# Domestic Tax Reform, New Inputs, and Productivity: Evidence from Indian Manufacturing*

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January 2026

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**Abstract**

Can commodity taxes distort plants' input sourcing and production decisions? This paper investigates the impact of India's 2017 Goods and Services Tax reform, which replaced a fragmented tax system with a nationwide one and eliminated cumulative taxes on out-of-state transactions. Using a panel of manufacturing plants from 2012 to 2022, and exploiting heterogeneity in their eligibility to the reform, I employ a difference-in-differences approach to compare treated plants able to claim input taxes with untreated ones. The results show that treated plants increase input sourcing post-reform, particularly through newly acquired imported inputs. The effects are stronger in inland states, and stronger in industries with lower input tariffs. Production is also impacted, as treated plants' productицity and product scope increases relatively more, and highly-taxed plants start adjusting their product mix to become eligible to the credits.

*Keywords:* intermediates, commodity taxation, international trade, plant-level data.
*JEL classification:* F14, H21, L25.

*Contact: maxime.berrou@essec.edu. I would like to thank my supervisor Pamela Bombarda, Pierre-Louis Vézina, Gianluca Orefice, Giordano Mion, Maria Bas, participants at the ThEMA internal seminar, the ESSEC internal seminar, the Young Researchers seminar at Paris 1, the Econ Reading Groups at King's College London for helpful comments and suggestions. I would also like to thank Johannes Boehm for providing information the Annual Survey of Industries (ASI), and Mohammad Hoseini for clarifications regarding the construction of the aggregated firm data. I am also grateful to the Ministry of Statistics and Programme Implementation (MOSPI) staff for their support with data access. All errors are my own.

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# 1 Introduction

Unimpeded access to intermediate inputs is a key determinant of plants' performance. Yet, the ability of some producers to source the most appropriate intermediates remains sometimes limited. Even after the implementation of substantial trade reforms, domestic institutional factors continue to shape plants' sourcing decisions. This phenomenon is particularly salient in developing economies, where trade-induced industrial upgrading should in principle lead to substantial productivity gains (Verhoogen, 2023; Atkin and Donaldson, 2015). Assessing the origin as well as the relative importance of those internal factors remains an open empirical question.

This paper assesses whether the design of commodity taxation can inadvertently distort firms' sourcing of intermediates. Modern tax systems typically avoid taxing intermediates. To that end, Goods and Services Taxes (hereafter, GSTs) have largely replaced earlier forms of commodity taxation, such as sales taxes.[1] The central advantage of GSTs over these alternative systems is that they allow firms to credit taxes paid on intermediate inputs against their tax liabilities, thereby limiting taxation to value added. Consequently, GSTs should not distort sourcing decisions. To the extent that GSTs reduce costs on firm-to-firm transactions, their implementation should make the sourcing of inputs less costly, and potentially expand the market for intermediates that domestic firms source from.

Despite the well-known efficiency properties of GSTs, many countries continue to tax intermediate inputs. In practice, GSTs are generally not implemented in this idealized manner (Dixit, 1990). This outcome reflects not only widespread tax evasion arising from limited enforcement by authorities, but the policy design itself. This paper focuses on a specific reason why some countries are sometimes unable to implement a well-functioning GST: they implement it *locally* (*e.g.*, at the state level), but not *nationwide*. Indeed, in decentralized political systems such as India, Brazil or Canada, long-lasting disagreements between local and central governments on tax revenue allocation have led to the emergence of multiple GSTs (Arnold et al., 2025). Such fragmentation makes the input tax credit inoperative, thereby raising the cost of sourcing non-local intermediates due to cumulative taxation. Furthermore, in developing economies, the transition from a multiple, fragmented GSTs to a single, nationwide GST constitutes a policy trade-off. On the one hand, a nationwide GST may lower the prices of intermediate inputs, resulting in increases in productivity for domestic producers. On the other hand, in economies with a large informal sector and imperfect enforcement, tax registration costs may be too costly for some firms, which may exit or choose to operate informally.[2] Evaluating how domestic producers are impacted by the removal of input taxes through the implementation of a nationwide GST is thus, ultimately, an empirical question. This paper addresses this question in the context of India, where internal tax barriers were historically high and are suspected to have greatly impacted international as well as interstate trade flows (Van Leemput and Wiencek, 2017). I evaluate the introduction of the Goods and Services Tax (GST) in 2017. It provides a particularly well-suited setting to study the uniformization of commodity taxation. Prior to the reform, intermediate inputs sourced from other states, including imports, were taxed, whereas the reform introduced a

[1] I use the term interchangeably with value-added taxes (VATs).

[2] Dixit (1990) also highlights an additionna policy trade-off related to the complexity of tax rate structures, which is not the focus of this paper.

well-functioning input tax credit, with relatively limited exceptions.

Despite decades of debate and a gradual implementation process, public discussion surrounding the GST largely emphasized concerns about tax regressivity and consumer prices, while the role of intermediate inputs and its effect on the performance of producers received comparatively little attention. Yet the effects of a well-functioning GST should in principle be magnified in developing economies, as those are typically further from the production possibility frontier. Access to out-of-state, and, specifically, foreign intermediates should allow them to upgrade their production processes.[3] The goal of this paper is thus to estimate the causal impact of an increase in input tax credit on plants' sourcing and production decisions. My contribution is twofold. First, I document three striking facts about the sourcing of intermediates in India: (i) there has been a substantial decrease in plant-level tax per sales after 2017, likely driven by a reduction in input taxes, (ii) interstate trade suddenly increased around 2017 and (iii) plants sourced a greater number of intermediate inputs after the reform. Second, in light of this facts, I establish a causal link between the sudden ability to claim input taxes on all intermediates as opposed to just a restricted set, and various plant-level measures of performance, such as tax burden, sourcing of intermediates along both the intensive and the extensive margins, and production decisions.

The 2017 nationwide GST implementation offers a promising setting to study how plants adapt to the removal of a distortion previously placed on the sourcing of their inputs. Indeed, the reform can be interpreted as a quasi-random reduction in taxes on intermediates. Its scope make it the the most ambitious tax reform since Independence in 1947. Because there is not yet an established database of tax rates, I first gather novel data on tax the main characteristics of this tax reform. Specifically, I codify information on which goods are taxable or exempted from the tax, and, if taxable, at which tax rate. Then, I implement an empirical strategy relying on the fact that some plants were effectively excluded from the nationwide input tax credit mechanism due to their pre-reform production of exempted goods. I show that those plants constitute a valid control group relative to the plants eligible to credit their input taxes. Then, I adopt a differences-in-differences methodology comparing plants eligible to input tax credit (treated) to those not eligible because they initially produce exempted good (control), before and after 2017.

I find that plants adjust their input sourcing and production decisions in response to the reduction of cascading taxation and input market expansion, and there are complementarities with local domestic institutions. My results suggest that the ability to source out-of-state intermediates significantly changes plants' sourcing and production decisions. First, relative to plants in the control group, treated plants' tax per gross sales decreases by approximately 45%. Second, plants react by sourcing more of the same intermediates, as well as adding new ones. Specifically, they increase the total number of intermediates sourced at a given period by 6%. The effects are driven by access to foreign intermediates. Those estimates are robust to a wide range of empirical checks. Further analysis suggests that those effects are driven by large plants, especially those with over 500 workers, and are magnified when in interaction with other policies facilitating the sourcing of intermediates, such as input tariff liberalization. Finally, large treated plants benefit from productivity increases, measured

[3] Other attractive characteristics of GSTs in low- and middle-income settings include the fact that they are self-enforcing and that they help replace lost tariff following trade liberalization (**?**).

by value-added per worker, of approximately 8%, relative to control plants and also add new goods to their production mix. All in all, those results suggest that large plants benefited greatly from the reform, an understudied aspect of GSTs.

**Literature review.** GSTs have been extensively studied theoretically and empirically. In developed economies, those studies rarely focus on the question of intermediates because input tax credits operate well there (Benzarti and Carloni, 2019; Benzarti et al., 2020; Benzarti and Tazhitdinova, 2021). In developing economies, some studies focusing on the effects of imperfect tax design show the production efficiency gains from the implementation of GST (Hoseini and Briand, 2020; Gadenne et al. (2022)). Perhaps the closest paper to his study is the one by Agrawal and Zimmermann (2025) who estimate the productivity gains stemming from the replacement of state-level sales taxes by the state-level GSTs in the 2000s, and find increases in plant-level productivity. I contribute those works by focusing on the case of an expansion in the set of intermediates covered by an efficient tax system.

I also contribute to a literature on access to intermediates in developing economies. In general, access to intermediates is distorted due to domestic distortions (Atkin and Donaldson, 2015; Atkin and Donaldson, 2022. These distortions are particularly pronounced in developing economies, where policy frictions can substantially raise the cost of acquiring and using intermediate inputs (Atkin and Donaldson, 2022). Key sources include limited contract enforcement, protectionist trade policies, and inadequate infrastructure, all of which impede efficient input allocation across firms. In general, the role of good quality infrastructure has also been identified as crucial (Fiorini et al., 2021; Asturias et al., 2019). Institutional quality, for instance for courts enforcing contracts, and more generally good domestic policies matter a lot (Boehm and Oberfield, 2020). Additionally, access to to foreign intermediates is also a crucial dimension of the performance of domestic plants (Amiti and Konings, 2007; Topalova and Khandelwal, 2011). An increased access to new intermediates has implications to production patterns; for instance with the adding of new domestic varieties in plants' output following trade liberalization (Goldberg et al., 2010). Alternatively, a reduction in barriers in input markets may prompt plants to start producing new goods whose technology relies on the plants' initial input mix (Boehm et al., 2022). I add to this literature by showing how commodity taxation is another type of institution whose design can have implications for both the sourcing of intermediates and the adding of new products and plant-level productivity.

This paper is organized as follows. Section 2 presents the conceptual framework guiding the analysis. Section 3 presents the data used and Section 4 the institutional background. Section 5 focuses on the identification strategy and Section 6 the results. Section 7 concludes.

## 2 Conceptual Framework

How would a reduction in commodity taxation on out-of-state goods impact sourcing and production decisions?

The removal of this distortions could impact plants' sourcing strategies in three ways. First, some plants may opt for substituting other types of inputs for intermediates. Indeed, costly intermediates may have prompted plants to rely on other types of inputs to produce. Brockmeyer et al. (2023) write that firms in inefficient tax systems may be incentivized to use more labor inputs, for instance.

Second, plants may react to the reform mechanically and source more in quantity of previously-sourced inputs, along the intensive margin. They may do that because of the new possibility to source more of the intermediate, for the same price as before, once the input taxes are removed.

Third, the reduction in input taxes may also prompt firms to explore the possibility to add new inputs, along the extensive margin. This makes sense, as adding a new input requires plants to incur a fixed cost plus variable costs. A reduction in the variable costs, due to reduced taxes on intermediates, may reduce the overall burden of the fixed cost of establishing the new supply reslationship, and incentivize plants to add an intermediate if they source enough of it. There are two ways adding intermediates can be beneficial to plants: (i) a price effect, as the newly-sourced intermediates may replace a prevously-sourced input, and (ii) a variety effect, since the new intermediates may not be entirely substitutable with the previously-sourced ones, and be added to the number of inputs used in the production process (Goldberg et al., 2010). Note that the goal of this article is not to distinguish between those two channels, but merely to argue that they are both likely at play in my empirical results.

The removal of this input-side distortion should also reduce plant-level misallocation of resources, permitting them to produce more efficiently. Therefore, productivity gains should also be expected, as well as increases in product scope (Goldberg et al., 2010).

# 3 Data

This paper draws on several datasets, which are presented in Table A.1.

**Plant-level data.** The main data source is the Annual Survey of Industries (ASI), a nationally representative panel of manufacturing plants. There are several reasons why the ASI is well-suited to study the effects of tax reforms on the production processes of plants (Boehm and Oberfield, 2020). First, it provides information at the plant-level rather than at the firm-level. Indeed, a firm may produce in different plants, potentially located far away from one another. Second, in addition to typical balance sheet information available in most firm-level datasets, the ASI includes detailed information on plants' use of intermediate inputs, as well as their production of goods. It provides that information following the Indian National Product Classification for Manufacturing Sector (NPCMS) at the 7-digit level.[4] Importantly, it records the origin (domestic or imported), physical quantity, purchase value and the unit price of the main intermediates sourced.[5] Third, it is representative of formal manufacturing plants, and, importantly, it covers the universe of large plants (over 100 workers). Fourth, it reports the total tax paid by plants on their supplies, net of input taxes if there is a possibility for plants to claim them.

[4]The NPCMS is a more detailed version of the CPC 2.1 classification. The two are identical up until the 5d-level.

[5]Unfortunately, information disaggregated at the input-level does not record all intermediates sourced, but only the main ones. However, the value of all intermediates sourced is recorded at the plant-level. It is therefore possible to compute the share of intermediates for which there is disaggregated information available. In 2014, the share is 91%, suggesting the disaggregated information for intermediate inputs in ASI indeed covers the vast majority of intermediates.

Because I study a reform which took place in 2017, I restrict the sample to the years 2012 to 2022 in the main analyses. I further trim the data to plants surveyed every year during that period, to avoid composition effects stemming from the entry of exit of plants in and out of the sample.[6] While this comes at the cost of keeping only large manufacturing plants in the estimating sample, it also has advantages. First, it helps ensuring issues related to the existence of informality, tax avoidance practices and tax exemption thresholds, which are common for smaller plants. Additionally, the restricted sample covers the universe of large plants and therefore provides an accurate picture of the top of the distribution of manufacturing plants. To summarize, the final sample is constituted of all large manufacturing plants in India.

It is important to acknowledge that the ASI also has intrinsic limitations in the context of this study. First, it does not provide information on the specific Indian state a domestic input is sourced from, nor about the specific country an imported good comes from. Second, as noted by Agrawal and Zimmermann (2025), the ASI is a survey, and is therefore not based on tax return data. This means that the tax information in ASI may be incorrect, as plants may have overreported the true tax paid to hide the fact that they practice tax evasion. I argue this issue is likely of limited impact here. Given that there was already a state-level GST before 2017, its self-enforcing properties may have incentivized plants to report the true taxes paid, and since the final sample is restricted to large formal plants, commodity tax evasion is less likely (Hoseini and Briand, 2020). The last limitation is that the ASI only provides information to the total tax paid by the plant on its supplies, and does not report infirmation on the input tax credit. It is therefore not possible to distinguish taxes paid on inputs from taxes on ouputs.[7]

**Nationwide GST data.** The second key data source is about the 2017 nationwide GST.[8]. Information about this reform was not available directly, but notifications in the form of PDF publications indicate key infrmation about the reform. They indicate for each good whether it is taxable or exempted, its rate if taxable, as well as potential changes of category. I codified the first notifications, issued on June 28th 2017, just prior to the implementation of the reform on July 1st. The June 28th notifications are the only ones which present the detailed structure of exempted goods and tax slabs.[9]

As an example, the first page of each of those PDFs is presented in Figure A.2. Panel A.1a is the first page of the document announcing exemptions, whereas Panel A.1b is the first page of the document indicating the rates applied to taxable goods. Relying on the classification of goods in the second coluymn of the document, I then merged the nationwide GST information with the ASI

[6] In effect, this means that I restrict the sample to large plants. In ASI methodology, plants surveyed every year are classified as census plants. Broadly speaking, census plants are large plants of 100 workers and above. In contrast to survey plants which are randomly sampled every few years, and therefore dropped when producing the balanced sample.

[7] In the empirical analysis in Section 6, I address some of those issues to claim that the decrease in the plant-level taxes primarily comes from a decline in input taxes, not output taxes.

[8] Note that I do not gather information about the pre-2017 state-level GST rates due to the complexity in obtaining those data for each state. Identification issues arising from this lack of data are adressed in Section 5.2

[9] Subsequent notifications only report changes relative to the June 28th notifications. To account for changes in the nationwide GST over time, I also codified follow-up notifications until 2022. What emerged is that the structure of the rates and exempted goods remains remarkably stable over time, with very few changes along those two dimensions, impacting fewer than 1% of plants in the sample. In the analysis, I therefore only keep GST rates and exempted goods for the initial announcement on June 28th 2017, and consider the reform as time-invariant.

through a 5-digit CPC-HS concordance table.[10] The merge was done for both the inputs and outputs of ASI, to have a plant-level measure of input-GST (to construct a mesure of input-weighted GST) and output-GST (to know whether the plant is producing an exempted good).

**Other datasets.** Lastly, for secondary analyses, I also gather tariff information from WITS for India's main trade partners, the EU27, United States, China, Japan, South Korea and ASEAN members, with input tariffs constructed with the 2007-2008 IO table. Finally, as gathered information on the evolution of interstate trade flows throughout from 2010 to 2019 for descriptive purposes.

# 4 Institutional Background

## 4.1 Manufacturing Plants and Access of Intermediates

India, like many developing economies, has a fragmented input market. Intermediate inputs are particularly impacted by the issue of excessive taxation, leading to high internal barriers, especially between states. This section turns to the data and discusses key facts on those impediments, and how plants adapt to them.

**Plants' reliance on intermediates** Large plants rely extensively on intermediate inputs in their production processes. Table A.3 describes some key characteristics of manufacturing plants across different subsamples for the year 2015. Column (1) presents the full dataset, whereas columns (2) to (4) are restricted to the estimating sample, with column (3) further restricted to importers and column (4) to multiproduct plants. Two key facts are worth mentioning. First, there is substantial adding and dropping of intermediates from one year to the next.[11] 48% of plants in the estimatig sample added at least one 7-digit intermediate input, and 45% of them dropped one. This is in line with the statistics provided by Lu et al. (2024), with the difference that they focus on imported inputs exclusively. Second, this observation is valid across different subsamples, with similar values of intermediate switching for importers (column 3) and multiproduct plants (column 4). However, those plants also tend to be larger, source more intermediates and manufacture more products. Overall, those observations suggest that plants seek to accumulate intermediates in order to produce more efficiently, only keeping the most efficient ones.

We next study plant-level sourcing dynamics. Table A.3 follows Halpern et al. (2015), extending their approach to both domestic and imported 7d-intermediates. It computes plant-level dynamics, along the intensive margin and various dimensions of the extensive margins, and aggregate them for years from 2012-2022.[12] The growth in the sourcing of intermediates relative to the previous year is given in column (3). It is by construction the sum of the growth of previously-sourced intermediates (column 3), of the growth of added intermediates (column 4) minus the decline due to dropped intermediates (column 7). Note that I further decompose added and dropped products by their origin,

[10] Also relying on the fact that CPC corresponds to NPCMS up to the 5d-level.

[11] This figure includes both domestic and imported varieties.

[12] Relying on survey data rather than transaction-level data is a limitation of those computations. Recall nonetheless Table A.3 primarily serves as a description to motivate the empirical analysis.

domestic or imported. The main message from Table A.3 is that there has been a reduction in both the adding and dropping or plants over time, notably after 2017.[13]

**The Indian market for intermediates.** The Indian internal market is highly fragmented. Plants are impacted on the input-side by a restricted ability to source the most efficient intermediates. Van Leemput (2021) finds that those intra-national costs make up to 40% of total trade barriers.[14] Despite their size, Indian states do not produce all types of goods. Production is geographically spread out. Figure A.2 illustrates the gross sale value of select categories of goods by district.[15] It is apparent that some districts do not produce the category of good under consideration. This effect is particularly strong for specialized and technological products, such as Office, optical and measurement apparatus or Transport equipment, or capital-intensive inputs such as Metal products and machinery. This means that a car producer in Uttar Pradesh, for instance, would have few options to source transport equipment in its own state and would have to source inputs out-of-state, a costlier transaction due to the distortions characterizing the market. Additionally, the structure of internal transactions has evolved over time. Relying on interstate transaction data, Figure A.3 shows that the aggregate quantity of goods crossing state borders has consistently increased since 2010, with a sharp increase around 2017, when the nationwide GST was implemented.

Those observations highlight the difficulties faced by manufacturers in India: plants need to source the most efficient intermediates and therefore they frequently add and drop inputs until they find the best possible option. In a fragmented input market, this process is costlier. Badly-designed commodity taxation has been identified as a major barrier to internal trade. We now describe in details how commodity taxation operates in India.

## 4.2 Commodity Taxation in India

**GSTs in theory and in practice.** A GST is designed to tax value added at each stage of the production chain (Brockmeyer et al., 2023). When a transaction between two establishments takes place, the seller declares to tax authorities the tax collected when selling the output (“output" GST) and the tax paid when purchasing inputs (“input" GST). The key characteristic of GSTs is that there exists an input tax credit, allowing sellers to credit the tax paid on inputs against the tax on their output, leaving only value added taxed.[16]

This “textbook" GST may not be an accurate description of how they are implemented in practice. Importantly, the input tax credit may be imperfectly enforced. Brockmeyer et al. (2023) notes that this

[13]There are no clear trends in the intensive margin. Note that the results may be impacted by the restrictions of the Covid-19 pandemic. Additionally, those observations are based on the entirety of manufacturing plants in India, and may hide substantial heterogeneity.

[14]Note that Van Leemput (2021)'s study is based on data from the early 2010s, well after state-level GSTs were implemented, indicating that this reform did not permit the unification of the domestic market.

[15]Data comes from the ASI aggregated at the product-2d-level. Some districts are never sampled, explaining why there is missing data even for commonly-produced categories such as foods and drinks.

[16]In addition to enabling input tax refunds, GSTs typically share additional features: the destination principle (the tax is paid where the good is sold, not where it is produced), non-discrimination between imported and domestic intermediates (which are both taxed at the same rate, can both be subject to the input tax credit), zero-rating of exports (a tax is not levied on exported goods, but exporters can claim input taxes).

may happen for various reasons: imperfect application of rules, notably delays between the paying of the tax and the input tax refunds, or the policy design itself (turnover thresholds, or exemptions, which this article exploits for the empirical analysis). Those inefficiencies, albeit common, lessen the positive effet of the input tax credit, the core advantage of GSTs over alternative commodity taxation systems, such as sales taxes (Dixit, 1990).

**History of GST implementation in India.** India transitioned from a sales tax, taxing inputs at each stage of production, to a GST, taxing only value-added, in two steps. First, it introduced a state-level GST in the mid-2000s, introducing a partial input-tax credit[17] Then, in 2017, it implemented the nationwide GST on which this paper focuses.

To better understand the significance of the 2017 reform, consider Figure A.4, which plots the average plant-level tax per sales over the period 1998-2022.[18] It is easy to see the two reforms described above: first, the implementation of the state-level GST in the mid-2000s decreased by roughly 65% the average tax per gross sales faced by plants, dropping from 6% to 4%. Then, after remaining relatively stable for several years, the average plant-level tax burden again dropped suddenly in 2017 by approximately 50%. In both cases, the decrease is likely due to the reduction in input taxes, since the output taxes did not change much. Indeed, they were already quite low when transitioning from the sales taxes to the state-level GST, because of tax wars between states. Additionally, even under the state-level GST, taxes remained low to avoid regressivity of the tax system (Sharma, 2021). Figure A.5 plots the average tax per gross sales in select industries by state. Taxes per sales were indeed low for consumer goods but could be quite high for other types of goods used as intermediates, with substantial heterogeneity between states. This suggests that the real issue with taxation was not so much rates for final good producers, but the accumulation of taxes on inputs along the supply chain.[19]

An example is useful to see how important the implementation of a nationwide GST was, relative to previous tax systems. The discussion in Section A.5.2 illustrates it through a simplified production structure. The focal plant is a vaccine producer located in Andhra Pradesh (the Producer). It sources three intermediate inputs from various locations (Suppliers A, B and C), and sells its output to a retailer (the Buyer). Figure A.6 presents the three possible cases in terms of input taxes and input tax credit. In Case 1, that of a sales tax such as in pre-2000s India, there is never the possibility to claim input taxes so the effective tax paid is the sum of input taxes of all suppliers added to the output tax. Case 2 illustrates the situation when a state-level GST made it possible to claim some of the taxes paid on inputs, as long as they were purchased from the same state. Plants were still taxed on their inter-states supplies, greatly limiting the pool of potential intermediates.[20] Finally, Case 3 shows how the implementation of a nationwide GST in 2017 vastly expanded the set of intermediates eligible to input tax credit: plants could for the first time source intermediates from anywhere in the world, and

[17] In other works, this reform is generally referred to as "state-level VAT".

[18] I rely on the full length of the ASI panel to produce this statistics.

[19] In addition to state-level GST, there were also high entry taxes for goods crossing states borders, and which could not be claimed. Those entry taxes were also removed in 2017.

[20] When the state-level GST was enforced, there was a mechanism called CENVAT which in principle provided an input tax credit for interstate transactions. However, state-level GST and CENVAT could not be credited against each other, making the mechanism highly inefficient (Agrawal and Zimmermann, 2024). That is why nationwide GST is considered to have implemented the first India-wide input tax credit.

not just their own state.

# 5 Identification Strategy

## 5.1 Identifying Treated and Control Plants

**Exemption as a source of identification.** An empirical evaluation of the effects of the nationwide GST on plant behavior and performance requires distinguishing between treated plants and control plants. This process is not straightforward as the reform was meant to be all-encompassing, a complete overhaul of the previous tax system. In reality, while the 2017 reform indeed largely removed previous distortions, some specificities in its design can be exploited to define a control group.

I focus on the fact that some goods were exempted from the reform, and therefore unable to claim input taxes. This is, to my knowledge, the first study exploiting commodity tax exemption to estimate the causal effect of a reform, although similar approaches have been used for trade policy analysis.[21][22] The existence of exempted goods provides the opportunity to compare plants suddenly able to exploit the introduction of the nationwide input tax credit, thus able to claim input taxes on intermediates sourced from other states or abroad. One advantage of focusing on exemption is that the one-time nature of the reform, on July 1st 2017, protects it from issues common in staggered designs or with continuous treatment variables (de Chaisemartin and D'Haultfœuille, 2018). A good is *taxable* if it is not exempted, that is, if it is within the scope of the nationwide GST reform.

$$\text{Included}_j = \begin{cases} 0, & \text{if good } j \text{ is on the list of exempted goods} \\ 1, & \text{otherwise} \end{cases} \tag{1}$$

Before moving on to the next step, which will be to define treated and control *plants*, I discuss some characteristics of exempted goods, specifically the potential issues associated with using the practice of exemption as an identification strategy.

I first check that exempted goods are not fundamentally different from taxable goods. Table B.1 presents the structure of the tax slabs and shows that exempted goods are quite common (there are 1091 of them, approximately 25% of all goods). In general, the main reason for exempting a good is to avoid an escessive tax burden or administrative cost. It could then be that all exempted goods are cheap or low-quality goods, all produced in more the same industries (food, or textile). While there is some truth to that, Table B.2 indicates that the reality is more nuanced. For 2-digit industries, it reports the average tax rate in that industry (for taxable goods only), the share of exempted goods in that industry and the share of imports in that industry. The table shows that there indeed tax

[21] For instance, Bas and Strauss-Kahn (2015) use processing firms, which are exempted from tariffs, as a control group.

[22] Another possibility could have been to rely on the fact that plants below a certain level of sales are excluded from GST, including the input tax credit. In principle, one could implement a regression discontinuity design to estimate the local treatment effect at the cutoff. Unfortunately, this is not an appropriate empirical approach in this setting. Figure B.1 shows why by plotting the distribution of plants by ln turnover for the years 2012 and 2018. It is easy to see that even prior to the reform, there was significant bunching just around the threshold, probably because the nationwide GST thresholds are actually the same as those that were enforced under the state-level GST. Plants were likely operating just below the threshold for tax evasion purposes. In that case, the effects of the nationwide GST would not be randomly assigned to plants, making the identification strategy invalid.

rates are lower and exemption more common in domestic industries (agriculture, food, textile), and that exemption becomes less common in more technologically complex industries which tend to be imported. However, there is also a lot of heterogeneity in the shares of exempted goods within industries, suggesting that exemption is a common practice across the entire economy.

Another way to justify the use of exemption in the analysis is to describe the political context around 2016. It is unlikely that the decision to exempt goods, or the choice of tax rates on taxable goods, was based on considerations regarding access to intermediates and plants' sourcing decisions. Most discussions about the reform were about the revenue sharing between states, making the resulting structure of the slabs largely exogeneous to plants' characteristics. Negociations had stalled for years, but the arrival of the BJP party in power in 2014 accelerated the negociations (Sharma, 2021). Due to the sudden accelaration of discussions, implementation details were not made official until relatively late. For example, the actual number of tax slabs became known only several months prior to implementation, reducing the risk of anticipatory effects.

I now check those arguments more formally. Lobbying activities may have protected the interests of specific industries. For instance, less productive industries may have lobbied to be excluded from GST if they thought the administrative burden would be too high. In that specific case, there could be underlying differences between plants producing exempted goods and taxable goods in their underlying productivity. To test this, I proceed by running an analysis in the spirit of what Topalova and Khandelwal (2011) do for tariffs. Specifically, I ensure that there is no systematic correlation between the fact that a good is exempted (or its nationwide GST rates if it is taxable) with the pre-reform characteristics of that good. Results are presented in Table C.1. Including only year fixed effects, there is always a highly significant correlation between taxable status (*i.e.*, non-exemption). Adding 2d-industry fixed effects makes the correlation non-significant: conditional on that, exempted goods do not differ from taxable goods in their pre-reform characteristics.[23]

**From taxable goods to treated plants.** Having shown that taxable/exempted goods were likely not selected based on their pre-reform characteristics, the next step is to assign treatment status to plants. The key idea is that plants producing exempted goods cannot claim input tax credit, whereas those which produce taxable goods can. Because production decisions are endogeneous to the reform, we fix the production of plants as the average for the years 2014, 2015 and 2016, just before the implementation of nationwide GST.

For single-product plants or multiproduct plants producing only one type of goods, treated plants will be those that were producing goods just prior to the reform that ended up being taxable, thereby permitting the plant to claim input taxes for out-of-state intermediates. Conversely, control plants are those which where producing goods which ended up being exempted under the nationwide GST, not allowing them to claim ITC. In the case of multiproduct plants initially producing both types of goods, we look at the way input taxes can be claimed in practice. Appendix D.1 presents in detail this process works. Importantly, it indicates that multi-product plants producing both taxable and exempted goods are able to claim input taxes in proportion to their production of taxable goods. This allows me to

[23]A similar analysis is carried out for the tax rates. See Table C.2. There is never a statistically significant correlation between the tax rates and the pre-reform industry characteristics.

define the main treatment variable, $\text{Eligible}_i$, which a time-invariant indicator variable defined in the following way.

$$\text{Eligible}_i = \begin{cases} 1, & \text{if Included}_j = 1 \\ & \text{for at least 50\% of the pre-reform product mix (in value) of plant } i \\ 0, & \text{otherwise} \end{cases} \tag{2}$$

Because $\text{Eligible}_i$ is dichotomized based on an arguably arbitrary threshold (50%), I also construct two alternative treatment variables, whose construction is defined in Appendix **??**. Specifically, Alt $\text{ITC}_i^{NatGST}$ assigns treated status to any plant producing at least one taxable good, no matter how little of it relative to exempted goods. Share $\text{ITC}_i^{NatGST}$ is a measure of the intensity of the treatment, and is simply the value of taxable goods over the value of all products manufactured.

Before turning to examining sourcing and production decisions, it is important to ensure that those variables indeed capture well exposure to the nationwide GST reform. Specifically, $\text{Eligible}_i$ and its variations should be associated to decreases in plant-level taxes in a causal way. In appendix **??**, I estimate an equation in which the dependent variable is the tax per gross sales of the plant. Results are presented in Table D.1, which estimates that eligibility to input tax credit caused a reduction in tax per gross sales relative, to plants in the control group. Given that the avarage tax per gross sales was approximately 4% pre-reform, this implies that treated plants benefited from a reduction in overall tax burden of almost 50%. In columns (2) and (3), I ensure that the results are robust to alternative treatment definitions. More precisely, in column (3) I restrict the sample to plants with taxable share of production strictly above 0 and stricly below 1, to ensure the results are not picked up by share value of exactly 0 or 1. In column (4), I restrict the sample to single-product plants and the results remain similar. In order to test for pre-trends, I also estimate an event-study specification of equation (D.3), not including the trends in the estimation. Figure D.2 shows the absence of pre-trends. Figure D.3 decomposes the results by input-weighted nationwide GST tercile: the effects are stronger for plants with a high level of input-weighted GST, suggesting the results are driven by a more effective input tax credit. Figure D.4 is similar but creates a tercile of input-weighted GST plus output-weighted GST, since control and treated plants also differ in that control plants do not pay taxes on their supplies, unlike treated plants, and results are robust.

## 5.2 Empirical Model

The identication strategy leverages two sources of variation: between plants producing different goods (inducing different ability to claim input taxes), and over time (before and after the reform). The baseline regressions are based on the following model:

$$\begin{aligned} y_{i(js)t} = \beta_0 + \beta_1 \text{Post}_t^{2017} + \beta_2 \text{Eligible}_i + \beta_3 \text{Post}_t^{2017} \times \text{ITC}_i^{NatGST} \\ + \beta_4 \text{Trends}_{it}^{2012} + \delta_i + \delta_{jt} + \delta_{st} + \varepsilon_{i(js)t} \end{aligned} \tag{3}$$

In equation (3), $y_{i(js)t}$ is a measure of input sourcing of plant $i$, located in state $s$ and producing in industry $j$, at time $t$. In the baseline regressions, it can be four variables: (i) the log value of intermediates sourced by the plant, (ii) the share of intermediates over total inputs, (iii) the log value of (7-digit) intermediates that were already sourced the previous year (intensive margin), or (iv) the number of intermediates sourced by the plant (capturing changes in the extensive margin).

On the right-hand side of this baseline specification, $\text{Post}_t^{2017}$ is an indicator taking value 1 if year $t$ is 2017 or after. The treatment variable, $\text{Eligible}_i$, indicates ability of plant $i$ to claim input tax credits. The key explanatory variable is the interaction of those two terms, $\text{Post}_t^{2017} \times \text{Eligible}_i$, making $\beta_3$ the coefficient of interest. $\delta_i$ is a plant fixed effect capturing any time-invariant plant characteristic. $\delta_{jt}$ is a 2d-industry-year fixed effect, accounting for time-varying aggregate shocks across broad industry groups. $\delta_{st}$ is a state-year fixed effect, particularly important in a decentralized system such as India, where key legislations are typically passed at the state-level, as discussed in Chapter 1. Finally, $\text{Trends}_{it}^{2012}$ ensures that the model compares plants under similar trends prior to the reform. Specifically, this vector contains importer, exporter and multiproduct dummies, to account for the fact that control and treated plants may differ along those lines.[24] As in Looi Kee and Tang (2016) and Villegas-Sanchez and Prades Illanes (2023), it also contains capital-intensity and wages per gross sales trends, since capital deepening and labor costs may influence sourcing decisions. Note that those variables are included as trends, because the variables themselves are likely to vary as a consequence of the reform, so controlling for them would induce bias.

I estimate equation 3 with OLS in all cases except when the outcome variable is a count, such as the number of intermediates sourced. In that case, I follow the standard practice and estimate the equation with PPML, which seems appropriate since in some cases the count of intermediates can be zero (for instance, if the count is for imported intermediates), but not too dispersed (which here should be the case since we only have information on the main inputs). Lastly, standard errors are clustered at the 5-digit of the main good produced, corresponding to the level of variation of the main explanatory variable.[25].

# 6 Results

## 6.1 Effects on the Sourcing of Intermediates

**Main results.** Table 1 presents how the reform impacted the main margins of the sourcing of intermediates.

In column (1), the coefficient on $\text{Post}_t^{2017} \times \text{Eligible}_i$ suggests that treated plants increased the value of intermediates sourced by 4.49%, relative to control plants, indicating the positive effect of the reform on access to intermediates. Next, in column (2), the reform does not appear to have a statistically-significant effect on the share of intermediates over total costs, meaning that there is no substitutability between intermediates and other types of inputs such as labor or capital. In column (3), eligibility to input tax credit is associated with a 35% decrease in the value of intermediates

[24] For instance, Table ?? suggests that import-intensive industries tend to have less exempted goods.

[25] Indeed, goods produced by plants are picked based on exemption status defined at the 5-digit level.

Table 1: Effects of nationwide GST on the plant-level sourcing of inputs

| | ln Intermediates$_{it}$ (1) | Intermediates Share$_{it}$ (2) | ln Previous Year$_{it}$ (3) | # Intermediates$_{it}$ (4) |
|---|---|---|---|---|
| $\text{Post}_t^{2017} \times \text{Eligible}_i$ | 0.044** | 0.003 | -0.304** | 0.060*** |
| | (0.022) | (0.003) | (0.152) | (0.012) |
| Plant-level trends$_{it}$ | ✓ | ✓ | ✓ | ✓ |
| Plant$_i$ FE | ✓ | ✓ | ✓ | ✓ |
| State$_s$ × Year$_t$ FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry$_j$ × Year$_t$ FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 117,285 | 117,285 | 117,205 | 116,555 |
| R-squared | 0.916 | 0.803 | 0.445 | |
| Pseudo R-squared | | | | 0.451 |

*Notes:* OLS estimation for columns (1) to (3), and PPML estimation for column (4). ln Intermediates$_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. Intermediates Share$_{it}$ is the share of intermediates over total input cost of plant $i$ in year $t$. ln Previous Year$_{it}$ is the log value of 7d-intermediates sourced by plant $i$ in year $t$ and which were already sourced in year $t-1$. # Intermediates$_{it}$ is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. $\text{Post}_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Eligible$_i$is the main measures of the treatment. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

which had been sourced in year $t-1$, and still sourced at year $t$. Finally, treated plants increase the number of intermediates sourced by 6% relative to control plants, suggesting not only an effect at the extensive margin, but also that plants accumulate more intermediates (instead of simply replacing one intermediate with another).

**Robustness checks.** This subsection addresses several identification concerns arising from estimating model (3). The first type of robustness checks I carry out deals with alternative specifications and set of fixed effects. First, sourcing decisions tend to be strongly serially autocorrelated, meaning that their past value determines much of their present value (Villegas-Sanchez and Prades Illanes, 2023). This is an issue which couls induce bias in the estimates, with the risk of making significant coefficients which truly are not. To deal with that issue, we follow Bertrand et al. (2003) and collapse the data for the three years before and the three years after the reform. Table E.1 presents the results, which are robust for columns (3) and (4). Next, in Table E.2, I estimate an equation similar to model (3) but only include year and plant FE. Then, in Table E.3, I ensure that the differerences-in-differences approach really compares plants with similar pre-reform sourcing practices. The inclusion of the 2d-industry-year FE partly controls for that, but there is a large amount of heterogeneity in input sourcing within industries in India (Boehm and Oberfield, 2020). That is why I also include a 3d-intermediates-year FE. Its function is to compare plants initially sourcing the same set of 3d-intermediate inputs (not in value, because it would be unique to each plant, but in number and 3d-NPCMS category of intermediates). Results are robust to the inclusion of that fixed effect.

The second type of checks is concerned with alternative definitions of the treatment. Table E.4 is similar to the table in the main results, but with the alternative treatment variable defined in equation (D.1). Similarly, I restrict the sample to plants producing at least one exempted and one taxable good and exploit the resulting variation in treatment intensity, defined in equation (D.2). In both cases the results are robust at the extensive margin: plants with greater ability to claim input taxes source a greater number of intermediate inputs.

The final type of robustness checks which I implement is to mitigate the risk of ommitted variables missing from model (3). The first type of ommitted variable is the log of gross sales, which is included here to ensure that the results are not driven the fact that treated plants expand production following the reform, and that they do not source more inputs purely due to that reason.[26] Results are presented in Table E.6. The results are also robust to changes in trade policy, which may have made foreign inputs cheaper (see Table E.7), as well as to changes in market concentration which could have raised plants' markup and therefore ability to buy inputs (Table E.8). Lastly, the results are robust to the inclusion of trends in the share of plant-level intermediates per inputs or tax per sales, which account for the fact that control and treated plants may have been on different trends in terms of their reliance to taxed intermediates prior to the reform. Future control plants may have, for instance, predicted that the upcoming nationwide GST would declare their main product exempted, and therefore decrease their reliance on intermediates before the implementation of the reform. Results are robust and are presented in Tables E.9 and E.10.

Overall, the most robust results seem to be on the extensive margin: treated plants are able to source new intermediates after the reform. Moreover, the fact that the number of intermediates sourced increases suggests an accumulation, and not just replacement, of intermediates.

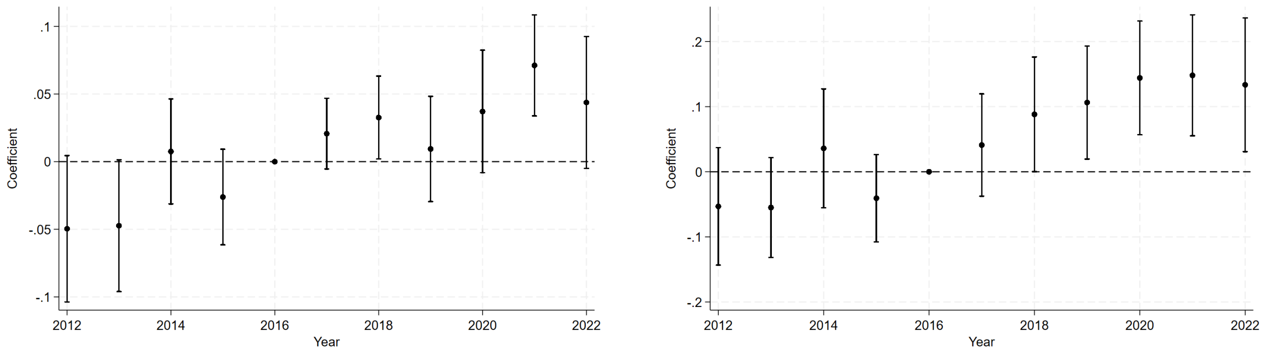
**Intensive margin.** The results in column (3) of Table 1, which appeared to suggest a reduction in the value of intermediates already sourced, are not robust across all specifications. An analysis at the plant-level makes it difficult to accurately analyze how plants respond on the intensive margin of intermediates, because it aggregates across many different inputs. To better understand how the reform impacted the intensive margin, I implement an analysis at the input-plant level. To deal with composition bias, I create a balanced panel and restrict the sample to inputs sourced by a plant all years from 2012 to 2022. Results are presented in Table E.11. The table separates domestic from imported inputs. A striking observation is that the price of the intermediates sourced by treated plants seems to decrease relative to control plants. This is surprising, since the tax is included in the purchase price, and claimed only afterwards, so sellers could keep their prices up and the buyers would still benefit later from the input tax credit. There are two possible explanations for these effects: (i) the price of suppliers decreases due to the fact that the supplier also benefits from the reform and in particular may become more productive due to the lower tax burden; or (ii) the focal plant actually switches to an alternative, cheaper supplier to buy the same type of intermediate. Data limitations precludes me from investigating this effect further, since this is not a transaction-level data. I also estimate an event-study version of equation (E.4), and the results indicate a clear increase in the quantity of domestically-sourced intermediates for treated plants that is persistent over time post-reform, but not for imported intermediates.

**Heterogeneity.** I now study what the main drivers to those changes in sourcing practices are. First, I check what type of intermediates plants sourced in greater numbers: domestic, or imported. I estimate the event-study version of equation (3). Results are presented in Figure 1: treated plants source relatively more of both types of intermediates, but the effect is much stronger for imported intermediates. Relative to the base year (2016), increase in the number of imported intermediates is

[26] If that was the case, the results would merely be picking up a mechanical increase in intermediates due to plant expansion, which may happen for other reasons.

approximately 12% in 2021, against an increase of only 5% for domestic inputs. The reform therefore appears to have particularly boosted imports of new intermediates.

Figure 1: Nationwide GST and sourcing of inputs: number of domestic and imported intermediates




(a) Domestic intermediates

(b) Imported intermediates

To better understand those results, I then check what kind of imported or domestic intermediates plants add. Unfortunately, I do not have information on the specific state or country a given intermediate is bought from. One way to circumvent this issue, at least to some extent, is to gather information on whether the sourced intermediate is produced in the same state the plant is located in, or not.[27] Table E.12 presents the results. Columns (2) and (3) focus on domestically-sourced intermediates. In column (2), the dependent variable is the count of intermediate inputs sourced domestically and which we know are not produced in the same state; whereas in column (3) the dependent variable is the count of domestically-sourced intermediates and which are also produced in the same state as the plant. Columns (4) and (5) proceed similarly but for imported intermediates. The results of the analysis suggest that treated plants are generally equally as likely to source new domestic intermediates whether they are produced in the same state or not; whereas plants imported new intermediates do so for intermediates which are already produced in their state. The fact that plants add intermediates which are already produced close to them suggests that imported inputs are not entirely substitutable to domestic inputs, a well-known result in the trade literature (Halpern et al., 2015). Lastly, table E.13 further decomposes those effect by plant employment. It shows that the results are driven by large plants, especially those with more than 500 workers.

Lastly, I show that the effects of the reform also vary depending on existing institutions. In particular, they appear to boost the effects of previously-implemented policies which failed to be as efficient as they could have due to domestic distortions. From Chapter 1, we know that input tariffs had already been liberalized for decads before 2017. Yet, it is possible that they failed to propagate throughout the Indian internal market, especially in inland states far away from major ports from which those foreign inputs arrived in India. Van Leemput (2021) discusses this and predicts that the nationwide GST likely reduced this issue. I formally test this hypothesis and regress the plant-level share of imported intermediates on the post-treatment dummy, and interact it with input tarifs. Results are presented in Table E.14: indeed, the interaction between the two is negative and significant, implying that the effect of lower input tariffs increases even import shares even more in a less distorted

[27] It is easy to create that variable from the ASI.

tax environment.[28] In Table E.15, I further test for this by showing that the effects of the nationwide GST in plant-level import shares are stronger in plants located away from ports.[29]

## 6.2 Effect on Productivity and Production Decisions

This section focuses on the output-side effects of the reform. It studies what the more efficient allocation of resources within plants, notably the ability to accumulate intermediates, implies for plant-level productivity and its ability to manufacture new products. Additionally, I investigate whether plants excluded from the input tax credit develop strategies to reduce the cost of input sourcing.

**Effect on Productivity.** First, I study whether the reduction in taxes impacted plants' productivity. This was already the case when India implemented its state-level GST (Agrawal and Zimmermann, 2025). In principle, the reduction in input-side distortions should increase the productivity of all treated plants. I test for this in Table F.1, which is collapsed in a pre-reform and post-reform period. I define productivity as the log of value-added per worker. The results indicate no direct effect of the reform on productivity. However, an analysis by plant size suggests that the reform vastly increased the productivity of large plants. The direct effect of the reform continues to be insignificant, but, relative to the ommitted category (plants with 100-199 workers), treated plants with more than 500 employees benefited from an increase in productivity of approximately 8%. Those effects are therefore very large, and are valid for alternative definitions of the treatment. It is interesting to recall that the results on input sourcing also indicated that larger plants were the ones sourcing more intermediates post-reform.

**Effect on the number of products manufactured.** A related question to ask, is whether plants add outputs to their production mix following the reform. Indeed, access to new intermediates should prompt plants to produce differently. This has been shown in the context of India for imported inputs as well as domestic ones (Goldberg et al., 2010; Boehm and Oberfield, 2020). Results are presented in Table F.2, and suggest a statistically significant increase in the number of goods produced for large treated plants.

**Strategies to reduce the cost of intermediates.** A related question is whether plants switch their production decisions in order to reduce become eligible to input tax credit. If control plants still face high input taxes, they may adapt their decisions to limit the cost of inputs. One adjustment margin would be to engage in non-taxed (informal) transactions of intermediates or to use more labor inputs (Brockmeyer et al., 2023). Here, I provide evidence that an additional margin of adjustment for plants initially excluded from the reform is to switch their production decisions towards the production of taxable (non-exempt) goods, in order to become eligible to input tax credit. To study this, I restrict the sample to control plants and interact the post-reform dummy variable with a measure of plant-level input-weighted GST rates. Results are presented in Table F.3. The main finding in this table is that plants facing higher taxes on their inputs increase relatively more the share of production of taxable

[28] The effect of input tariffs alone is not important: there was little variation in tariffs in the 2010s. What is of interest here is the fact that already low tariffs can suddenly be exploited by plants.

[29] I compute the average distance between the district the plant is located in and the district where the port is located, following the methodology defined in Couttenier et al. (2023).

Table 2: Effect on value-added per worker

| | ln Value-added per worker$_{it}$ | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| ln Labor$_{it}$ | | -0.508*** | -0.507*** | -0.403*** |
| | | (0.080) | (0.078) | (0.049) |
| Post$_t^{2017}$ × Eligible$_i$ | 0.021 | -0.013 | | |
| | (0.019) | (0.028) | | |
| Post$_t^{2017}$ × Eligible$_i$ × Less than 100 workers$_{it}$ | | -0.021 | | |
| | | (0.079) | | |
| Post$_t^{2017}$ × Eligible$_i$ × 200 − 299 workers$_{it}$ | | 0.038*** | | |
| | | (0.015) | | |
| Post$_t^{2017}$ × Eligible$_i$ × 300 − 399 workers$_{it}$ | | 0.056*** | | |
| | | (0.021) | | |
| Post$_t^{2017}$ × Eligible$_i$ × 400 − 499 workers$_{it}$ | | 0.067*** | | |
| | | (0.025) | | |
| Post$_t^{2017}$ × Eligible$_i$ × More than 500 workers$_{it}$ | | 0.078*** | | |
| | | (0.026) | | |
| Post$_t^{2017}$ × Alt Eligible$_i$ | | | -0.029 | |
| | | | (0.021) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × Less than 100 workers$_{it}$ | | | -0.021 | |
| | | | (0.077) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × 200 − 299 workers$_{it}$ | | | 0.040*** | |
| | | | (0.014) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × 300 − 399 workers$_{it}$ | | | 0.057*** | |
| | | | (0.020) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × 400 − 499 workers$_{it}$ | | | 0.069*** | |
| | | | (0.025) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × More than 500 workers$_{it}$ | | | 0.079*** | |
| | | | (0.025) | |
| Post$_t^{2017}$ × Share Eligible$_i$ | | | | -0.014 |
| | | | | (0.030) |
| Post$_t^{2017}$ × Share Eligible$_i$ × Less than 100 workers$_{it}$ | | | | 0.034 |
| | | | | (0.046) |
| Post$_t^{2017}$ × Share Eligible$_i$ × 200 − 299 workers$_{it}$ | | | | 0.010 |
| | | | | (0.030) |
| Post$_t^{2017}$ × Share Eligible$_i$ × 300 − 399 workers$_{it}$ | | | | 0.026 |
| | | | | (0.029) |
| Post$_t^{2017}$ × Share Eligible$_i$ × 400 − 499 workers$_{it}$ | | | | 0.033 |
| | | | | (0.029) |
| Post$_t^{2017}$ × Share Eligible$_i$ × More than 500 workers$_{it}$ | | | | 0.056* |
| | | | | (0.030) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Post FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Post FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 27,224 | 27,224 | 27,224 | 4,590 |
| R-squared | 0.818 | 0.840 | 0.840 | 0.905 |

*Notes:* This table collapses together the pre-reform (2014, 2015 and 2016) and post-reform (2017, 2018 and 2019) years. OLS estimation. Columns (1) to (3) contain the whole sample, and column (4) is restricted to plants producing at least one taxable and one exempt product. ln Value-added per Worker$_{it}$ is the value-added per production worker by plant $i$ in period $t$. Post$_t^{2017}$ is an indicator variable taking value 1 in the post-reform period, and 0 otherwise. Plant-level trends$_{it}$ are the first period values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a period indicator. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

goods making them eligible to the input tax credit. This highlights the diversity of the margins of adustments stemming from a distorted commodity taxation due to the practice of exemption.

# 7 Conclusion

This paper provides causal evidence that the removal of cumulative taxation significantly shapes production plants' input-sourcing and production decisions. Exploiting the introduction of a nationwide input tax credit, I show that input taxes faced by treated plants decline by nearly one half following the reform. In response, these plants expand sourcing along the intensive margin, by increasing purchases of previously sourced inputs, and, most importantly, along the extensive margin, with the total number of intermediate inputs used increasing by approximately 6 percent. These effects are heterogeneous: they are stronger for larger plants, for plants located further away from ports, and for firms operating in industries characterized by low input tariffs. This suggests complementarity between domestic and trade policies. Consistent with improved access to intermediate inputs, treated plants experience relative gains in productivity and expand the range and quantity of goods produced in the post-reform period.

Beyond documenting these effects, the results highlight important policy trade-offs inherent in the design of input tax credit systems. While unified taxation lowers input costs and improves access to new intermediates, this effect is concentrated among larger plants. Importantly though, I do not find empirical evidence that smaller plants are hurt by the reform, but rather that they are not impacted in terms of input sourcing or productivity per worker. This suggest that the costs of implementing a nationwide GST are smaller than previously thought, especially at the bottom of the formal plant size distribution. This may call for a rethinking of common tax practices made to reduce those costs (*e.g.*, through exemptions or turnover thresholds). An alternative approach could be to replace exemptions by zero-rating, which does not break the chain of the input tax credit and thus does not lead to cumulative taxation. As debates over how to increase tax revenue harmonize tax systems remains ongoing in many emerging economies, these findings speak directly to the design of domestic tax policy aimed at improving firms' production efficiency and long-run growth.

## References


Agrawal, D. R. and L. Zimmermann (2024): "Agrawal, David R.and Brueckner, Jan K. and and Brülhart, Marius," *Annual Review of Economics*.

——— (2025): "The Effects of Adopting a Value Added Tax on Firms," *Review of Economics and Statistics*.

Amiti, M. and J. Konings (2007): "Trade liberalization, intermediate inputs, and productivity: Evidence from Indonesia," *American Economic Review*, 97(5), 1611–1638.

Arnold, J. M., P. Battiau, F. Fall, and K. Spies (2025): "The reform of Brazil's consumption tax system," *OECD Working Paper*.

Asturias, J., M. Garcia-Santana, and R. Ramos (2019): "Competition and the Welfare Gains from Transportation Infrastructure: Evidence from the Golden Quadrilateral of India," *Journal of the European Economic Association*, 17, 1881–1940.

Atkin, D. and D. Donaldson (2015): "Who'se Getting Globalized? The Size and Implication of Intra-National Trade Costs," *NBER Working Paper Series*.

——— (2022): "The Role of Trade in Economic Development," *Handbook of International Economics*, 5.

Bas, M. and V. Strauss-Kahn (2015): "Input-trade liberalization, export prices and quality upgrading," *Journal of International Economics*, 95, 250–262.

Benzarti, Y. and D. Carloni (2019): "Who Really Benefits from Consumption Tax Cuts? Evidence from a Large VAT Reform in France," *American Economic Journal: Economic Policy*.

Benzarti, Y., D. Carloni, J. Harju, and T. Kosonen (2020): "What Goes Up May Not Come Down: Asymmetric Incidence of Value-Added Taxes," *Journal of Political Economy*.

Benzarti, Y. and A. Tazhitdinova (2021): "Do Value-Added Taxes Affect International Trade Flows? Evidence from 30 Years of Tax Reforms," *American Economic Journal: Economic Policy*.

Bertrand, M., E. Duflo, and S. Mullainathan (2003): "How Much Should We Trust Differences-in-Differences Estimates?" *The Quarterly Journal of Economics*.

Boehm, J., S. Dhingra, and J. Morrow (2022): "The Comparative Advantage of Firms," *Journal of Political Economy*, 130.

Boehm, J. and E. Oberfield (2020): "Misallocation in the Market for Inputs: Enforcement and the Organization of Production," *Quarterly Journal of Economics*, 135, 2007–2058.

Brockmeyer, A., G. Mascagni, V. Nair, M. Waseem, and M. Almunia (2023): "Does the Value-Added Tax Add Value? Lessons Using Administrative Data from a Diverse Set of Countries," *Journal of Economic Perspectives*, 38(1), 107–132.

Couttenier, M., N. Monnet, and L. Piemontese (2023): "The Economic Costs of Conflict: A Production Network Approach," *Working Paper*.

de Chaisemartin, C. and X. D'Haultfœuille (2018): "Two-way fixed effects estimators with heterogeneous treatment effects," *arXiv preprint arXiv:1803.08807*.

Dixit, A. (1990): "International Trade Effects of Value-Added Taxation: Comment," in *Taxation in the Global Economy*, National Bureau of Economic Research, Inc.

Fiorini, M., M. Sanfilippo, and A. Sundaram (2021): "Trade Liberalization, Roads and Firm Productivity," *Journal of Development Economics*, 153.

Gadenne, L., T. K. Nandi, and R. Rathelot (2022): "Taxation and Supplier Networks: Evidence from India," *Working Paper*.

Goldberg, P., A. Khandelwal, N. Pavcnik, and P. Topalova (2010): "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India," *Quarterly Journal of Economics*.

Halpern, L., M. Koren, and A. Szeidl (2015): "Imported Inputs and Productivity," *American Economic Review*, 105, 3660–3703.

Hoseini, M. and O. Briand (2020): "Production efficiency and self-enforcement in value-added tax: Evidence from state-level reform in India," *Journal of Development Economics*.

Looi Kee, H. and H. Tang (2016): "Domestic Value Added in Exports: Theory and Firm Evidence from China," *American Economic Review*, 106, 1402–1436.

Lu, D., A. Mariscal, and L.-F. Mejia (2024): "How firms accumulate inputs: Evidence from import switching," *Journal of International Economics*, 148, 1726–1768.

Sharma, C. K. (2021): "The political economy of India's transition to Goods and Services Tax," *GIGA Working Papers, No. 325*.

Topalova, P. and A. Khandelwal (2011): "Trade Liberalization and Firm Productivity: The Case of India," *The Review of Economics and Statistics*, 93, 995–1009.

Van Leemput, E. (2021): "A passage to India: Quantifying internal and external barriers to trade," *Journal of International Economics*, 131.

Van Leemput, E. and E. Wiencek (2017): "The Effect of the GST on Indian Growth," *International Finance Discussion Paper Note*.

Verhoogen, E. (2023): "Firm-Level Upgrading in Developing Countries," *Journal of Economic Literature*, 61(4), 1410–1464.

Villegas-Sanchez, C. and E. Prades Illanes (2023): "Made in Spain: Import Switching and Productivity," *Working Paper*.

# Appendices

## A Data and Descriptive Statistics

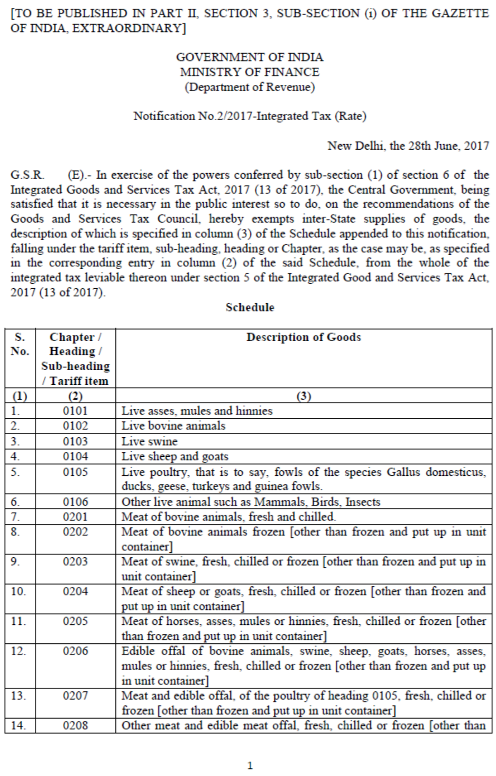
### A.1 Datasets used

Table A.1: Summary of the main datasets used in Chapter 2

| Dataset | Source | Description | Years |
|---|---|---|---|
| *Annual Survey of Industries* (ASI) | MOSPI | Panel of large formal manufacturing plants. Sample restricted to plants belonging to the "census" part of the survey, sampled every year. Detailed information on 7-digit intermediates, products and tax paid. Used for the main plant-level and within-plant-level regressions, as well as for creating representative aggregate statistics and controls. | 2012 to 2022 |
| *Goods and Services Tax* | Gazette of India | Compilation of GST rates and exemption status for official notifications. No time dimension. Available on the website of the GST Council at `https://taxinformation.cbic.gov.in/content-page/explore-notification` (retrieved October 30th, 2025) | 2017 |
| *Tariffs* | WITS | Average applied tariffs on India's main trade partners over the period (EU27, United States, China, Japan, South Korea and ASEAN partners). Inputs tariffs created using the 2007 Indian IO table. | 2012 to 2022 |
| *Interstate Trade Flows* | MOSPI | Yearly matrix of trade flows between Indian states in quantity for 70 commodities. Only for goods transported by air, river or rail. | 2010 to 2019 (excl. 2018) |

## A.2 Official publications of GST

Figure A.1: First page of the raw data on GST rates and exempted goods



[TO BE PUBLISHED IN PART II, SECTION 3, SUB-SECTION (i) OF THE GAZETTE OF INDIA, EXTRAORDINARY]

GOVERNMENT OF INDIA
MINISTRY OF FINANCE
(Department of Revenue)

Notification No.2/2017-Integrated Tax (Rate)

New Delhi, the 28th June, 2017

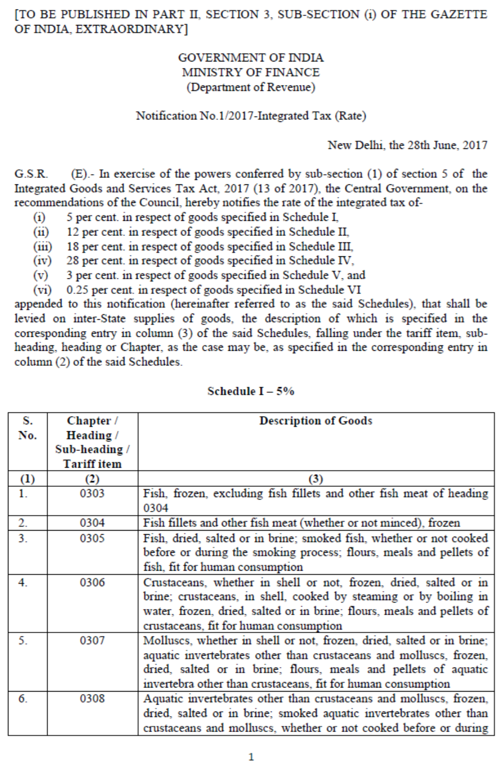
G.S.R. (E).- In exercise of the powers conferred by sub-section (1) of section 6 of the Integrated Goods and Services Tax Act, 2017 (13 of 2017), the Central Government, being satisfied that it is necessary in the public interest so to do, on the recommendations of the Goods and Services Tax Council, hereby exempts inter-State supplies of goods, the description of which is specified in column (3) of the Schedule appended to this notification, falling under the tariff item, sub-heading, heading or Chapter, as the case may be, as specified in the corresponding entry in column (2) of the said Schedule, from the whole of the integrated tax leviable thereon under section 5 of the Integrated Good and Services Tax Act, 2017 (13 of 2017).

**Schedule**

| S. No. | Chapter / Heading / Sub-heading / Tariff item | Description of Goods |
|---|---|---|
| (1) | (2) | (3) |
| 1. | 0101 | Live asses, mules and hinnies |
| 2. | 0102 | Live bovine animals |
| 3. | 0103 | Live swine |
| 4. | 0104 | Live sheep and goats |
| 5. | 0105 | Live poultry, that is to say, fowls of the species Gallus domesticus, ducks, geese, turkeys and guinea fowls. |
| 6. | 0106 | Other live animal such as Mammals, Birds, Insects |
| 7. | 0201 | Meat of bovine animals, fresh and chilled. |
| 8. | 0202 | Meat of bovine animals frozen [other than frozen and put up in unit container] |
| 9. | 0203 | Meat of swine, fresh, chilled or frozen [other than frozen and put up in unit container] |
| 10. | 0204 | Meat of sheep or goats, fresh, chilled or frozen [other than frozen and put up in unit container] |
| 11. | 0205 | Meat of horses, asses, mules or hinnies, fresh, chilled or frozen [other than frozen and put up in unit container] |
| 12. | 0206 | Edible offal of bovine animals, swine, sheep, goats, horses, asses, mules or hinnies, fresh, chilled or frozen [other than frozen and put up in unit container] |
| 13. | 0207 | Meat and edible offal, of the poultry of heading 0105, fresh, chilled or frozen [other than frozen and put up in unit container] |
| 14. | 0208 | Other meat and edible meat offal, fresh, chilled or frozen [other than |

1

(a) Notification of exempted goods



[TO BE PUBLISHED IN PART II, SECTION 3, SUB-SECTION (i) OF THE GAZETTE OF INDIA, EXTRAORDINARY]

GOVERNMENT OF INDIA
MINISTRY OF FINANCE
(Department of Revenue)

Notification No.1/2017-Integrated Tax (Rate)

New Delhi, the 28th June, 2017

G.S.R. (E).- In exercise of the powers conferred by sub-section (1) of section 5 of the Integrated Goods and Services Tax Act, 2017 (13 of 2017), the Central Government, on the recommendations of the Council, hereby notifies the rate of the integrated tax of-

(i) 5 per cent. in respect of goods specified in Schedule I,
(ii) 12 per cent. in respect of goods specified in Schedule II,
(iii) 18 per cent. in respect of goods specified in Schedule III,
(iv) 28 per cent. in respect of goods specified in Schedule IV,
(v) 3 per cent. in respect of goods specified in Schedule V, and
(vi) 0.25 per cent. in respect of goods specified in Schedule VI

appended to this notification (hereinafter referred to as the said Schedules), that shall be levied on inter-State supplies of goods, the description of which is specified in the corresponding entry in column (3) of the said Schedules, falling under the tariff item, sub-heading, heading or Chapter, as the case may be, as specified in the corresponding entry in column (2) of the said Schedules.

**Schedule I – 5%**

| S. No. | Chapter / Heading / Sub-heading / Tariff item | Description of Goods |
|---|---|---|
| (1) | (2) | (3) |
| 1. | 0303 | Fish, frozen, excluding fish fillets and other fish meat of heading 0304 |
| 2. | 0304 | Fish fillets and other fish meat (whether or not minced), frozen |
| 3. | 0305 | Fish, dried, salted or in brine; smoked fish, whether or not cooked before or during the smoking process; flours, meals and pellets of fish, fit for human consumption |
| 4. | 0306 | Crustaceans, whether in shell or not, frozen, dried, salted or in brine; crustaceans, in shell, cooked by steaming or by boiling in water, frozen, dried, salted or in brine; flours, meals and pellets of crustaceans, fit for human consumption |
| 5. | 0307 | Molluscs, whether in shell or not, frozen, dried, salted or in brine; aquatic invertebrates other than crustaceans and molluscs, frozen, dried, salted or in brine; flours, meals and pellets of aquatic invertebra other than crustaceans, fit for human consumption |
| 6. | 0308 | Aquatic invertebrates other than crustaceans and molluscs, frozen, dried, salted or in brine; smoked aquatic invertebrates other than crustaceans and molluscs, whether or not cooked before or during |

1

(b) Notification of the rates of taxable goods

## A.3 Manufacturing Plants in India

Table A.2: Characteristics of manufacturing plants in 2015

| | Full dataset | Sample for analysis | | |
|---|---|---|---|---|
| | | All | $\text{Importer}_{it}$ | $\text{Multiproduct}_{it}$ |
| | (1) | (2) | (3) | (4) |
| $\text{Age}_{it}$ | 20.31 | 21.13 | 21.14 | 21.57 |
| | (19.43) | (20.33) | (17.19) | (19.35) |
| $\text{Labor}_{it}$ | 233.61 | 331.71 | 523.53 | 364.12 |
| | (750.73) | (903.02) | (970.30) | (687.57) |
| $\ln \text{Gross sale value}_{it}$ | 18.49 | 19.59 | 20.40 | 19.88 |
| | (2.33) | (1.71) | (1.59) | (1.70) |
| $\text{\# intermediates}_{it}$ | 4.07 | 4.56 | 6.28 | 4.99 |
| | (4.05) | (4.49) | (5.30) | (5.12) |
| $\text{Adds intermediate}_{it}$ | 0.47 | 0.48 | 0.57 | 0.49 |
| | (0.50) | (0.50) | (0.50) | (0.50) |
| $\text{Drops intermediate}_{it}$ | 0.48 | 0.45 | 0.54 | 0.46 |
| | (0.50) | (0.50) | (0.50) | (0.50) |
| $\text{Import share}_{it}$ | 0.07 | 0.10 | 0.30 | 0.11 |
| | (0.19) | (0.22) | (0.29) | (0.22) |
| $\text{\# products}_{it}$ | 1.68 | 1.84 | 2.03 | 2.47 |
| | (1.51) | (1.69) | (1.95) | (2.00) |
| $\text{Export share}_{it}$ | 0.07 | 0.09 | 0.17 | 0.08 |
| | (0.22) | (0.25) | (0.32) | (0.23) |
| Observations | 24,590 | 16,346 | 5,193 | 9,057 |

Mean and standard deviation of selected variables in 2015. From the ASI dataset.

Table A.3: Decomposition of the sourcing of intermediates, 2012-2022

| Year | Value | Growth | Intensive | Extensive | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Added | | | Dropped | | |
| | | | | Total | *Domestic* | *Imported* | Total | *Domestic* | *Imported* |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 2012 | 16,443,737 | | | | | | | | |
| 2013 | 15,183,889 | -7.66 | -5.25 | 21.26 | 15.33 | 5.93 | -23.67 | -15.52 | -8.15 |
| 2014 | 14,387,357 | -5.25 | -6.41 | 16.24 | 10.38 | 5.85 | -15.07 | -10.58 | -4.49 |
| 2015 | 14,024,961 | -2.52 | -5.81 | 15.42 | 10.28 | 5.13 | -12.13 | -7.67 | -4.46 |
| 2016 | 14,421,318 | 2.83 | 2.77 | 13.16 | 8.18 | 4.97 | -13.10 | -7.81 | -5.29 |
| 2017 | 16,015,602 | 11.06 | 7.84 | 15.95 | 9.10 | 6.86 | -12.74 | -7.38 | -5.37 |
| 2018 | 16,927,632 | 5.69 | 4.71 | 11.27 | 6.37 | 4.90 | -10.28 | -6.11 | -4.17 |
| 2019 | 15,622,596 | -7.71 | -6.97 | 9.17 | 6.21 | 2.96 | -9.91 | -7.20 | -2.71 |
| 2020 | 13,768,482 | -11.87 | -13.26 | 9.59 | 5.04 | 4.56 | -8.20 | -5.06 | -3.14 |
| 2021 | 16,396,184 | 19.08 | 19.62 | 8.00 | 5.78 | 2.22 | -8.53 | -5.02 | -3.51 |
| 2022 | 17,549,064 | 7.03 | 6.79 | 5.04 | 3.90 | 1.14 | -4.80 | -3.88 | -0.92 |

Sample of manufacturing plants present every year. This table decomposes the growth of the sourcing of intermediates in the spirit of Halpern et al. (2015).
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

## A.4 Local Production Patterns and Interstate Trade

Figure A.2: Location of production for select industries prior to the nationwide GST (2012-2015)

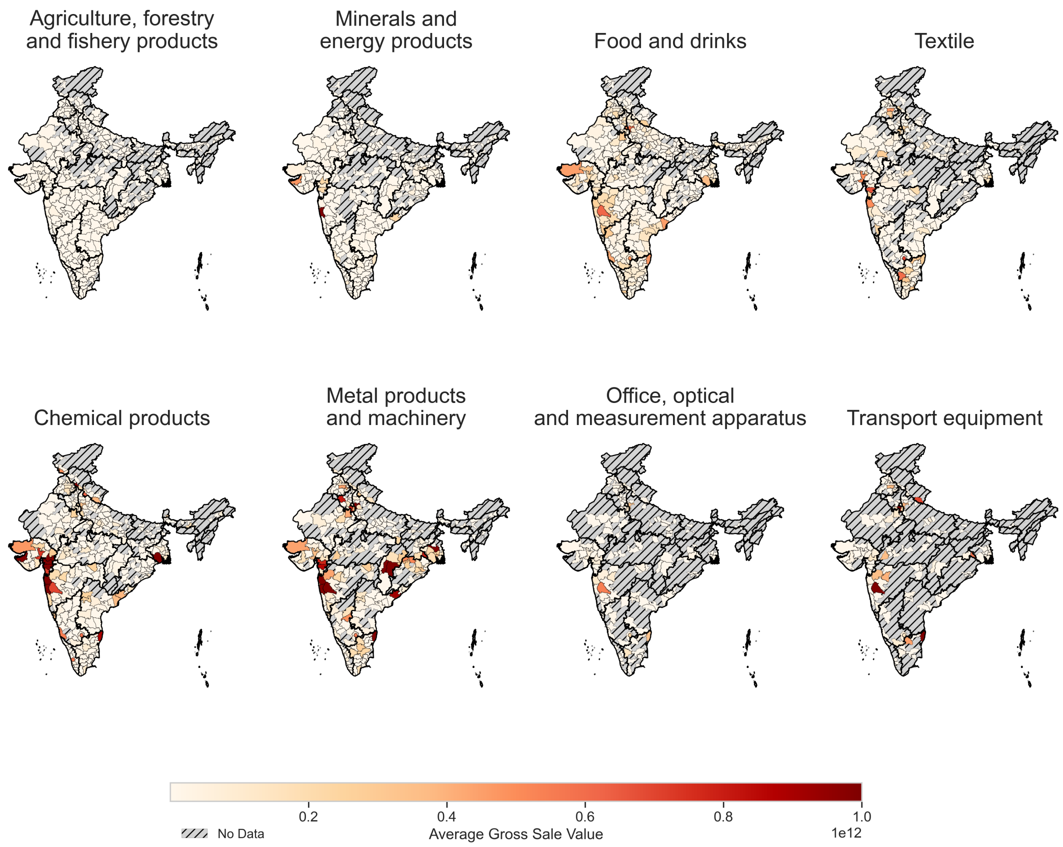
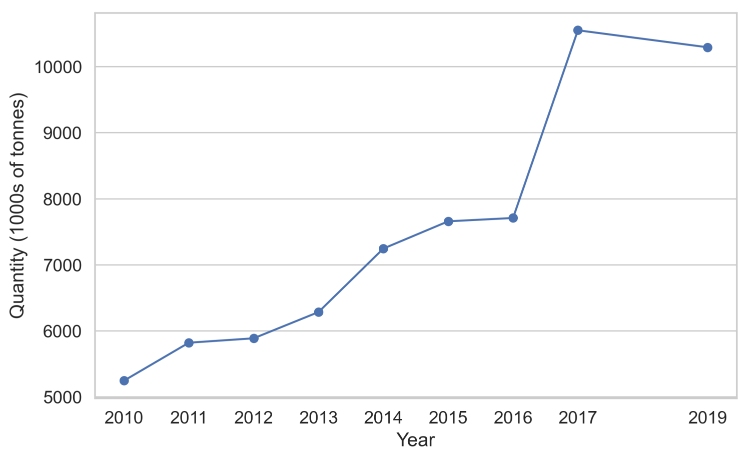



Figure A.3: Interstate trade between 2010 and 2019 (quantity)



## A.5 Commodity Taxation in India

### A.5.1 Summary Statistics

Figure A.4: Evolution of average plant-level tax per sales from 2000 to 2022

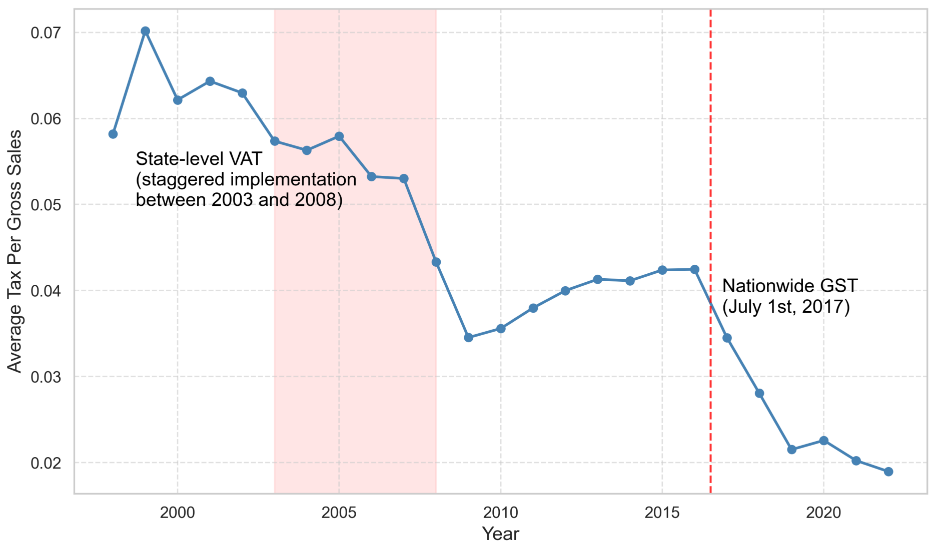
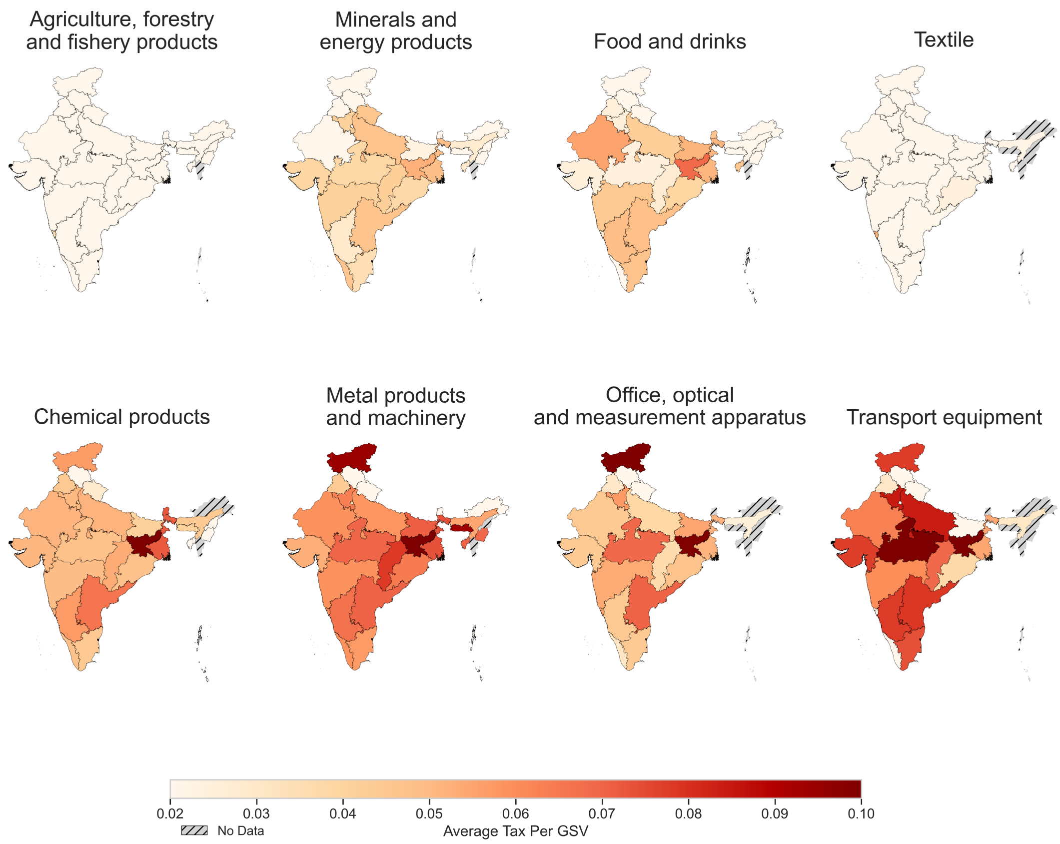



Figure A.5: Average tax rates in Indian states prior to the nationwide GST (2012-2015)



### A.5.2 Example of a vaccine producer

This figure illustrates how commodity taxation operates in India, and how effective taxation of inputs evolved over time. It presents a simplified production structure, where the focal plant is a vaccine producer operating in the state of Andhra Pradesh. This producer sources three types of intermediates: raw chemicals from supplier A in also located in Andhra Pradesh, microscopes from supplier B in another Indian state, Bihar, and filters from supplier C in China. The producer pays taxes on both inputs and outputs, and can or cannot claim input taxes, depending on the input tax credit (ITC) regime. On the input side, suppliers pay the tax when the transaction is made but then add it to the price paid by the buyer. For instance, when selling raw chemicals to the producer, supplier A declares the tax $T^{A}_{input}$ paid on this transaction to tax authorities (75 rupees), and adds that tax amount to the final price paid by the producer.[30] After using those taxed inputs to produce vaccines, the producer sells those to a retailer (the buyer), and declares the tax $T_{output}$ paid on this transaction. Under some tax regimes such as GST, the producer is then able to claim taxes declared by its suppliers when selling to the buyer, leaving only its value added taxed.

Figure A.6: Various commodity taxation regimes: example of a vaccine producer

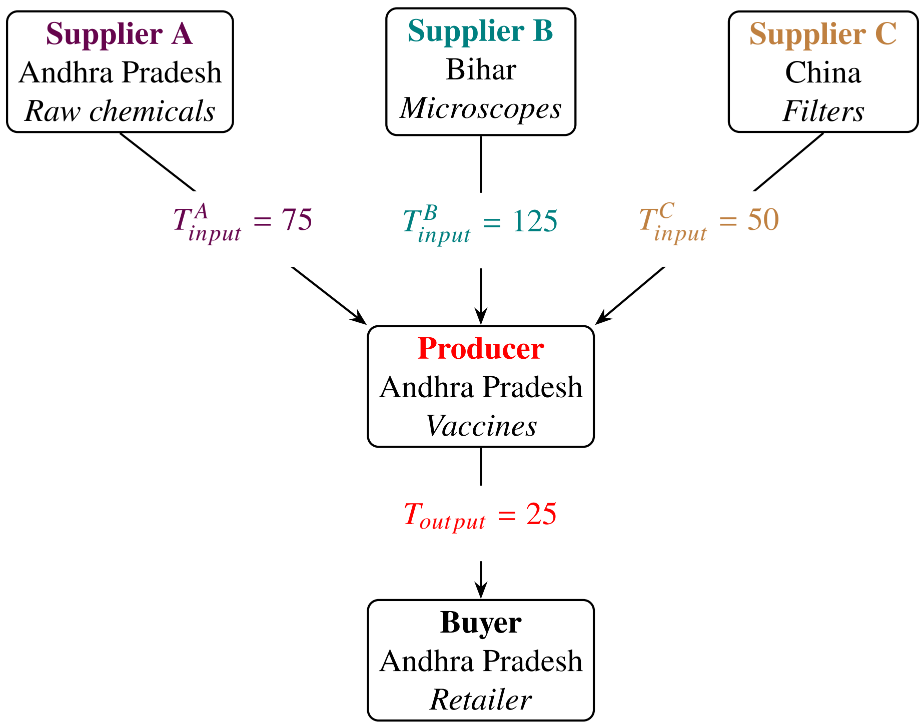



Figure A.6 can be useful to describe the evolution of commodity taxation in India. The tax amount $T$ effectively paid by the producer in different input tax credit regimes is:

1. **No GST (pre-2000s):** $T = T^{A}_{input} + T^{B}_{input} + T^{C}_{input} + T_{output} = 75 + 125 + 50 + 25 = 275$
2. **State-level GST (2000s-2017):** $T = T^{B}_{input} + T^{C}_{input} + T_{output} = 125 + 50 + 25 = 200$
3. **Nationwide GST (post-2017):** $T = T_{output} = 25$

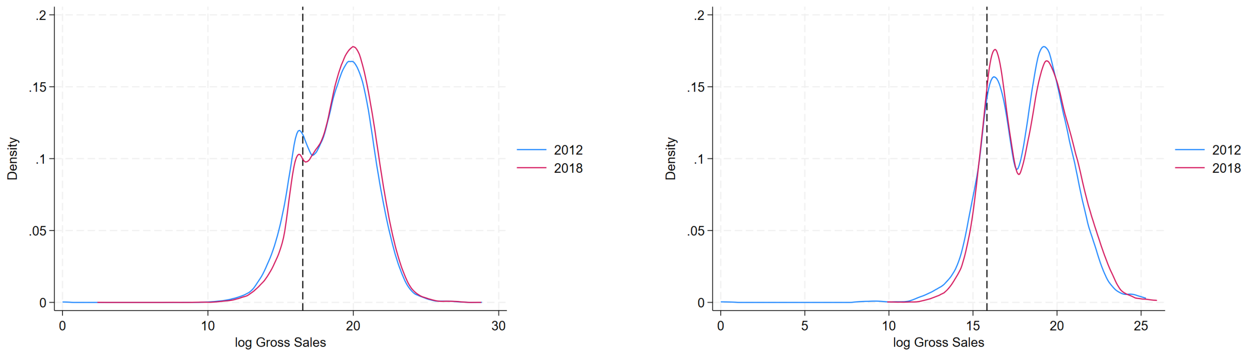
[30]Under full pass-through of the tax. I adopt this simplifying assumption because the main purpose of this study is to show how manufacturers react to the removal in input taxes, not changes in the incidence of the tax.

# B Characteristics of the 2017 nationwide GST

This section presents the main characteristics of the nationwide GST as it was implemented in 2017. Under the nationwide GST, there are two ways to remain out of the reach of the new tax system: (i) having a small turnover (selling below a threshold value), and (ii) producing specific goods (regardless of turnover).

**Turnover thresholds.**

Figure B.1: Nationwide GST exemption threshold and density of plants' turnover




(a) Regular states

(b) Special states

*Notes:* The dotted line is the turnover threshold under the nationwide GST. There are two types of turnover thresholds, depending on the type of state. Special states, characterized by low population and mountainous terrain, benefit from a lower threshold and are Arunachal Pradesh, Assam, Jammu and Kashmir, Himachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand. Regular states are remaining states.

**Structure of tax rates.**

Table B.1: Number of goods by nationwide GST slab

| **Tax rate (%)** (1) | **Number of products** (2) |
|---|---|
| 0% (exempted) | 1,091 |
| 0.25% | 1 |
| 3% | 50 |
| 5% | 610 |
| 12% | 763 |
| 18% | 1150 |
| 28% | 768 |

*Notes:* This table presents the repartition of the main tax slabs in the basic GST scheme. Column (2) reports the number of products belonging a a particular slab (5-digit CPC Rev.2.1).

Table B.2: Nationwide GST characteristics by 2d-industry

| | Average GST rate (%) | Value share of exempted goods (%) | Value share of imports (%) |
|---|---|---|---|
| Products of agriculture, horticulture and market gardening | 5.0 | 92.2 | 4.6 |
| Live animals and animal products (excluding meat) | 5.6 | 67.1 | 4.4 |
| Forestry and logging products | 15.1 | 57.1 | 15.2 |
| Fish and other fishing products | N/A | 100.0 | 2.6 |
| Other minerals | 4.6 | 16.7 | 13.4 |
| Electricity, town gas, steam and hot water | 5.0 | 36.2 | 15.4 |
| Meat, fish, fruits, vegetables, oils and fats | 10.2 | 44.3 | 8.7 |
| Dairy products and egg products | 11.7 | 30.1 | 0.8 |
| Grain mill products, starches and starch products; other food products | 14.0 | 48.8 | 5.4 |
| Beverages | 22.0 | 28.7 | 3.7 |
| Yarn and thread; woven and tufted textile fabrics | 7.8 | 9.3 | 12.2 |
| Textile articles other than apparel | 11.2 | 27.5 | 9.0 |
| Knitted or crocheted fabrics; wearing apparel | 9.2 | 5.2 | 9.2 |
| Products of wood, cork, straw and plaiting materials | 16.9 | 4.2 | 15.3 |
| Pulp, paper and paper products; printed matter and related articles | 13.1 | 16.1 | 16.7 |
| Basic chemicals | 12.6 | 5.4 | 30.5 |
| Other chemical products; man-made fibres | 16.7 | 10.9 | 19.4 |
| Rubber and plastics products | 16.4 | 8.4 | 15.2 |
| Glass and glass products and other non-metallic products n.e.c. | 20.5 | 5.4 | 14.8 |
| Furniture; other transportable goods n.e.c. | 16.8 | 18.4 | 15.9 |
| Fabricated metal products, except machinery and equipment | 18.9 | 3.0 | 12.2 |
| Special-purpose machinery | 18.5 | 2.6 | 12.9 |
| Medical appliances, precision and optical instruments, watches and clocks | 19.4 | 2.4 | 25.1 |
| Transport equipment | 16.0 | 4.8 | 11.7 |

# C Identification Strategy

## C.1 Nationwide GST and Initial Industry Characteristics of Goods

Table C.1: Taxable goods under the nationwide GST and initial characteristics

| | Average Labor$_{jt}$ | | Capital Intensity$_{jt}$ | | Intermediates Share$_{jt}$ | | Value-added Per Labor$_{jt}$ | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Taxable$_j$ | 0.384*** | 0.083 | -0.180*** | 0.022 | -0.045*** | -0.009 | -0.164*** | 0.024 |
| | (0.068) | (0.085) | (0.035) | (0.026) | (0.009) | (0.010) | (0.033) | (0.025) |
| Constant | 4.426*** | 4.679*** | 0.266*** | 0.097*** | 0.791*** | 0.761*** | 0.248*** | 0.091*** |
| | (0.062) | (0.074) | (0.034) | (0.022) | (0.008) | (0.009) | (0.032) | (0.021) |
| Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2d-industry FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Observations | 5,164 | 5,163 | 5,164 | 5,163 | 5,164 | 5,163 | 5,038 | 5,037 |
| R-squared | 0.020 | 0.153 | 0.019 | 0.073 | 0.016 | 0.141 | 0.018 | 0.072 |

This table reports the results of the regression of 5-digit good $j$'s characteristics , taken from the aggregated ASI data, on a binary variable taking value 1 if the good is taxable (non-exempted) under the nationwide GST.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C.2: GST rates for taxable goods and initial characteristics

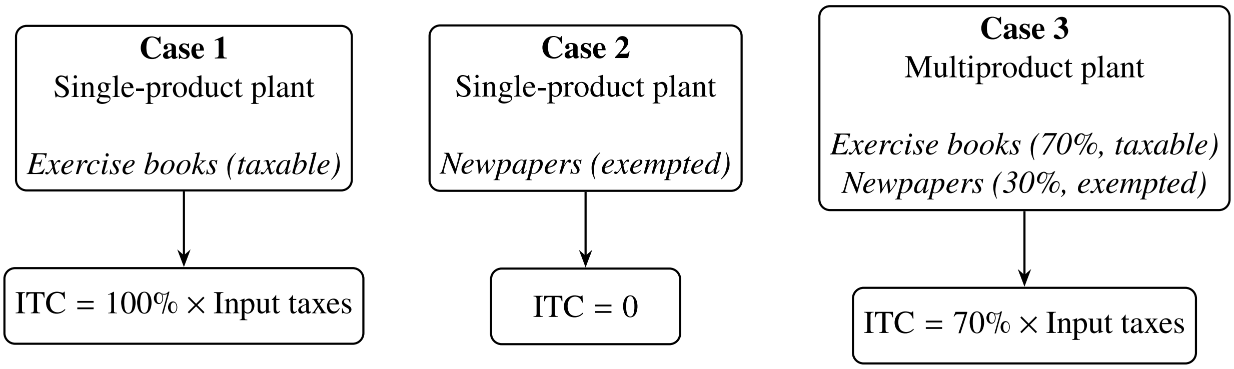
| | Average Labor$_{jt}$ | | Capital Intensity$_{jt}$ | | Intermediates Share$_{jt}$ | | Value-added Per Labor$_{jt}$ | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Rate$_j^{GST}$ | -0.451 | 0.379 | 0.019 | 0.216 | -0.053 | 0.033 | 0.001 | 0.189 |
| | (0.430) | (0.493) | (0.117) | (0.141) | (0.053) | (0.059) | (0.118) | (0.139) |
| Constant | 4.881*** | 4.751*** | 0.083*** | 0.052** | 0.755*** | 0.741*** | 0.084*** | 0.054*** |
| | (0.074) | (0.080) | (0.018) | (0.020) | (0.009) | (0.010) | (0.018) | (0.020) |
| Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2d-industry FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Observations | 4,318 | 4,317 | 4,318 | 4,317 | 4,318 | 4,317 | 4,221 | 4,220 |
| R-squared | 0.002 | 0.145 | 0.000 | 0.026 | 0.002 | 0.130 | 0.001 | 0.030 |

This table reports the results of the regression of 5-digit good $j$'s characteristics, taken from the aggregated ASI data, on the tax rate applied to that good taxable (non-exempted) under the nationwide GST. Excludes exempted goods, which by definition have a tax rate of zero.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# D How the Input-Tax Credit Operates

**Exemption and input tax credit.** This paragraph describes how plants' ability to claim input taxes depends on the type of good they produce. Specifically, Figure D.1 illustrates how the input tax credit (ITC) operates under the nationwide GST framework implemented in 2017. The ITC corresponds to the amount of taxes paid by a plant on its inputs, which can credited when the plant sells its good and declares GST paid on its output. Importantly in the post-2017 Indian setting, the ability to claim input taxes depends, among other things, on the type of good produced by the plant. To better understand, consider the following example based. Under the 2017 GST, exercise books are taxable, while newspapers are exempted. There are three possible cases. A first case of a producer of one taxable good (or producing exclusively taxable goods), a second case of a producer of an exempted good (or producing exclusively exempted goods), and a third case of a multi-product producer of both types of goods. As shown in Figure D.1, in all cases, the ITC is proportional to the share of taxable (*i.e.*, non-exempted) goods in the plants' product mix. This means that some multiproduct plants, if they produce both types of goods, will be partly able to claim input taxes, making it possible to derive a measure of treatment intensity with the ASI dataset.[31]

Figure D.1: How input tax credit works for different types of plants




[31]Note that the 2017 GST legislation does not require to know which intermediate went to the production of which product in order to claim inputs taxes.

## D.1 Variable Construction

In addition to $\text{Eligible}_i$, I construct two additional measures of exposure to the reform.

$$\text{Alt ITC}_i^{NatGST} = \begin{cases} 1, & \text{if Included}_j = 1 \\ & \text{for at least one product the pre-reform product mix of plant } i \\ 0, & \text{otherwise} \end{cases} \tag{D.1}$$

$$\text{Share ITC}_i^{NatGST} = \frac{\sum_{j=1}^{J} v_{ij} \times \text{Taxable}_j^{NatGST}}{\sum_{j=1}^{J} v_{ij}} \quad \begin{array}{r} \text{where } v_{ij} \text{ is the value of intermediate } j \in \{1, \dots, J\} \\ \text{sourced by plant } i \text{ in pre-reform years} \end{array} \tag{D.2}$$

## D.2 Effect on the Tax Burden of Plants

The goal of this subsection is to provide evidence that the treatment variable is valid, *i.e.*, that defining the treatment based on the fact that some goods are exempted accurately captures an exogeneous reduction in input taxes. To do so, I estimate the following equation model:

$$\text{Tax per Sales}_{it} = \beta_0 + \beta_1 \text{Post}_t^{2017} + \beta_2 \text{Eligible}_i + \beta_3 \text{Post}_t^{2017} \times \text{ITC}_i^{NatGST} + \beta_4 \text{Trends}_{it}^{2012} + \delta_i + \delta_t + \varepsilon_{it} \tag{D.3}$$

where $\beta_3$ is the coefficient of interest, and is expected to be negative, implying that being taxable is decreases plant-level tax per gross sales.

Table D.1: Effects of nationwide GST on the plant-level tax burden

| | Tax per Gross Sales$_{it}$ | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Post$_t^{2017}$ × Eligible$_i$ | -0.019*** | | | -0.018*** |
| | (0.004) | | | (0.006) |
| Post$_t^{2017}$ × Alt Eligible$_i$ | | -0.017*** | | |
| | | (0.003) | | |
| Post$_t^{2017}$ × Share Eligible$_i$ | | | -0.011** | |
| | | | (0.005) | |
| Plant-level trends$_{it}$ | ✓ | ✓ | ✓ | ✓ |
| Plant$_i$ FE | ✓ | ✓ | ✓ | ✓ |
| Year$_t$ FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 117,288 | 117,288 | 21,335 | 46,094 |
| R-squared | 0.627 | 0.627 | 0.628 | 0.672 |

*Notes:* OLS estimation. Columns (1) and (2) cover the full sample, column (3) is restricted to plants with a production mix of taxable goods that is strictly superior to 0 and strictly less than 1, and column (4) is restricted to single-product plants. In all columns, the dependent variable Tax per Gross Sales$_{it}$ is the total tax declared by the plant on the supply of all its products divided by its annual gross sales value. Post$_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Eligible$_i$, Alt Eligible$_i$ and Share Eligible$_i$ are respectively the main and two alternative measures of the treatment. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure D.2: Dynamic effect of eligibility to ITC

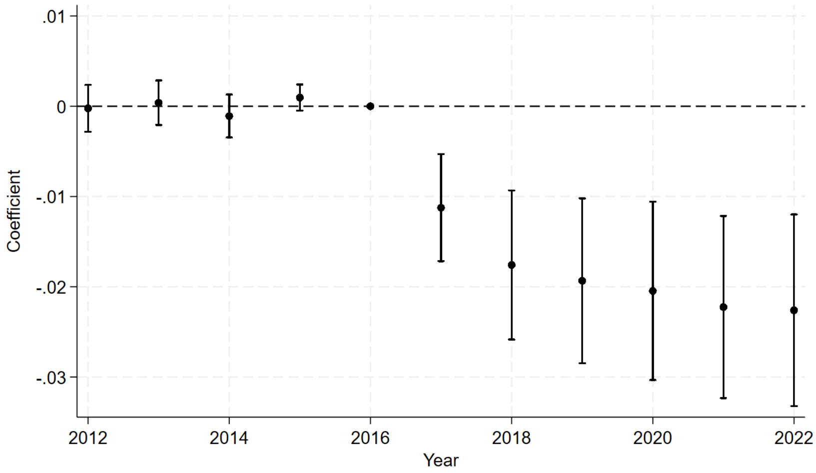



Figure D.3: Dynamic effect of eligibility to ITC, by input-weighted GST tercile

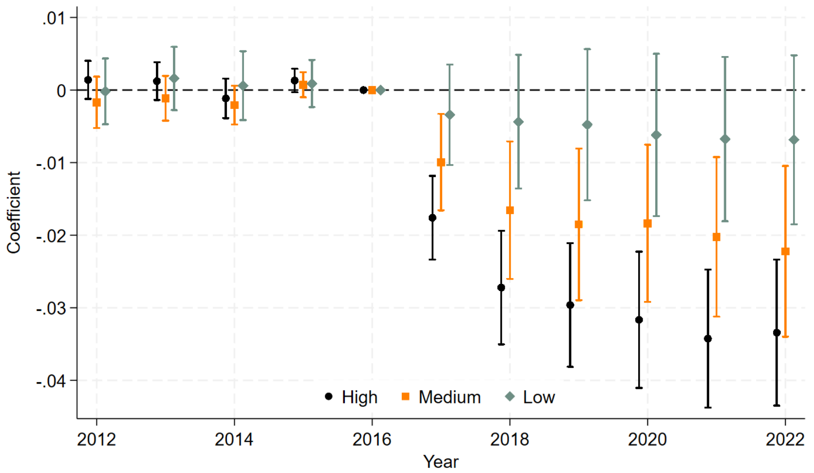
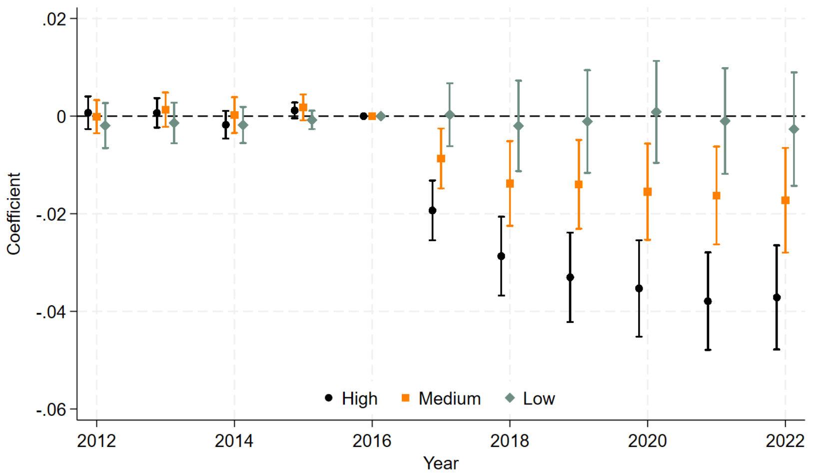



Figure D.4: Dynamic effect of eligibility to ITC, by input-weighted and output GST tercile



# E Results: Sourcing of Inputs

This section presents results for how the tax reform impacted various dimensions of input sourcing.

**Alternative specifications and fixed effects.**

Table E.1: Effect on intermediates: collapsing pre- and post-reform years

| | ln Intermediates$_{it}$ (1) | Intermediates Share$_{it}$ (2) | ln Previous Year$_{it}$ (3) | # Intermediates$_{it}$ (4) |
|---|---|---|---|---|
| Post$_t$ × Eligible$_i$ | 0.048* | 0.006 | -0.329* | 0.028** |
| | (0.028) | (0.004) | (0.172) | (0.012) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 31,786 | 31,786 | 31,776 | 31,526 |
| R-squared | 0.968 | 0.926 | 0.694 | |
| Pseudo R-squared | | | | 0.467 |

*Notes:* This table collapses together the pre-reform (2014, 2015 and 2016) and post-reform (2017, 2018 and 2019) years. OLS estimation for columns (1) to (3), and PPML estimation for column (4). ln Intermediates$_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in period $t$. Intermediates Share$_{it}$ is the share of intermediates over total input cost of plant $i$ in period $t$. ln Previous Year$_{it}$ is the log value of 7d-intermediates sourced by plant $i$ in period $t$ and which were already sourced at least once in period $t-1$. # Intermediates$_{it}$ is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in period $t$. Post$_t^{2017}$ is an indicator variable taking value 1 in the post-reform period, and 0 otherwise. Eligible$_i$ is the main measures of the treatment. Plant-level trends$_{it}$ are the first period values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a period indicator. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.2: Effect on intermediates: fewer FE

| | ln Intermediates$_{it}$ (1) | Intermediates Share$_{it}$ (2) | ln Previous Year$_{it}$ (3) | # Intermediates$_{it}$ (4) |
|---|---|---|---|---|
| Post$_t$ × Eligible$_i$ | 0.087** | 0.009* | 0.529** | 0.033*** |
| | (0.043) | (0.005) | (0.237) | (0.011) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| Year FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 117,288 | 117,288 | 117,209 | 116,559 |
| R-squared | 0.913 | 0.799 | 0.422 | |
| Pseudo R-squared | | | | 0.449 |

*Notes:* OLS estimation for columns (1) to (3), and PPML estimation for column (4). ln Intermediates$_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. Intermediates Share$_{it}$ is the share of intermediates over total input cost of plant $i$ in year $t$. ln Previous Year$_{it}$ is the log value of 7d-intermediates sourced by plant $i$ in year $t$ and which were alreadu sourced in year $t-1$. # Intermediates$_{it}$ is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. Post$_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Eligible$_i$ is the main measures of the treatment. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.3: Effect on intermediates: fewer FE

| | $\ln$ Intermediates$_{it}$ | Intermediates Share$_{it}$ | $\ln$ Previous Year$_{it}$ | # Intermediates$_{it}$ |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Post$_t$ × Eligible$_i$ | 0.035 | 0.005 | -0.259 | 0.061*** |
| | (0.033) | (0.006) | (0.175) | (0.018) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ |
| 3d-intermediates × Year FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 66,155 | 66,155 | 66,091 | 65,338 |
| R-squared | 0.927 | 0.851 | 0.538 | |
| Pseudo R-squared | | | | 0.444 |

*Notes:* OLS estimation for columns (1) to (3), and PPML estimation for column (4). $\ln$ Intermediates$_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. Intermediates Share$_{it}$ is the share of intermediates over total input cost of plant $i$ in year $t$. $\ln$ Previous Year$_{it}$ is the log value of 7d-intermediates sourced by plant $i$ in year $t$ and which were alreadu sourced in year $t-1$. # Intermediates$_{it}$ is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. Post$_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Eligible$_i$ is the main measures of the treatment. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. The 2d-industry FE follows the NIC-2008 classification. The 3d-intermediates FE follows the the NPCMS classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Sensitivity to alternative treatment definition.**

Table E.4: Effect on intermediates: alternative treatment variable

| | ln Intermediates$_{it}$ (1) | Intermediates Share$_{it}$ (2) | ln Previous Year$_{it}$ (3) | # Intermediates$_{it}$ (4) |
|---|---|---|---|---|
| Post$_t^{2017}$ × Alt Eligible$_i$ | 0.014 | 0.001 | -0.200 | 0.033*** |
| | (0.019) | (0.003) | (0.141) | (0.012) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 117,285 | 117,285 | 117,205 | 116,555 |
| R-squared | 0.916 | 0.803 | 0.445 | |
| Pseudo R-squared | | | | 0.451 |

*Notes:* OLS estimation for columns (1) to (3), and PPML estimation for column (4). ln Intermediates$_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. Intermediates Share$_{it}$ is the share of intermediates over total input cost of plant $i$ in year $t$. ln Previous Year$_{it}$ is the log value of 7d-intermediates sourced by plant $i$ in year $t$ and which were alreadu sourced in year $t-1$. # Intermediates$_{it}$ is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. Post$_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Alt Eligible$_i$ is the alternate measures of the treatment defined in Appendix **??**. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.5: Effect on intermediates: treatment intensity variable

| | ln Intermediates$_{it}$ (1) | Intermediates Share$_{it}$ (2) | ln Previous Year$_{it}$ (3) | # Intermediates$_{it}$ (4) |
|---|---|---|---|---|
| Post$_t^{2017}$ × Share Eligible$_i$ | 0.091 | 0.008 | -0.301 | 0.089** |
| | (0.069) | (0.006) | (0.257) | (0.035) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 21,321 | 21,321 | 21,280 | 21,212 |
| R-squared | 0.876 | 0.781 | 0.431 | |
| Pseudo R-squared | | | | 0.519 |

*Notes:* Sample is restricted to multi-product plants producing at least one taxable good and one exempted good. OLS estimation for columns (1) to (3), and PPML estimation for column (4). ln Intermediates$_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. Intermediates Share$_{it}$ is the share of intermediates over total input cost of plant $i$ in year $t$. ln Previous Year$_{it}$ is the log value of 7d-intermediates sourced by plant $i$ in year $t$ and which were alreadu sourced in year $t-1$. # Intermediates$_{it}$ is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. Post$_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Alt Eligible$_i$ is the alternate measures of the treatment defined in Appendix **??**. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Mitigating the risk of omitted variable bias.**

Table E.6: Effect on intermediates: controlling for gross sales

| | ln Intermediates$_{it}$ | Intermediates Share$_{it}$ | ln Previous Year$_{it}$ | # Intermediates$_{it}$ |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i$ | 0.042 | 0.002 | -0.337** | 0.060*** |
| | (0.037) | (0.003) | (0.150) | (0.012) |
| ln Gross Sale$_{it}$ | 0.944*** | 0.052*** | 1.203*** | 0.051*** |
| | (0.016) | (0.002) | (0.043) | (0.004) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 117,205 | 117,285 | 117,205 | 116,555 |
| R-squared | 0.857 | 0.816 | 0.452 | |
| Pseudo R-squared | | | | 0.451 |

*Notes:* Sample is restricted to multi-product plants producing at least one taxable good and one exempted good. OLS estimation for columns (1) to (3), and PPML estimation for column (4). ln Intermediates$_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. Intermediates Share$_{it}$ is the share of intermediates over total input cost of plant $i$ in year $t$. ln Previous Year$_{it}$ is the log value of 7d-intermediates sourced by plant $i$ in year $t$ and which were alreadu sourced in year $t-1$. # Intermediates$_{it}$ is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. $\text{Post}_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Alt Eligible$_i$ is the alternate measures of the treatment defined in Appendix **??**. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. ln Gross Sales$_{it}$ is the log of gross sales of plant $i$ at year $t$. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.7: Effect on intermediates: controlling for tariffs

| | ln Intermediates$_{it}$ | Intermediates Share$_{it}$ | ln Previous Year$_{it}$ | # Intermediates$_{it}$ |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i$ | 0.046** | 0.004 | -0.251** | 0.060*** |
| | (0.023) | (0.003) | (0.122) | (0.012) |
| $\ln(\tau_{O,jt}+1)$ | -0.214* | | -3.279*** | |
| | (0.120) | | (1.002) | |
| $\ln(\tau_{I,jt}+1)$ | 0.436* | | 0.140 | |
| | (0.248) | | (1.821) | |
| $\ln(\tau_{X,jt}+1)$ | -0.326 | | 1.804 | |
| | (0.558) | | (3.135) | |
| $\tau_{O,jt}$ | | -0.033*** | | -0.099* |
| | | (0.010) | | (0.060) |
| $\tau_{I,jt}$ | | 0.079*** | | 0.123 |
| | | (0.028) | | (0.120) |
| $\tau_{X,jt}$ | | -0.119* | | -0.348 |
| | | (0.065) | | (0.241) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 110,619 | 110,619 | 110,544 | 109,992 |
| R-squared | 0.916 | 0.805 | 0.439 | |
| Pseudo R-squared | | | | 0.453 |

*Notes:* Sample is restricted to multi-product plants producing at least one taxable good and one exempted good. OLS estimation for columns (1) to (3), and PPML estimation for column (4). ln Intermediates$_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. Intermediates Share$_{it}$ is the share of intermediates over total input cost of plant $i$ in year $t$. ln Previous Year$_{it}$ is the log value of 7d-intermediates sourced by plant $i$ in year $t$ and which were alreadu sourced in year $t-1$. # Intermediates$_{it}$ is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. $\text{Post}_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Alt Eligible$_i$ is the alternate measures of the treatment defined in Appendix **??**. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. $\tau_{O,jt}$, $\tau_{I,jt}$ and $\tau_{X,jt}$ are the output, input and export tariffs. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.8: Effect on intermediates: controlling for market structure

| | ln Intermediates$_{it}$ (1) | Intermediates Share$_{it}$ (2) | ln Previous Year$_{it}$ (3) | # Intermediates$_{it}$ (4) |
|---|---|---|---|---|
| $\text{Post}_t^{2017} \times \text{Eligible}_i$ | 0.012 | -0.001 | -0.332** | 0.070*** |
| | (0.024) | (0.002) | (0.162) | (0.012) |
| Share Top 8 Share$_{jt}$ | -0.033 | -0.002 | -0.168 | 0.011 |
| | (0.031) | (0.004) | (0.201) | (0.014) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 102,801 | 102,801 | 102,733 | 102,155 |
| R-squared | 0.907 | 0.788 | 0.449 | |
| Pseudo R-squared | | | | 0.462 |

*Notes:* Sample is restricted to multi-product plants producing at least one taxable good and one exempted good. OLS estimation for columns (1) to (3), and PPML estimation for column (4). ln Intermediates$_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. Intermediates Share$_{it}$ is the share of intermediates over total input cost of plant $i$ in year $t$. ln Previous Year$_{it}$ is the log value of 7d-intermediates sourced by plant $i$ in year $t$ and which were alreadu sourced in year $t-1$. # Intermediates$_{it}$ is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. Post$_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Alt Eligible$_i$ is the alternate measures of the treatment defined in Appendix **??**. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. Share Top 8 Share$_{jt}$ is the time-varying share of production by the top 8 plants producing a 4d-good. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.9: Effect on intermediates: controlling for initial intermediate share

| | ln Intermediates$_{it}$ (1) | Intermediates Share$_{it}$ (2) | ln Previous Year$_{it}$ (3) | # Intermediates$_{it}$ (4) |
|---|---|---|---|---|
| $\text{Post}_t^{2017} \times \text{Eligible}_i$ | 0.067* | 0.003 | -0.304** | 0.060*** |
| | (0.038) | (0.003) | (0.152) | (0.012) |
| Trend: Intermediates Share$_{it}^{2012}$ | 0.000 | 0.000*** | -0.000*** | -0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Constant | 18.808*** | 0.719*** | 17.018*** | 1.836*** |
| | (0.017) | (0.001) | (0.065) | (0.005) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 117,205 | 117,285 | 117,205 | 116,555 |
| R-squared | 0.839 | 0.803 | 0.445 | |
| Pseudo R-squared | | | | 0.451 |

*Notes:* Sample is restricted to multi-product plants producing at least one taxable good and one exempted good. OLS estimation for columns (1) to (3), and PPML estimation for column (4). ln Intermediates$_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. Intermediates Share$_{it}$ is the share of intermediates over total input cost of plant $i$ in year $t$. ln Previous Year$_{it}$ is the log value of 7d-intermediates sourced by plant $i$ in year $t$ and which were alreadu sourced in year $t-1$. # Intermediates$_{it}$ is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. Post$_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Alt Eligible$_i$ is the alternate measures of the treatment defined in Appendix **??**. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. Trend: Intermediates Share$_{it}^{2012}$ is the 2012 share of intermediates over total inputs interacted with years. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.10: Effect on intermediates: controlling for initial tax per sales

| | $\ln$ Intermediates$_{it}$ (1) | Intermediates Share$_{it}$ (2) | $\ln$ Previous Year$_{it}$ (3) | # Intermediates$_{it}$ (4) |
|---|---|---|---|---|
| $\text{Post}_t^{2017} \times \text{Eligible}_i$ | 0.067* | 0.003 | -0.304** | 0.060*** |
| | (0.038) | (0.003) | (0.152) | (0.012) |
| Trend: Tax per Sales$_{it}^{2012}$ | 0.000 | 0.000** | 0.000 | -0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 117,205 | 117,285 | 117,205 | 116,555 |
| R-squared | 0.839 | 0.803 | 0.445 | |
| Pseudo R-squared | | | | 0.451 |

*Notes:* Sample is restricted to multi-product plants producing at least one taxable good and one exempted good. OLS estimation for columns (1) to (3), and PPML estimation for column (4). $\ln$ Intermediates$_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. Intermediates Share$_{it}$ is the share of intermediates over total input cost of plant $i$ in year $t$. $\ln$ Previous Year$_{it}$ is the log value of 7d-intermediates sourced by plant $i$ in year $t$ and which were alreadu sourced in year $t-1$. # Intermediates$_{it}$ is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. $\text{Post}_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Alt Eligible$_i$ is the alternate measures of the treatment defined in Appendix **??**. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. Trend: Tax per Sales$_{it}^{2012}$ is the 2012 tax per gross sales interacted with years. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**The Intensive Margin.**

This section investigates the effect of the reform at the intensive margin. I create a balanced panel of plant-inputs between 2012 and 2022 and estimate the following model, which is quite similar to regression model 3. The dependent variable is the log value, quantity or unit price of intermediate $p$ sourced by plant $i$ at time $t$, operating in industry $j$ and located in state $s$. Intermediates here can be either domestic or imported.

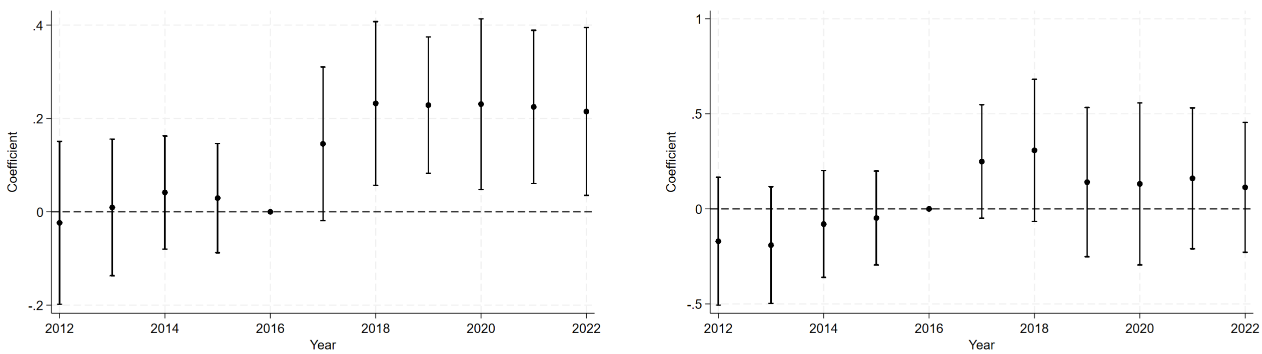
$$\begin{aligned} y_{ip(js)t} = \beta_0 + \beta_1 \text{Post}_t^{2017} + \beta_2 \text{Eligible}_i + \beta_3 \text{Post}_t^{2017} \times \text{ITC}_i^{NatGST} \\ + \beta_4 \text{Trends}_{it}^{2012} + \delta_{ip} + \delta_{jt} + \delta_{st} + \varepsilon_{ip(js)t} \end{aligned} \tag{E.4}$$

Table E.11: Effect on intermediates: the intensive margin

| | Domestic$_{pit}$ | | | Imported$_{pit}$ | | |
|---|---|---|---|---|---|---|
| | Value$_{pit}$ (1) | Quantity$_{pit}$ (2) | Price$_{pit}$ (3) | Value$_{pit}$ (4) | Quantity$_{pit}$ (5) | Price$_{pit}$ (6) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i$ | 0.088*** | 0.203*** | -0.131* | -0.019 | 0.268 | -0.296** |
| | (0.028) | (0.070) | (0.069) | (0.088) | (0.169) | (0.136) |
| $\text{Trends}_{it}^{2012}$ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Plant-7d-input FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 125,462 | 125,462 | 125,462 | 21,545 | 21,545 | 21,545 |
| R-squared | 0.900 | 0.926 | 0.953 | 0.849 | 0.896 | 0.930 |

*Notes:* OLS estimation using input-plant-level ASI data over the period 2012-2022. Standard errors clustered by 5-digit main product are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure E.1: Log quantity of intermediates sourced every year




(a) Domestically-sourced intermediates

(b) Imported intermediates

## Heterogeneity

This section investigates results mechanisms behind the baseline results.

Table E.12: Effect on intermediates: number of intermediates of different types

| | | Domestically-sourced | | Imported | |
|---|---|---|---|---|---|
| | $\#\,\text{Intermediates}_{it}$ | Prod. Other $\text{State}_{i(s)t}$ | Prod. Same $\text{State}_{i(s)t}$ | Prod. Other $\text{State}_{i(s)t}$ | Prod. Same $\text{State}_{i(s)t}$ |
| | (1) | (2) | (3) | (4) | (5) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i$ | 0.060*** | 0.050*** | 0.067*** | 0.051 | 0.202*** |
| | (0.012) | (0.018) | (0.018) | (0.049) | (0.054) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 116,555 | 111,847 | 109,715 | 48,243 | 48,075 |
| Pseudo R-square | 0.451 | 0.361 | 0.402 | 0.297 | 0.308 |

*Notes:* Sample is restricted to multi-product plants producing at least one taxable good and one exempted good. OLS estimation for columns (1) to (3), and PPML estimation for column (4). $\ln \text{Intermediates}_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. The dependent variable in column (1), $\#\,\text{Intermediates}_{it}$, is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. In column (2), the dependent variable is the number of domestically-sourced intermediates, and which are not produced in the same state as where the plant is located. In column (3), the dependent variable is the number of domestically-produced intermediates, and which are produced in the same state as where the plant is located. A similar decomposition is adopted for imported intermediates in columns (4) and (5). $\text{Post}_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Alt $\text{Eligible}_i$ is the alternate measures of the treatment defined in Appendix **??**. Plant-level $\text{trends}_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.13: Effect on intermediates: number of intermediates of different types and plant size

| | | Domestically-sourced | | Imported | |
|---|---|---|---|---|---|
| | $\#\,\text{Intermediates}_{it}$ | Prod. Other $\text{State}_{i(s)t}$ | Prod. Same $\text{State}_{i(s)t}$ | Prod. Other $\text{State}_{i(s)t}$ | Prod. Same $\text{State}_{i(s)t}$ |
| | (1) | (2) | (3) | (4) | (5) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i$ | 0.044*** | 0.029 | 0.054*** | 0.019 | 0.120* |
| | (0.013) | (0.019) | (0.019) | (0.058) | (0.063) |
| $\ln \text{Labor}_{it}$ | 0.053*** | 0.035*** | 0.055*** | 0.105*** | 0.111*** |
| | (0.006) | (0.008) | (0.008) | (0.024) | (0.019) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i \times \text{Less than 100 workers}_{it}$ | -0.004 | -0.008 | -0.013 | -0.005 | -0.014 |
| | (0.009) | (0.012) | (0.013) | (0.041) | (0.044) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i \times 200-299\ \text{workers}_{it}$ | 0.017* | 0.021 | 0.014 | 0.010 | 0.077** |
| | (0.010) | (0.013) | (0.012) | (0.033) | (0.030) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i \times 300-399\ \text{workers}_{it}$ | 0.009 | 0.011 | 0.014 | -0.029 | 0.073** |
| | (0.012) | (0.016) | (0.016) | (0.039) | (0.036) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i \times 400-499\ \text{workers}_{it}$ | 0.030** | 0.018 | 0.033* | 0.065* | 0.125*** |
| | (0.014) | (0.017) | (0.020) | (0.037) | (0.039) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i \times \text{More than 500 workers}_{it}$ | 0.042*** | 0.067*** | 0.033* | 0.070** | 0.130*** |
| | (0.012) | (0.015) | (0.017) | (0.034) | (0.033) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| State × Year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 116,555 | 111,847 | 109,715 | 48,243 | 48,075 |
| Pseudo R-square | 0.451 | 0.361 | 0.402 | 0.297 | 0.309 |

*Notes:* Sample is restricted to multi-product plants producing at least one taxable good and one exempted good. OLS estimation for columns (1) to (3), and PPML estimation for column (4). $\ln \text{Intermediates}_{it}$ is the log value of all intermediate inputs purchased by plant $i$ in year $t$. The dependent variable in column (1), $\#\,\text{Intermediates}_{it}$, is a count variable measuring the number of 7d-intermediates (both domestic and imported) sourced by plant $i$ in year $t$. In column (2), the dependent variable is the number of domestically-sourced intermediates, and which are not produced in the same state as where the plant is located. In column (3), the dependent variable is the number of domestically-produced intermediates, and which are produced in the same state as where the plant is located. A similar decomposition is adopted for imported intermediates in columns (4) and (5). $\text{Post}_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. Alt $\text{Eligible}_i$ is the alternate measures of the treatment defined in Appendix **??**. Plant-level $\text{trends}_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.14: Effect on intermediates: complementarity with trade policy rate

| | Share of Imported Intermediates$_{it}$ | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i$ | 0.001 | 0.003 | 0.005 |
| | (0.007) | (0.006) | (0.006) |
| $\tau_{I,jt}$ | | 0.043* | 0.033 |
| | | (0.023) | (0.023) |
| $\tau_{O,jt}$ | | 0.005 | 0.006 |
| | | (0.010) | (0.010) |
| $\tau_{X,jt}$ | | -0.002 | -0.002 |
| | | (0.002) | (0.002) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i \times \tau_{I,jt}$ | | | -0.041** |
| | | | (0.019) |
| Plant controls | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ |
| Year FE | ✓ | ✓ | ✓ |
| Observations | 117,214 | 110,553 | 110,553 |
| R-squared | 0.789 | 0.793 | 0.793 |

*Notes:* OLS estimation.Share of Imported Intermediates$_{it}$ is the share of 7-digit imported intermediates over total intermediates sourced by plant $i$ in year $t$. $\text{Post}_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. $\text{Eligible}_i$ is the alternate measures of the treatment defined in Appendix **??**. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.15: Effect on intermediates: role of distance to major ports

| | Share of Imported Intermediates$_{it}$ | |
|---|---|---|
| | (1) | (2) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i$ | -0.015 | -0.025** |
| | (0.011) | (0.012) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i \times \ln \text{Distance to major port}_d$ | 0.004*** | 0.004** |
| | (0.001) | (0.001) |
| $\text{Post}_t^{2017} \times \text{Eligible}_i \times \ln \text{Distance to state capital}_d$ | | 0.002** |
| | | (0.001) |
| Plant controls | ✓ | ✓ |
| Plant FE | ✓ | ✓ |
| Year FE | ✓ | ✓ |
| Observations | 91,278 | 91,278 |
| R-squared | 0.799 | 0.799 |

*Notes:* OLS estimation.Share of Imported Intermediates$_{it}$ is the share of 7-digit imported intermediates over total intermediates sourced by plant $i$ in year $t$. $\text{Post}_t^{2017}$ is an indicator variable taking value 1 in the year 2017 and after, and 0 otherwise. $\text{Eligible}_i$ is the alternate measures of the treatment defined in Appendix **??**. Plant-level trends$_{it}$ are the 2012 values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a year indicator. $\ln \text{Distance to major port}_d$ is the distance between a district and the closest major port, and $\ln \text{Distance to capital}_d$ is the distance from a district to the state's capital. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# F Results: Productivity and Production Decision

Table F.1: Effect on value-added per worker

| | ln Value-added per worker$_{it}$ | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| ln Labor$_{it}$ | | -0.508*** | -0.507*** | -0.403*** |
| | | (0.080) | (0.078) | (0.049) |
| Post$_t^{2017}$ × Eligible$_i$ | 0.021 | -0.013 | | |
| | (0.019) | (0.028) | | |
| Post$_t^{2017}$ × Alt Eligible$_i$ | | | -0.029 | |
| | | | (0.021) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × Less than 100 workers$_{it}$ | | | -0.021 | |
| | | | (0.077) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × $200-299$ workers$_{it}$ | | | 0.040*** | |
| | | | (0.014) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × $300-399$ workers$_{it}$ | | | 0.057*** | |
| | | | (0.020) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × $400-499$ workers$_{it}$ | | | 0.069*** | |
| | | | (0.025) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × More than 500 workers$_{it}$ | | | 0.079*** | |
| | | | (0.025) | |
| Post$_t^{2017}$ × Share Eligible$_i$ | | | | -0.014 |
| | | | | (0.030) |
| Post$_t^{2017}$ × Share Eligible$_i$ × Less than 100 workers$_{it}$ | | | | 0.034 |
| | | | | (0.046) |
| Post$_t^{2017}$ × Share Eligible$_i$ × $200-299$ workers$_{it}$ | | | | 0.010 |
| | | | | (0.030) |
| Post$_t^{2017}$ × Share Eligible$_i$ × $300-399$ workers$_{it}$ | | | | 0.026 |
| | | | | (0.029) |
| Post$_t^{2017}$ × Share Eligible$_i$ × $400-499$ workers$_{it}$ | | | | 0.033 |
| | | | | (0.029) |
| Post$_t^{2017}$ × Share Eligible$_i$ × More than 500 workers$_{it}$ | | | | 0.056* |
| | | | | (0.030) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Post FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Post FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 27,224 | 27,224 | 27,224 | 4,590 |
| R-squared | 0.818 | 0.840 | 0.840 | 0.905 |

*Notes:* This table collapses together the pre-reform (2014, 2015 and 2016) and post-reform (2017, 2018 and 2019) years. OLS estimation. Columns (1) to (3) contain the whole sample, and column (4) is restricted to plants producing at least one taxable and one exempt product. ln Value-added per Worker$_{it}$ is the value-added per production worker by plant $i$ in period $t$. Post$_t^{2017}$ is an indicator variable taking value 1 in the post-reform period, and 0 otherwise. Plant-level trends$_{it}$ are the first period values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a period indicator. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table F.2: Effect on the number of products

| | #Products$_{it}$ | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| ln Labor | | 0.062*** | 0.064*** | 0.111*** |
| | | (0.012) | (0.013) | (0.022) |
| Post$_t^{2017}$ × Eligible$_i$ | 0.001 | -0.023 | | |
| | (0.016) | (0.019) | | |
| Post$_t^{2017}$ × Eligible$_i$ × Less than 100 workers$_{i,2012}$ | | 0.012 | | |
| | | (0.012) | | |
| Post$_t^{2017}$ × Eligible$_i$ × 200 − 299 workers$_{i,2012}$ | | 0.024** | | |
| | | (0.011) | | |
| Post$_t^{2017}$ × Eligible$_i$ × 300 − 399 workers$_{i,2012}$ | | 0.036* | | |
| | | (0.020) | | |
| Post$_t^{2017}$ × Eligible$_i$ × 400 − 499 workers$_{i,2012}$ | | 0.026 | | |
| | | (0.020) | | |
| Post$_t^{2017}$ × Eligible$_i$ × More than 500 workers$_{i,2012}$ | | 0.057*** | | |
| | | (0.016) | | |
| Post$_t^{2017}$ × Alt Eligible$_i$ | | | 0.043*** | |
| | | | (0.014) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × Less than 100 workers$_{i,2012}$ | | | 0.006 | |
| | | | (0.012) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × 200 − 299 workers$_{i,2012}$ | | | 0.013 | |
| | | | (0.012) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × 300 − 399 workers$_{i,2012}$ | | | 0.030** | |
| | | | (0.014) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × 400 − 499 workers$_{i,2012}$ | | | 0.010 | |
| | | | (0.015) | |
| Post$_t^{2017}$ × Alt Eligible$_i$ × More than 500 workers$_{i,2012}$ | | | 0.055*** | |
| | | | (0.015) | |
| Post$_t^{2017}$ × Share Eligible$_i$ | | | | -0.088*** |
| | | | | (0.033) |
| Post$_t^{2017}$ × Share Eligible$_i$ × Less than 100 workers$_{i,2012}$ | | | | 0.028 |
| | | | | (0.033) |
| Post$_t^{2017}$ × Share Eligible$_i$ × 200 − 299 workers$_{i,2012}$ | | | | 0.049 |
| | | | | (0.030) |
| Post$_t^{2017}$ × Share Eligible$_i$ × 300 − 399 workers$_{i,2012}$ | | | | 0.039 |
| | | | | (0.066) |
| Post$_t^{2017}$ × Share Eligible$_i$ × 400 − 499 workers$_{i,2012}$ | | | | 0.057 |
| | | | | (0.072) |
| Post$_t^{2017}$ × Share Eligible$_i$ × More than 500 workers$_{i,2012}$ | | | | 0.065** |
| | | | | (0.031) |
| Plant-level trends | ✓ | ✓ | ✓ | ✓ |
| Plant FE | ✓ | ✓ | ✓ | ✓ |
| State × Post FE | ✓ | ✓ | ✓ | ✓ |
| 2d-industry × Post FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 31,766 | 31,766 | 31,766 | 5,400 |
| Pseudo R-square | 0.262 | 0.262 | 0.263 | 0.329 |

*Notes:* This table collapses together the pre-reform (2014, 2015 and 2016) and post-reform (2017, 2018 and 2019) years. PPML estimation. Columns (1) to (3) contain the whole sample, and column (4) is restricted to plants producing at least one taxable and one exempt product. #Products$_{it}$ is the number of products manufactured by plant $i$ in period $t$. Post$_t^{2017}$ is an indicator variable taking value 1 in the post-reform period, and 0 otherwise. Plant-level trends$_{it}$ are the first period values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a period indicator. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table F.3: Effect on excluded plants

| | $\ln$ Eligible Share$_{it}$ | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Post$_t^{2017}$ × InputGST$_i^H$ | -0.037 | 0.095** | | |
| | (0.085) | (0.046) | | |
| Post$_t^{2017}$ × InputGST$_i^M$ | -0.112* | 0.042* | | |
| | (0.060) | (0.025) | | |
| Post$_t^{2017}$ × InputGST$_i$ | | | 0.535** | 0.270* |
| | | | (0.215) | (0.148) |
| Plant-level trends | Yes | Yes | Yes | Yes |
| Plant FE | Yes | Yes | Yes | Yes |
| State × Post FE | Yes | Yes | Yes | Yes |
| 2d-industry × Post FE | Yes | Yes | Yes | Yes |
| Observations | 2,084 | 6,048 | 6,048 | 6,038 |
| R-squared | | 0.728 | 0.729 | 0.757 |

*Notes:* This table collapses together the pre-reform (2014, 2015 and 2016) and post-reform (2017, 2018 and 2019) years. OLS estimation. The sample is restricted to the control group of plants unable to claim input tax credit. Taxable Share$_{it}$ is the share of taxable products, *i.e.*, enabling input tax credit, made by plant $i$ in period $t$. Post$_t^{2017}$ is an indicator variable taking value 1 in the post-reform period, and 0 otherwise. InputGST$_i$ is the main measures of the treatment. Plant-level trends$_{it}$ are the first period values of plant-level variables (exporter indicator, importer indicator, multiproduct indicator, log of capital per labor, wages per gross sales) interacted with a period indicator. The 2d-industry FE follows the NIC-2008 classification. Heteroskedasticity-robust standard errors clustered by the 5-digit main product of the plant are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$