-1)                    | -0.150<br>(0.160)     |                      | 0.260<br>(0.169)         |                           | 0.057<br>(0.135)     |                      | -0.089<br>(0.298)   |                     |
| Importer (i,t-1)                        | 0.163***<br>(0.051)   | 0.170***<br>(0.053)  | 0.152***<br>(0.048)      | 0.141***<br>(0.052)       | 0.206***<br>(0.048)  | 0.211***<br>(0.050)  | 0.112**<br>(0.055)  | 0.124**<br>(0.057)  |
| Input tariffs(s,t-1) x Importer (i,t-1) | -0.203**<br>(0.087)   | -0.225**<br>(0.092)  | -0.171<br>(0.109)        | -0.186<br>(0.115)         | -0.312***<br>(0.091) | -0.300***<br>(0.099) | -0.068<br>(0.097)   | -0.118<br>(0.103)   |
| Output tariffs(s,t-1)                   | -0.229**<br>(0.092)   |                      | -0.076<br>(0.086)        |                           | -0.191*<br>(0.111)   |                      | -0.120<br>(0.124)   |                     |
| Age(i,t-1)                              | 0.423***<br>(0.058)   | 0.387***<br>(0.055)  | 0.373***<br>(0.064)      | 0.474***<br>(0.071)       | 0.415***<br>(0.055)  | 0.422***<br>(0.061)  | 0.412***<br>(0.065) | 0.383***<br>(0.062) |
| Capital intensity(i,t-1)                | 0.197***<br>(0.015)   | 0.189***<br>(0.015)  | 0.194***<br>(0.019)      | 0.196***<br>(0.020)       | 0.208***<br>(0.017)  | 0.205***<br>(0.017)  | 0.180***<br>(0.017) | 0.166***<br>(0.016) |
| Herfindhal index(s,t-1)                 | 0.020<br>(0.086)      |                      | 0.113<br>(0.141)         |                           | 0.055<br>(0.100)     |                      | 0.037<br>(0.104)    |                     |
| Firm FE                                 | YES                   | YES                  | YES                      | YES                       | YES                  | YES                  | YES                 | YES                 |
| Year FE                                 | YES                   | NO                   | YES                      | NO                        | YES                  | NO                   | YES                 | NO                  |
| Industry-year FE                        | NO                    | YES                  | NO                       | YES                       | NO                   | YES                  | NO                  | YES                 |
| Observations                            | 8,941                 | 8,915                | 4,741                    | 4,713                     | 7,423                | 7,397                | 6,208               | 6,194               |
| R-squared                               | 0.932                 | 0.937                | 0.927                    | 0.934                     | 0.937                | 0.939                | 0.919               | 0.925               |

*Notes:* The dependent variable is the logarithm of borrowings of firm  $i$  in sector  $s$  in year  $t$ . Output tariffs( $s, t - 1$ ) are applied MFN import tariffs on final goods at the 3-digit industry level from WITS (WB) in year  $t - 1$ . Input tariffs( $s, t - 1$ ) is the weighted average of output tariffs using constant input weights from India's 1993 IO Table at the 3-digit industry level in year  $t - 1$ . Importer inputs( $i, t - 1$ ) is an indicator variable equal to one if the firm  $i$  reports positive expenditures in imported inputs in year  $t - 1$ . Age is the logarithm of the year of creation reported by the firm. Capital intensity( $i, t - 1$ ) is the logarithm of capital stock over wage bill of the firm in year  $t - 1$ . Herfindhal index( $s, t - 1$ ) is the concentration index at the 3-digit industry level in year  $t - 1$ . Heteroskedasticity-robust standard errors clustered by 3-digit industry-year level are reported in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## Disentangling the effects from input and capital goods-trade liberalization

Since sourcing capital goods (machinery) from abroad is also associated with a fixed cost of importing, firms are likely to demand external credits in order to finance the fixed cost of upgrading foreign technology embodied in imported capital goods. We then disentangle the effect of intermediate inputs and capital goods tariffs reductions on firms' borrowings.

A good feature of the Indian firm level data is that information on imports is categorized by type of good. Accordingly, we construct a measure of capital goods tariffs in the same way as inputs tariffs were constructed. For each 3-digit industry, we construct a capital goods tariff as the weighted average of tariffs on the capital goods used in the production of final goods of that 3-digit industry, where the weights reflect the share of capital goods of the final goods industry on total expenditures in capital goods using India's input-output matrix in 1993. Using a disaggregated input-output matrix, 14 from a total of 52 industries are classified as capital goods.<sup>8</sup> Then, we interact this measure with a dummy equals one if firm  $i$  imports capital goods in the year  $t - 1$ . In this specification, we reconstruct the input tariffs excluding the capital goods and thereby in this case input tariffs only capture the variations in tariffs applied to variable intermediate goods.

The results are reported in Table 4. Across all specifications, the effect of input tariffs cuts (variable intermediate goods) for importers of inputs on firms' borrowings is still negative and significant. Moreover, as expected, capital goods tariffs reductions induce importers to increase their borrowings. In Table 5, we take into account the alternative explanations discussed in section 6. Our coefficient of interest, of input tariffs cuts for importing firms, is robust and stable across all specifications.

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<sup>8</sup>Capital goods industries are tractors and agriculture machinery, industrial machinery, industrial machinery (others), office computing machines, other non-electrical machinery, electrical industrial machinery, communication equipment, other electrical machinery, electronic equipment, ships and boats, rail equipment, motor vehicles motor cycles and other transport equipment.

Table 4: Input and capital goods tariffs reductions

| Dependent variable                          | logarithm of borrowings of firm $i$ in sector $s$ in year $t$ |                      |                      |                      |                      |
|---|---|----------------------|----------------------|----------------------|----------------------|
|   | (1)   | (2)                  | (3)                  | (4)                  | (5)                  |
| Input tariffs no K(s,t-1)                   | -0.011<br>(0.142)   | 0.036<br>(0.136)     | 0.056<br>(0.131)     | 0.053<br>(0.131)     |                      |
| Importer(i,t-1)                             | 0.111***<br>(0.036)   | 0.114***<br>(0.036)  | 0.125***<br>(0.036)  | 0.125***<br>(0.036)  | 0.147***<br>(0.037)  |
| Input tariffs no K(s,t-1) x Importer(i,t-1) | -0.196***<br>(0.075)  | -0.223***<br>(0.074) | -0.240***<br>(0.071) | -0.240***<br>(0.071) | -0.288***<br>(0.075) |
| K goods tariffs(s,t-1)                      | 0.200<br>(0.155)  | 0.219<br>(0.151)     | 0.181<br>(0.147)     | 0.177<br>(0.147)     |                      |
| Importer K(i,t-1)                           | 0.172***<br>(0.017)   | 0.175***<br>(0.017)  | 0.143***<br>(0.016)  | 0.142***<br>(0.016)  | 0.141***<br>(0.016)  |
| K goods tariffs(s,t-1) x Importer K(i,t-1)  | -0.189**<br>(0.076)   | -0.201***<br>(0.075) | -0.169**<br>(0.074)  | -0.169**<br>(0.074)  | -0.174**<br>(0.074)  |
| Output tariffs(s,t-1)                       | -0.220***<br>(0.078)  | -0.218***<br>(0.078) | -0.163**<br>(0.073)  | -0.164**<br>(0.073)  |                      |
| Age(i,t-1)                                  |   | 0.290***<br>(0.043)  | 0.408***<br>(0.041)  | 0.408***<br>(0.041)  | 0.407***<br>(0.041)  |
| Capital intensity(i,t-1)                    |   |                      | 0.183***<br>(0.012)  | 0.183***<br>(0.012)  | 0.178***<br>(0.012)  |
| Herfindhal index(s,t-1)                     |   |                      |                      | 0.049<br>(0.071)     |                      |
| Firm FE                                     | YES   | YES                  | YES                  | YES                  | YES                  |
| Year FE                                     | YES   | YES                  | YES                  | YES                  | NO                   |
| Industry-year FE                            | NO  | NO                   | NO                   | NO                   | YES                  |
| Observations                                | 13,899  | 13,899               | 13,899               | 13,899               | 13,876               |
| R-squared                                   | 0.927   | 0.928                | 0.931                | 0.931                | 0.935                |

*Notes:* The dependent variable is the logarithm of borrowings of firm  $i$  in sector  $s$  in year  $t$ . Output tariffs( $s, t - 1$ ) are applied MFN import tariffs on final goods at the 3-digit industry level from WITS (WB) in year  $t - 1$ . Input tariffs( $s, t - 1$ ) (capital goods tariffs( $s, t - 1$ )) is the weighted average of output tariffs using constant input weights on variable intermediate goods only (capital goods only) from India's 1993 IO Table at the 3-digit industry level in year  $t - 1$ . Importer inputs( $i, t - 1$ ) (Importer capital goods( $i, t - 1$ )) is an indicator variable equal to one if the firm  $i$  reports positive expenditures in imported variable inputs (capital goods) in year  $t - 1$ . Age is the logarithm of the year of creation reported by the firm. Capital intensity( $i, t - 1$ ) is the logarithm of capital stock over wagebill of the firm in year  $t - 1$ . Herfindhal index( $s, t - 1$ ) is the concentration index at the 3-digit industry level in year  $t - 1$ . Heteroskedasticity-robust standard errors clustered by 3- digit industry-year level are reported in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## Technology upgrading

The increase in the borrowings of a firm can also be due to technology upgrading. The literature showed that trade liberalization is associated with increases in firms' product innovation, R&D investments and imports of capital goods (Goldberg et al., 2009; Bas and Berthou, 2017). Thereby, firms might increase their demand for external credits in order to finance domestic and foreign technology upgrading associated with input-trade liberalization.



Table 5: Input and capital goods tariffs reductions: alternative explanations

| Dependent variable                                | logarithm of borrowings of firm $i$ in sector $s$ in year $t$ |                      |                      |                      |                      |                      |                      |                      |
|---|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|   | (1)   | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  | (7)                  | (8)                  |
|   |   |                      |                      |                      | No foreign           |                      | No State             |                      |
| Input tariffs no $K(s,t-1)$                       | 0.011<br>(0.134)  |                      | -0.018<br>(0.121)    |                      | 0.229**<br>(0.112)   |                      | 0.064<br>(0.134)     |                      |
| Importer( $i,t-1$ )                               | 0.106***<br>(0.036)   | 0.128***<br>(0.037)  | 0.111***<br>(0.036)  | 0.135***<br>(0.037)  | 0.154***<br>(0.033)  | 0.173***<br>(0.034)  | 0.133***<br>(0.036)  | 0.152***<br>(0.037)  |
| Input tariffs no $K(s,t-1)$ x Importer( $i,t-1$ ) | -0.212***<br>(0.072)  | -0.262***<br>(0.076) | -0.210***<br>(0.071) | -0.260***<br>(0.075) | -0.307***<br>(0.069) | -0.344***<br>(0.074) | -0.264***<br>(0.074) | -0.307***<br>(0.078) |
| K goods tariffs( $s,t-1$ )                        | 0.173<br>(0.148)  |                      | 0.098<br>(0.136)     |                      | 0.288**<br>(0.124)   |                      | 0.177<br>(0.148)     |                      |
| Importer $K(i,t-1)$                               | 0.140***<br>(0.016)   | 0.138***<br>(0.016)  | 0.142***<br>(0.016)  | 0.140***<br>(0.016)  | 0.158***<br>(0.015)  | 0.156***<br>(0.015)  | 0.145***<br>(0.016)  | 0.145***<br>(0.016)  |
| K goods tariffs( $s,t-1$ ) x Importer $K(i,t-1)$  | -0.164**<br>(0.073)   | -0.168**<br>(0.073)  | -0.181**<br>(0.076)  | -0.181**<br>(0.077)  | -0.205***<br>(0.078) | -0.206***<br>(0.076) | -0.162**<br>(0.073)  | -0.167**<br>(0.073)  |
| Export tariff( $s,t-1$ ) x Exporter( $i,t-1$ )    | -0.228**<br>(0.111)   | -0.230**<br>(0.108)  |                      |                      |                      |                      |                      |                      |
| Exporter( $i,t-1$ )                               | 0.103***<br>(0.016)   | 0.105***<br>(0.016)  |                      |                      |                      |                      |                      |                      |
| Export tariff( $s,t-1$ )                          | -0.019<br>(0.087)   |                      |                      |                      |                      |                      |                      |                      |
| Output tariffs( $s,t-1$ )                         | -0.150**<br>(0.075)   |                      | -0.115<br>(0.076)    |                      | -0.128*<br>(0.072)   |                      | -0.160**<br>(0.073)  |                      |
| Age( $i,t-1$ )                                    | 0.394***<br>(0.041)   | 0.390***<br>(0.041)  | 0.424***<br>(0.043)  | 0.415***<br>(0.044)  | 0.449***<br>(0.041)  | 0.448***<br>(0.040)  | 0.418***<br>(0.041)  | 0.415***<br>(0.042)  |
| Capital intensity( $i,t-1$ )                      | 0.186***<br>(0.012)   | 0.180***<br>(0.012)  | 0.181***<br>(0.012)  | 0.175***<br>(0.012)  | 0.176***<br>(0.012)  | 0.170***<br>(0.013)  | 0.182***<br>(0.012)  | 0.177***<br>(0.012)  |
| Herfindhal index( $s,t-1$ )                       | 0.020<br>(0.075)  |                      | 0.031<br>(0.070)     |                      | 0.061<br>(0.070)     |                      | 0.008<br>(0.070)     |                      |
| Firm FE   | YES   | YES                  | YES                  | YES                  | YES                  | YES                  | YES                  | YES                  |
| Year FE   | YES   | NO                   | NO                   | NO                   | YES                  | NO                   | YES                  | NO                   |
| Industry-year FE                                  | NO  | YES                  | NO                   | YES                  | NO                   | YES                  | NO                   | YES                  |
| Region-year FE                                    | NO  | NO                   | YES                  | YES                  | NO                   | NO                   | NO                   | NO                   |
| Observations                                      | 13,669  | 13,653               | 13,638               | 13,614               | 12,537               | 12,519               | 13,497               | 13,474               |
| R-squared   | 0.932   | 0.935                | 0.934                | 0.937                | 0.936                | 0.939                | 0.926                | 0.930                |

*Notes:* The dependent variable is the logarithm of borrowings of firm  $i$  in sector  $s$  in year  $t$ . Output tariffs( $s,t-1$ ) are applied MFN import tariffs on final goods at the 3-digit industry level from WITS (WB) in year  $t-1$ . Input tariffs( $s,t-1$ ) (capital goods tariffs( $s,t-1$ )) is the weighted average of output tariffs using constant input weights on variable intermediate goods only (capital goods only) from India's 1993 IO Table at the 3-digit industry level in year  $t-1$ . Importer inputs( $i,t-1$ ) (Importer capital goods( $i,t-1$ )) is an indicator variable equal to one if the firm  $i$  reports positive expenditures in imported variable inputs (capital goods) in year  $t-1$ . Export tariffs( $s,t-1$ ) is the average of the tariffs applied by India's main trading partners to India at the 3-digit industry level in year  $t-1$ . Exporter( $i,t-1$ ) is an indicator variable equal to one if the firm  $i$  reports positive exports in year  $t-1$ . Age is the logarithm of the year of creation reported by the firm. Capital intensity( $i,t-1$ ) is the logarithm of capital stock over wagebill of the firm in year  $t-1$ . Herfindhal index( $s,t-1$ ) is the concentration index at the 3-digit industry level in year  $t-1$ . Heteroskedasticity-robust standard errors clustered by 3-digit industry-year level are reported in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

The main channel through which input tariffs reductions allows firms to foster new innovation projects is through the increase in revenues due to the access to cheaper inputs or better quality/higher technology inputs. Thereby, in order to test the domestic technology channel, we first investigate the effect of trade liberalization through input and capital goods tariffs reductions on firms' sales and then on domestic and foreign technology investments. For domestic technology, we rely on R&D status and R&D expenses share. R&D status is a dummy variable equals one if the firm's R&D expenses are positive. R&D share is calculated as the share of R&D expenditures over total sales. We measure foreign technology upgrading by the importer of capital goods status of the firm computed as an indicator variable equal to one if the firm sources capital goods from abroad in year  $t$ .

Results are reported in Table 6. Columns (1) and (2) shows that input-trade liberalization increases firms' sales for firms sourcing input from abroad. Next, columns (3) to (6) shows that both input and capital goods tariffs cuts induce importing firms to increase the probability of investing in R&D and the share of R&D investments. These findings show that firms might raise their borrowings after trade liberalization in order to finance domestic technology upgrading.

Finally, we present direct evidence that input-trade liberalization increases the probability of upgrading foreign technology. The last column shows that capital goods tariffs reduction directly leads to higher probability of becoming an importer of capital goods and adopt a higher foreign technology. Moreover, even though the magnitude is smaller, the coefficient of input tariffs is negative and significant which shows a complementarity between importing inputs and capital goods as studied by Bas and Berthou (2017).

These findings suggest that one of the main channels through which input and capital goods tariffs cuts affect firms' demand for credit is to finance new technological investments.

## 8 Conclusion

This paper investigates the impact of input-trade liberalization in India during the 1989-1997 period on firms' borrowings. Access to foreign inputs leads to technology upgrading inducing firms to increase their demand for external credits in order to finance the fixed costs of importing as well as investment in technology.

Our results confirm this hypothesis. Input-trade liberalization increases borrowings for firms

Table 6: Technology upgrading

| Dependent variable                          | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  | (7)                 |
|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---------------------|
|   | Ln(sales)            | Ln(sales)            | R&D status           | R&D status           | R&D share            | R&D share            | Importer K goods    |
| Input tariffs no K(s,t-1)                   | 0.149<br>(0.142)     |                      | 0.572***<br>(0.143)  |                      | 0.467***<br>(0.216)  |                      | -0.152**<br>(0.068) |
| Importer(i,t-1)                             | 0.170***<br>(0.040)  | 0.159***<br>(0.039)  | 0.154***<br>(0.023)  | 0.128***<br>(0.022)  | 0.125***<br>(0.046)  | 0.093*<br>(0.049)    |                     |
| Input tariffs no K(s,t-1) x Importer(i,t-1) | -0.207***<br>(0.077) | -0.172**<br>(0.074)  | -0.356***<br>(0.049) | -0.293***<br>(0.047) | -0.281***<br>(0.083) | -0.207**<br>(0.098)  |                     |
| K goods tariffs(s,t-1)                      | 0.062<br>(0.189)     |                      | 0.139<br>(0.143)     |                      | 0.031<br>(0.225)     |                      | -0.170**<br>(0.082) |
| Importer K(i,t-1)                           | 0.083***<br>(0.013)  | 0.084***<br>(0.013)  | 0.017*<br>(0.010)    | 0.025**<br>(0.010)   | 0.046***<br>(0.018)  | 0.057***<br>(0.018)  |                     |
| K goods tariffs(s,t-1) x Importer K(i,t-1)  | -0.075<br>(0.064)    | -0.178***<br>(0.062) | -0.182***<br>(0.059) | -0.183***<br>(0.060) | -0.166**<br>(0.075)  | -0.183**<br>(0.079)  |                     |
| Output tariffs(s,t-1)                       | 0.060<br>(0.081)     |                      | 0.074<br>(0.056)     |                      | 0.126<br>(0.103)     |                      | -0.053<br>(0.053)   |
| Age(i,t-1)                                  | 0.382***<br>(0.046)  | 0.415***<br>(0.046)  | -0.150***<br>(0.028) | -0.142***<br>(0.025) | -0.102**<br>(0.048)  | -0.098***<br>(0.038) | -0.004<br>(0.031)   |
| Capital intensity(i,t-1)                    | -0.048***<br>(0.013) | -0.045***<br>(0.013) | 0.007<br>(0.005)     | 0.010**<br>(0.005)   | 0.013<br>(0.012)     | 0.016<br>(0.013)     | 0.013**<br>(0.006)  |
| Herfindhal index(s,t-1)                     | 0.097<br>(0.078)     |                      | 0.096*<br>(0.050)    |                      | -0.139<br>(0.117)    |                      | 0.045<br>(0.056)    |
| Firm FE                                     | YES                  | YES                  | YES                  | YES                  | YES                  | YES                  | YES                 |
| Year FE                                     | YES                  | NO                   | YES                  | NO                   | YES                  | NO                   | YES                 |
| Industry-year FE                            | NO                   | YES                  | NO                   | YES                  | NO                   | YES                  | NO                  |
| Observations                                | 13,899               | 13,876               | 13,899               | 13,876               | 13,899               | 13,876               | 13,899              |
| R-squared                                   | 0.949                | 0.953                | 0.624                | 0.649                | 0.566                | 0.587                | 0.624               |

*Notes:* The dependent variable is the logarithm of borrowings of firm  $i$  in sector  $s$  in year  $t$ . Output tariffs( $s, t - 1$ ) are applied MFN import tariffs on final goods at the 3-digit industry level from WITS (WB) in year  $t - 1$ . Input tariffs( $s, t - 1$ ) (capital goods tariffs( $s, t - 1$ )) is the weighted average of output tariffs using constant input weights on variable intermediate goods only (capital goods only) from India's 1993 IO Table at the 3-digit industry level in year  $t - 1$ . Importer inputs( $i, t - 1$ ) (Importer capital goods( $i, t - 1$ )) is an indicator variable equal to one if the firm  $i$  reports positive expenditures in imported variable inputs (capital goods) in year  $t - 1$ . Age is the logarithm of the year of creation reported by the firm. Capital intensity( $i, t - 1$ ) is the logarithm of capital stock over wagebill of the firm in year  $t - 1$ . Herfindhal index( $s, t - 1$ ) is the concentration index at the 3-digit industry level in year  $t - 1$ . Heteroskedasticity-robust standard errors clustered by 3-digit industry-year level are reported in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

importing inputs. Our results remain robust after controlling for several alternative explanations: foreign demand shocks, others reforms in India and firm ownership type. We also disentangle the effect of input-trade liberalization that is driven by changes in tariffs applied to variable inputs and those applied to capital goods (machinery). Our findings show that both channels matter but the former is stronger. One policy implication of these results is that the success of trade reforms and the development of financial markets in developing countries go hand in hand.

# Appendix

Table A1: Descriptive statistics

|                   | All               | 1990              | 1997              |
|-------------------|-------------------|-------------------|-------------------|
| Borrowings        | 46.53<br>(308.62) | 35.50<br>(181.43) | 56.48<br>(390.58) |
| TFP(LP)           | 1.28<br>(0.53)    | 1.37<br>(0.48)    | 1.18<br>(0.59)    |
| Imports of K      | 1.79<br>(20.15)   | 0.52<br>(2.49)    | 2.95<br>(40.55)   |
| Imports of inputs | 8.54<br>(47.89)   | 6.70<br>(32.04)   | 10.77<br>(60.19)  |

*Notes:* Mean values and standard errors in parenthesis are reported. *Source:* Authors' calculation based on the prowess data.

Table A2: Number of firms

|           | Nb. of firms |
|-----------|--------------|
| 1990-1997 | 3744         |
| 1990      | 935          |
| 1997      | 314          |

*Source:* Authors' calculation based on the Prowess data.

Table A3: Input Tariff Reductions Between 1990 and 1997 and Industrial Characteristics in 1990

| Dependent variable    | $\Delta$ Input tariffs between 1990 and 1997 |                  |                  |                  |                  |                  |
|-----------------------|--|------------------|------------------|------------------|------------------|------------------|
|                       | (1)  | (2)              | (3)              | (4)              | (5)              | (6)              |
| Borrowings(s,1990)    | 0.006<br>(0.006)                             |                  |                  |                  |                  |                  |
| Sales(s,1990)         |  | 0.007<br>(0.006) |                  |                  |                  |                  |
| Capital share(s,1990) |  |                  | 0.006<br>(0.006) |                  |                  |                  |
| Wage(s,1990)          |  |                  |                  | 0.007<br>(0.006) |                  |                  |
| Imp.K goods(s,1990)   |  |                  |                  |                  | 0.011<br>(0.007) |                  |
| Imp.inputs(s,1990)    |  |                  |                  |                  |                  | 0.004<br>(0.004) |
| <i>N</i>              | 47   | 47               | 47               | 47               | 47               | 47               |

*Notes:* Robust standard errors in parentheses. All industry level variables are expressed in logarithms. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table A4: Initial Firm Characteristics in 1990 and Input Tariff Changes Between 1990-1997

| Dependent variable              | (1)              | (2)              | (3)                | (4)              | (5)               |
|---------------------------------|------------------|------------------|--------------------|------------------|-------------------|
|                                 | ln(borrow)       | Importer of K    | Imports of K/sales | K intensity      | TFP               |
| $\Delta$ input tariffs(s,97-90) | 1.966<br>(1.286) | 0.005<br>(0.450) | -0.003<br>(0.108)  | 0.630<br>(0.585) | -0.229<br>(0.391) |
| <i>N</i>                        | 669              | 676              | 676                | 676              | 676               |

*Notes:* OLS standard errors in parentheses. Imports of capital goods and capital intensity are expressed in logarithm. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table A5: Baseline results: initial importer status

| VARIABLES                             | (1)<br>Ln(borrow)   | (2)<br>Ln(borrow)    | (3)<br>Ln(borrow)    |
|---------------------------------------|---------------------|----------------------|----------------------|
| Input tariffs(s,t-1) x Importer(i,90) | -0.497**<br>(0.196) | -0.506***<br>(0.184) | -0.547***<br>(0.182) |
| Capital intensity(t-1)                |                     | 0.300***<br>(0.021)  | 0.303***<br>(0.021)  |
| Age(t-1)                              |                     |                      | 0.271***<br>(0.068)  |
| Firm FE                               | YES                 | YES                  | YES                  |
| Industry-year FE                      | YES                 | YES                  | YES                  |
| Observations                          | 6,142               | 6,142                | 6,142                |
| R-squared                             | 0.924               | 0.930                | 0.931                |

*Notes:* Clustered standard errors at the 3 digit industry year level in parentheses.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

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