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# Production and evasion responses with limited state capacity

Evidence from major  
tax reforms in India



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# PRODUCTION AND EVASION RESPONSES WITH LIMITED STATE CAPACITY - EVIDENCE FROM MAJOR TAX REFORMS IN INDIA

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## Abstract

Taxes on transactions are a common way of raising tax revenue, mostly in the form of a sales tax or a value-added tax (VAT). We analyze the effect of a switch from a sales tax to a VAT on output and tax evasion. States in India gradually transitioned from a sales tax to a VAT system. We digitize and harmonize all of India's state-level consumption tax systems, which feature tax rates on hundreds of categories of goods that vary across states. Exploiting state- and product-specific tax variation and the staggered implementation of VAT across states, we show that by five years after the reform, gross sales increase by 16%. This increase in output is a result of the VAT lowering tax rates and reducing distortionary effects of double taxation. Furthermore, in a sample of relatively large manufacturing firms, we find limited evidence of bunching at registration thresholds indicating limited tax evasion. Our study has implications for India's more recent reforms aimed at simplifying the tax law and for the consequences of a similar move in other countries.

Keywords: value added tax, sales tax, production efficiency, evasion, bunching  
JEL: Codes: H21, H25, H26, H71, O17, O23

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# 1 Introduction

Governments around the world raise revenue to provide public goods and services to their citizens. In many countries, taxes on transactions make up a substantial part of government revenue, whether in the form of value added taxes, retail sales taxes, or various excise taxes. The popularity of value-added tax (VAT) systems has grown sharply in the past 30 years: 50 countries had a VAT in 1990, but by 2016 that number had increased to 165 (OECD, 2016). While many of the early adopters of the VAT were European countries, many recent adopters have been developing countries. How does the introduction of a VAT affect the economy in those settings, for example due to limited state capacity and a large informal sector?<sup>1</sup> We answer this question in the context of India, focusing on two margins of response: output responses and tax evasion.

As in other developing countries, reliance on transaction taxes in India is high: Indirect taxes (of which transaction taxes are the largest component) make up about 86% of state revenue. During the 2000s, Indian states moved from a sales tax system to a value-added tax system. The sales tax system has highly decentralized and complex, inducing inefficiency in three main ways: (1) taxation focused on the first point of sale, which requires higher tax rates than a retail sales tax to raise the same amount of revenue, (2) taxation at the first point of sale also encourages firms to create inefficient supply chains that allow them to shift production past the first point of sale to avoid the tax, and (3) despite being a first-point-of-sale tax, the tax laws feature a large amount of cascading due to the fact that industrial inputs, plants, and machinery are taxed with no credit to the eventual manufactured product. The latter of these inefficiencies arose due to pressures to raise revenue induced by the fact that only taxing the first point of sale results in a narrow tax base. Such double taxation violates production-efficiency conditions (Diamond and Mirrlees 1971) and may impose substantial welfare costs (Keen 2012).

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<sup>1</sup>For a historical overview and stylized facts about the relationship between taxation and development see Besley and Persson (2013) and Gadenne and Singhal (2014).

To reduce inefficiencies resulting from India’s sales taxes, many economists advocated a switch to a VAT, which reduces these concerns. Firms only pay taxes on the value added in production, i.e. the difference between sales and the cost of purchased inputs. This reduces double taxation. Additionally, firms have an incentive to truthfully report their input purchases to receive a tax credit, which functions as a check on reported sales by suppliers and reduces the scope for tax evasion. The VAT system is therefore generally considered to be a more efficient transaction tax system.

Despite these advantages, there are multiple reasons to be cautious about the overall effectiveness in a developing country context. First, firms may evade VAT by shifting to a lower-rate turnover tax (Best et al. 2015; Emran and Stiglitz 2005) or may encourage firms to move to the informal economy, thus avoiding taxes altogether. This negatively affects tax revenue and may introduce production inefficiencies by inducing firms to remain small enough to not have to formally register.<sup>2</sup> Second, the lack of state capacity in developing countries may not allow developing countries to take advantage of the paper-trail and self-enforcing properties of the VAT. Recent research suggests that the effectiveness of the VAT may be severely limited when transparency and enforcement of the system are weak, or when the technology to cross-check returns from firms at scale without initiating an audit is not available (Carrillo, Pomeranz and Singhal, 2017; Mittal and Mahajan, 2017; Naritomi, 2015; Pomeranz, 2015; Shah, 2019).<sup>3</sup> Third, like for other big government initiatives, corruption opportunities, mismatched incentives between officials at different levels, the lack of financial literacy of entrepreneurs, and high compliance costs due to complicated rules may all undermine an otherwise ambitious system (Amodio et al., 2018; Khan, Khwaja and Olken, 2016, 2019; Kumler, Verhoogen and Frias, 2015; Okunogbe and Pouliquen, 2018; Olken and Singhal, 2011). The Indian VAT introduction did not completely eliminate double taxa-

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<sup>2</sup>Additionally, Gadenne, Nandi and Rathelot (2019) find evidence for additional supply chain inefficiencies that are created by differential incentives to register for the tax: registered firms have an incentive to mostly interact with other registered firms to take advantage of the tax credit. This leads to partial segmentation of supply chains, causing production inefficiencies and network effects, and contributes to the large misallocation of resources between firms observed in developing countries (Hsieh and Klenow, 2009).

<sup>3</sup>For a recent overview of the literature see Pomeranz and Vila-Belda (forthcoming).

tion, for example, because key features from the complex federal system remained in place. While many policymakers argued that it was a vast improvement from the “arcane” sales tax system, the system was therefore not entirely similar to European-style VATs.

The overall impact of the switch from a sales tax to a VAT is therefore unclear. Despite many countries switching over the last 30 years, little empirical evidence on the switch from sales to value-added taxes exists; two exceptions are Keen and Lockwood (2010) and Smart and Bird (2009).<sup>4</sup> India’s reform in the 2000s provides an ideal testing ground for the overall impact of a VAT on the economy, allowing us to exploit several features of the Indian system like its federalist structure, substantial heterogeneity across states and staggered adoption of VAT. We provide the first empirical evidence that document the productive and evasion response to this transition.<sup>5</sup> Although India’s tax structure and institutional context are very different from other countries, this study will also allow us to derive important policy implications of potential reforms in other federal countries, which may eventually consider the switch. The study also represents one of the the most important policy reforms affecting firms in India – mainly because the reform affected a substantially large share of economic activity. Many other policy reforms studied in India have focused on tariffs or trade liberalization (Goldberg et al. 2009; Goldberg et al. 2010*a*; Goldberg et al. 2010*b*; Topalova and Khandelwal 2011), which necessitate studying particular industries. This reform affected all industries such to transaction taxes.

To study the Indian tax reform, we use firm-level data from the Annual Survey of Industries (ASI) made available by the Indian government and combine it with state-specific and commodity-specific tax system information. The ASI regularly samples large manufacturing firms and surveys smaller firms for a subset of years. This provides an ideal database to

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<sup>4</sup>The first paper focuses on aggregate data and the second paper focuses on the Canadian experience.

<sup>5</sup>Our research provides the first evidence of the effect of an adoption of a VAT on evasion and real production responses in a developing country, and also provides the first empirical evidence on subnational VATs in a country other than Canada. We contribute to the literature that has studied tax evasion and bunching in the context of Pakistan, as in Kleven and Waseem (2013), Best et al. (2015), Slemrod, Rehman and Waseem (2018), Waseem (2018*b*), Waseem (2018*c*) and Waseem (2018*a*), and to the literature that has studied evasion of commodity taxes in developing countries, such as Pomeranz (2015), Gadenne (2018), Gadenne (2014) and Naritomi (2015).

study the transition given India’s first-point-of-sale tax system substantially affected manufacturing firms. The manufacturing database contains specific information on sales and inputs that firms use as well as product classification codes. Although the ASI has some information on total taxes paid, it does not have information on tax rates faced by the firm or whether the firm has registered to pay sales tax or VAT.

To assemble product specific tax rates, we comb through all 36 state and union territory laws and amendments concerning both VAT and sales taxes from the years 2001 and until 2016. This results in a unique tax database that captures variation in tax rates across various goods and sectors within a state, variation across states and over time, and variation in the exemption thresholds below which firms do not need to register. This exercise is complicated by the fact that each state levies commodity-specific tax rates on hundreds or thousands of different itemized products. Each state publishes a schedule of commodities (often times 50 pages of commodities per state-year) and the appropriate tax rate to be levied on those commodities. Then, every time a state changes a tax, the state issues a notification of the amendment. To construct our tax calculator, we digitize the sales tax schedule in 2002 and the VAT schedule in the first year of adoption. We then comb through state archives of all revenue notifications (amendments) and identify the ones relevant for our calculator. Unfortunately, the tax schedules issued by the states contain only product names and no numerical identifiers. We then use fuzzy match algorithms to name merge these to the ASI database, verifying the accuracy of all matches using manual verification and a manual match of all commodities that the algorithm is unable to match. Given the schedules differ across the 36 states for the sales tax and the VAT regime, we need to conduct this procedure 36 times for both the pre- and post-reform period. This provides us with the most comprehensive database of all commodity tax rates in India ever assembled. In addition, we use legal books to identify sales and value added tax registration thresholds, turnover tax thresholds, and any other tax thresholds that may exist for special fees, etc. These thresholds are also state and year specific and many states have different thresholds

depending characteristics of the firm. We check legal notifications to identify any threshold changes that have occurred.

With these data, we employ two separate methodologies to identify production responses and evasion responses. First, to identify production responses, we exploit a generalized difference-in-differences approach in an event study context. Although the central government allowed states to transition to the VAT starting in 2003, some states adopted years later than others. We exploit the staggered implementation of state level VATs between 2003 and 2008 to create treatment and control groups. In our simplest approach, we study the change in sales as a result of the transition and find a 16% increase in gross output by five years after the tax reform. When studying large manufacturers we identify a 30% increase in production by five years after the reform. Because states differed in their tax schedules and industries differ in their rate of taxation within a state, the adoption of the VAT more intensely affects some states and sectors; in particular, states or industries with very high tax rates under the sales tax system are likely to see the largest production responses.

Second, to identify tax evasion responses, we exploit a bunching analysis similar to Best et al. (2015). Unlike prior studies, our thresholds happen very low in the firm size distribution and the ASI generally has larger firms, which creates complications to construct counterfactual densities. We overcome these by focusing on a “discontinuity” based approach where we look for excess mass *right at* the threshold rather than estimating excess mass over a bunching region near the threshold. Keeping in mind that the data focuses on large formal firms, we find no evidence of a discontinuity in the distribution of firms when pooling all sales tax or VAT registration thresholds. In contrast, we do find significant discontinuities at larger VAT thresholds where we have a sufficient number of firms around the threshold. We also find large discontinuities at the turnover tax threshold, allowing firms to pay a lower rate of tax if they wish. Consistent with Best et al. (2015), this is consistent with tax evasion. Combining these two analyses, we conclude that for the manufacturing sector, it is likely the case that the output gains are large and outweigh changes in evasion for manufacturing.

To conclude, indirect taxation in India historically relied on a complicated and highly decentralized sales tax system. The “irrational” and “complex” nature of the sales tax resulted in various rates across products – often not justified by economic theory but by political or historical reasons – and across states, creating ample room for evasion and tax avoidance. Despite its original first point of sale setup, the sales tax system resulted in taxes “cascading” through the production process, as inputs to production were not fully exempt from taxation and governments sought to tax products at multiple stages in order to raise tax revenue. As inputs were taxed several times, businesses have an incentive to reduce the use of these inputs and may even merge vertically (Keen 2014). These inefficiencies have a negative impact on economic growth. Replacing the retail sales tax with subnational VATs in India was designed to spur growth (Poirson 2006). Although the VAT system adopted was not ideal and maintained many complexities, our analysis provides the first evidence suggesting that growth was enhanced by the transition to the new tax system, while tax evasion remained unchanged. These results have important policy implications for the recent shift from the state VAT to a centralized VAT in India.

Historically, India’s highly decentralized system of indirect taxation has led to production inefficiencies because it relied on a sales tax that resulted in substantial cascading (double taxation), very high rates of taxation because of its first-point-of-sale levy, and incentives for manufacturers to shift production past the first point of sale. During the 2000s, states replaced this archaic sales tax system with a value added tax (VAT) system, which, although not entirely similar to European-style VATs, was an improvement on the prior structure. Against this backdrop, we ask: what is the effect of switching from a sales tax to a VAT in a country with limited tax capacity and a large informal sector? In particular, we focus on two margins of response: output responses and tax evasion.



## 2 India’s Commodity Tax System

India has always had a complex commodity-tax system compared to other countries.<sup>6</sup> According to the Indian Constitution, state governments have the power to levy taxes on intra-state sales, whereas inter-state sales are taxed by the central government.<sup>7</sup> Services cannot be taxed by the states and instead were taxed under the Central Value Added Tax (CENVAT). Given the difficulty enforcing direct taxes in a low-capacity environment, commodity taxes are an important source of state revenue. In 1950, sales tax revenue made up 26 percent of states’ own-tax revenue, but by 2013, that share had increased to 61 percent (Sury, 2015).

Most states adopted independent sales tax systems in the 1940s or 1950s.<sup>8</sup> Unlike most other commodity tax systems around the world, the Indian sales tax system is distinguished by its rate schedules, which feature many product-specific tax rates within a given state. Many states had detailed schedules with long lists of product-specific tax rates. While goods considered to be necessities were mostly exempt from sales tax or subject to lower tax rates than other products and luxuries, the same good was often taxed differently across Indian states.<sup>9</sup> All goods not listed under a specific schedule are subject to a “default tax rate” was 8 to 10 percent in many states, but ranged from 3 percent in Pondicherry to 13 percent in Maharashtra (Purohit, 2001*a*).

Unlike the retail sales tax in the United States, most states levied sales tax at the first point of sale in their state, defined as the sale by the first registered dealer in the state. Each state had its own rules guiding which dealers had to formally register and pay taxes, typically

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<sup>6</sup>Please see appendix for further details. Some useful references include Mukherjee and Rao (2015), Santra and Hati (2014), Rao and Rao (2005), Cnossen (2012), Bagchi and Team (1994) and Chelliah and Committee (1992).

<sup>7</sup>This changed with the introduction of a national VAT in 2017.

<sup>8</sup>Some other states like Arunachal Pradesh and Mizoram, however, only introduced sales taxes much later. The Andaman and Nicobar islands as well as the Union Territory of Lakshadweep have never had a sales tax system.

<sup>9</sup>Purohit (2001*a*) groups products into three broad categories: “Necessities” are either exempted or subject to tax rates of 1 to 4 percent across states, “comforts” have a typical tax rate of 10 to 12 percent, and “luxuries” have tax rates of 15 to 25 percent.

based on turnover, but also often subject to additional criteria such as industry. Only Delhi, Haryana and Punjab had a last-point tax, which taxes the sale by the last registered dealer either to an unregistered dealer or to a consumer.<sup>10</sup> While most states had a single-point tax system, some imposed turnover taxes on dealers in a certain turnover range or on sellers in particular industries, for example restaurants and hotels.<sup>11</sup>

By the late 1990s and early 2000s the sales tax systems differed widely, based on a mixture of administrative convenience, ad hoc measures to increase tax revenues, and measures to attract firms to their state (Sury, 2015). In addition to its complexity, problems with double taxation (cascading taxes) and tax competition (Kanbur and Keen 1993) between states were widespread. How does double taxation arise in a first-point system? The first point of sale required very high rates to raise the same amount of revenue as would be generated under an equivalent retail sales tax system. This narrow base led many states to begin to tax inputs in the production process, which in turn were denied credits against the manufacturing stage resulting in the double taxation of industrial inputs and machinery (Bagchi and Team 1994). Furthermore, the presence of turnover taxes that were not deductible (Bagchi and Team 1994) also resulted in double taxation. With respect to tax competition, highly time-, industry- and location-specific tax incentives were common, and some states had engaged in “rate wars” by lowering tax rates to attract firms to their state (Purohit and Purohit, 2014; Sury, 2015). At a time of increasing state fiscal deficits, this led to large tax revenue losses among states because sales tax revenue was the main source of own tax revenue (Ministry of Finance, 2003). This further resulted in states looking for additional revenue by creating additional provisions that resulted in double taxation. A 1994 report by Indian tax experts on behalf of the Ministry of Finance referred to the the commodity tax system as “archaic, irrational and complex - according to knowledgeable experts the most complex in the world”

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<sup>10</sup>This is equivalent to a retail sales tax. Punjab and Haryana also allowed input tax credit for manufacturers (Purohit, 2001*b*).

<sup>11</sup>All Indian states collected more than 50 percent of their sales tax revenue through first-point taxes. Even Haryana, which had a last-point sales tax system, taxed 81 commodities at the first point of sale, subject to input credit that could be claimed for registered dealers. Haryana collected 60 percent of revenue at that level (Purohit, 2001*a,b*).

(Bagchi and Team 1994). Given the existing system and the division of constitutional powers, the Bagchi report regarded the switch from a state sales tax to a state VAT regime as the most realistic step towards a more efficient commodity tax system.

Implementing such a reform required getting all state governments on board with suggested changes, because the central government could not mandate a reform and many states were highly protective of their right to levy taxes (Purohit, 2001*b*).<sup>12</sup> To facilitate a discussion about a state-specific VAT system, the central government developed a model VAT act that was supposed to serve as a guideline for state governments. While state governments acknowledged the need for harmonization of their widely differing systems, finding an agreement proved to be difficult in practice. States were also concerned about short-run revenue losses from the move to a completely new tax system.

Both of these issues led to repeated delays in the process. In 2002, the central government reduced its demands for harmonization of the state VAT systems. It now sought to harmonize a few key features of the VAT system while allowing state governments more freedom to adjust the model VAT act to state-specific concerns. The central government also agreed to compensate states for any reform-related losses in the first three years (Ministry of Finance, 2002, 2003; Sury, 2015). April 1, 2003 was chosen as the start date for introduction of the VAT, but only one state, Haryana, actually switched to the VAT on that date. The other states delayed their start dates, mostly due to delays in these legislative processes and the administrative changes required for the reform (Ministry of Finance, 2005). Many Indian states introduced the VAT system two years later on April 1, 2005, but a few states delayed their start date even further. The Indian state of Chhattisgarh, for example, implemented the reform in 2006, when details of the compensation formula for initial revenue losses had been worked out. Other large states like Tamil Nadu and Uttar Pradesh switched to a VAT system in 2007 and 2008, respectively. Table A.1 provides an overview of the VAT implementation date in all states.

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<sup>12</sup>Please see the appendix for additional details.

The VAT system in every state was established in a VAT Act, passed in the state legislature. Like the sales tax, the Act included schedules with lists of goods and their tax rates. Most states had an exempt category, as well as tax rates of 1, 4 and a general tax rate of 12.5 percent. But many states also levied higher tax rates on items such as diesel and alcohol. Most states therefore saw a reduction in the complexity of their tax system, as well as some harmonization of tax rates with their neighbors. Frequent tax rate changes after the VAT introduction also led to a new divergence of state tax rates. These differences only disappeared with the introduction of a national VAT system in 2017.

Despite the continuing complexity and the remaining state differences, tax revenue increased substantially after the reform, and the central government called the implementation “quite encouraging.” In their annual report *Economic Survey*, the process is summarized like this:

“The new system has been received well by all the stakeholders, and the transition has been quite smooth with the Empowered Committee [of State Finance Ministers] constantly reviewing the progress of implementation. The EC has advised the States to constantly interact with trade and industry to remove their apprehensions, if any, and to ensure that the benefits of VAT due to input tax credit and reduction in tax rates (where applicable) are passed on to the consumers. The EC is also persuading the remaining States/UTs to implement VAT at the earliest” (Ministry of Finance, 2006).

Tax revenue for the financial year 2005-06 increased by 13.8 percent relative to the previous year. Tax revenue increased by 21 percent in the year of 2006-07, by 14.6 percent in 2007-08 and by 19.1 percent in 2008-09 (Ministry of Finance, 2007, 2008, 2009). States could request compensation for revenue losses related to the VAT at the rate of 100 percent for 2005-06, 75 percent for 2006-07, and 50 percent for 2007-08.<sup>13</sup>

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<sup>13</sup>According to Ministry of Finance (2007), 8 of 25 VAT-implementing states requested VAT compensation for 2005-06 for a total of Rs 6,765.6 crore.

Nevertheless, the new system retained a number of shortcomings, including state differences in schedules and a complete non-taxation of services (the sales tax and VAT both only tax goods), leading to calls for further reform (Cnossen, 2012). In addition, although tax cascading was reduced by the reform, it was not entirely eliminated due to delays in credits against the CENVAT, the exclusion of major sectors from the CENVAT and denial of these sectors to credits on state VAT as well as the non-credibility of Central Sales Tax on interstate trade (Keen 2014).

### 3 Theory Background

A large literature studies the efficiency consequences of retail sales taxes (RST); similarly the value added tax has been thoroughly analyzed for its efficiency enhancing properties.<sup>14</sup> Despite the extensive study of these two taxes in isolation, few papers study the transition from a sales tax to a VAT. Two reasons likely explain this void in the literature. First, most countries that impose VAT were “early” adopters, so the long-past switch to a value added tax makes micro-data access problematic. Second, with the exception of decentralized countries like India, the United States, Canada and Brazil, commodity taxes are usually highly centralized, which implies little within-country variation in these taxes.<sup>15</sup> India’s recent transition and highly decentralized setting overcome both of these issues, providing us with rich data that facilitates treatment and control groups.

Although empirically researchers have not studied the transition between tax system, a large theoretical literature sheds light on the expected effects of transitioning from a sales tax to a VAT. On the one hand, the imposition of a VAT will eliminate double taxation (cascading) of inputs and reduce incentives to vertically integrate, thus improving production

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<sup>14</sup>See Crawford, Keen and Smith (2010) in the Mirrlees Review for a survey.

<sup>15</sup>Empirical evidence on VAT-rate changes in developed countries is often not applicable to a country like India because (1) services are omitted from the state level VATs, (2) the credit invoice system often breaks down because unregistered firms are unable to receive a VAT credit, (3) the tax system is characterized by two or more rates across commodities and variation across states, and (4) a country like India is characterized by having many small family firms (Kopczuk and Slemrod 2011) that often have high compliance costs but can easily escape taxation.

efficiency and lowering prices (Keen, 2014). On the other hand, in the presence of an informal underground economy, the introduction of a VAT may also have welfare costs as the VAT can encourage the growth of the informal economy by creating incentives for firms to go underground (Emran and Stiglitz, 2005).<sup>16</sup>

### 3.1 Theory of Cascading and Production Inefficiencies

Diamond and Mirrlees (1971) show that efficiency requires that producers should all face the same relative input prices before and after taxes. Such production efficiency requires that the economy not tax inputs, which if taxed would alter the prices for the buyer and seller. Under this classic result, tax cascading is undesirable.<sup>17</sup> While the sales tax is often regarded as a tax on final consumption goods, intermediate materials or services are often subject to taxation, which is referred to as “cascading” or “pyramiding.” Tax cascading can be especially large. Even in the United States, where states have rules designed to prevent cascading, it is estimated that two-thirds of sales tax revenues are derived from purchases other than those of final consumers (Ring, 1989). Wildasin (2001) shows that this leads to effective tax rates between 0% and 12%. As a result, tax rates vary dramatically across different commodities, often in sub-optimal ways. This taxation of inputs creates large production inefficiencies and may increase final consumer prices by more than the statutory tax rate (Agrawal and Hoyt 2018).

In the case of India, tax cascading was a major problem even as many states operate a first-point-of-sale retail sales tax, which was often the manufacturer. Poddar and Ahmad (2009) suggest that 35-40% of revenue is raised from cascading elements. Faced with this narrow base and base erosion due to arguments over whether a given stage was manufacturing, states resorted to taxing inputs. The Bagchi report (Bagchi and Team 1994) finds

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<sup>16</sup>For a counterpoint see Keen (2008). Of course, the retail sales tax also has rampant tax evasion on cross-border transactions (Agrawal and Mardan, 2019), which legally should be taxed at destination but are de facto taxed at origin.

<sup>17</sup>The result requires that the government is able to tax all final consumption, which is unlikely to be the case in developing countries like India. As a result, it may be desirable to tax inputs and to have some tax cascading.

that inputs were often subject to their own tax schedule, were denied credits on technical grounds, and no relief was provided to taxes on plant and equipment. Furthermore, taxation at the first point of sale created additional production inefficiencies by encouraging firms to shift some of their production to later stages in the supply chain in order to reduce the tax burden. The first-point-of-sale tax also resulted in excessively high tax rates, which introduces substantial reasons to shift production to a lower taxed but less efficient production process.<sup>18</sup> All of these factors result in a tax system with large productive inefficiencies, which in turn have important welfare implications (Keen 2012).<sup>19</sup>

While it may seem that the VAT does not suffer from the same problems, it also creates distortions. While the tax is a share of value added at each stage of production, exemptions under credit-invoice VAT systems and, under subtraction VATs, differential taxation of different products that may be inputs, create differences in the effective tax of final products. However, these tax cascading effects are minimal under a VAT. At the same time, India's state level VATs are not European-style VATs and substantial cascading remains due to delays in the credit on investment under the CENVAT, the exclusion of major sectors, the denial of credits on state taxes paid, and the inability to credit the central sales tax on interstate trade. This implies that the overall effect of the VAT reform on output remains an empirical question despite anecdotal evidence that the transition was an improvement of the tax system.

### 3.2 Theory of Evasion and Bunching

The efficiency gains of the VAT must be weighed against possible tax evasion. de Paula and Scheinkman (2010) explain that the VAT may facilitate evasion in the presence of a large informal sector. Collecting VAT using the credit-invoice system leads to the transmission of informality across the supply chain. Under the credit-invoice system, VAT applies on each

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<sup>18</sup>See Avittathur, Shah and Gupta (2005) for evidence on this phenomenon.

<sup>19</sup>See also Piggott and Whalley (2011) and Boadway and Sato (2009) for discussion of the informal sector and its effect on the efficiency of commodity taxes.

stage of production, with the seller receiving a credit for any taxes paid in the prior stage. This credit is then used by the taxpayer against future tax liabilities. The authors note: “Since purchases from informal suppliers do not generate tax credits and informal buyers cannot use tax payments from formal suppliers, there is an incentive for informal (formal) firms to deal with other informal (formal) firms.” Thus, the VAT may amplify the incentives to engage in tax evasion in places where informality is common place. The reason is that firms cannot take advantage of tax credits because it is likely that at some point in the production process a buyer or a supplier is informal.

The recent literature has suggested that the presence of bunching at mandatory registration thresholds can be used to shed light on evasion. In particular, although mandatory registration thresholds will induce both real and evasion responses (Liu et al. 2018), the specific structure of many tax systems in developing countries helps to bound tax evasion. Best et al. (2015) argue that the presence of a low-rate turnover tax coupled with changes in the definition of the tax base can help bound tax evasion, given the low-rate turnover tax is unlikely to have large real effects on production. Liu et al. (2018) show that firms are more likely to voluntarily register if they have high costs of inputs relative to sales, when they have few business to consumer sales, and when markets are less competitive. In the Indian case, complexity of the VAT relative to the turnover tax regime – resulting in high compliance costs – may also encourage firms to not register.<sup>20</sup>

In the Indian case, the issue of evasion around thresholds is complicated by the fact that many states have both turnover and sales tax/ VAT registration thresholds. Kanbur and Keen (2014) show that when firms and individuals face multiple forms of tax and non-tax obligations with different thresholds, quite complex patterns of compliance, adjustment and evasion can be generated.<sup>21</sup>

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<sup>20</sup>Although India’s commodity tax system is regarded as highly complex, some states are more complex than others, likely a result of political factors or characteristics of the state. Slemrod (2005) discussed the determinants of complexity in the U.S. setting.

<sup>21</sup>Velayudhan (2018) shows that India’s central government taxes also have thresholds that generate bunching, but this threshold is higher in the turnover distribution than the state thresholds that we are focusing on.



## 4 Data

### 4.1 Tax Database

No standardized database exists from all of India’s state-specific tax rates and registration requirements for firms. We assemble the first database, which creates a standardized listing of tax rates by products for all states as well as a unique database of registration thresholds for firms. To create these databases, we combine multiple sources. All states provide information on their state-specific VAT systems on the website of their state Commercial Taxes Department. This information typically includes the state’s VAT Act, a list of schedules with specific products and their tax rate, and an archive of tax change notifications. But the states do not maintain a database that provides a panel of tax rates over time, and the exact version of the VAT Act and the tax rate schedules is sometimes unknown.<sup>22</sup>

We digitize hundreds of pages of these state documents to create extensive tax databases. First, we digitize the tax rate schedules for a given point in time, which gives us a cross-sectional snapshot of the product-specific VAT rates. We then trace any tax rate changes from information on the schedules or from the notifications in the online archive, and note the old and new tax rates as well as the exact date the changes went into effect. Sometimes, notification date and implementation dates differ, in which case we keep track of both dates. This gives us a state-product-specific panel database of tax rates from the VAT introduction in a state until 2016. In rare instances, the notification archive is not complete, leading us to miss information on any tax rate changes for a period of time.<sup>23</sup>

The VAT Act documents also contain information regarding state-specific registration thresholds for firms. We code up all general thresholds in addition to any additional rules, such as different thresholds for specific industries or firm characteristics. In addition to the

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<sup>22</sup>Most states include information about notifications that altered tax rates in footnotes. Based on the last tax rate change and a comparison with all individual tax notifications from the archive, it is typically possible to roughly date the posted documents.

<sup>23</sup>For the small north-eastern states of Sikkim and Nagaland, for example, the online archives are missing any information on VAT rate changes before 2010.

VAT registration thresholds, we also track turnover tax thresholds for which firms can pay a (generally) lower rate on their turnover rather than the VAT. We also track other thresholds for which firms are required to pay additional fees or other taxes. Like the tax rate changes, we keep track of any changes to the registration rules over time.

We supplement these databases with information from two collected volumes of state VAT systems, one from 2005 and one from 2007 (Sangal, 2005; Sangal and Goel, 2007). These books contain snapshots of the VAT systems of any states that had implemented the reform by the publication date, as well as details on all notifications since the VAT introduction. For the few states for which we miss notifications in the online archives for a time period, this allows us to considerably narrow the time window of any missing tax rate changes. Additionally, the books allow us to cross-check the tax rates and registration thresholds at the VAT implementation start date, which is crucial for our empirical analysis.

Information on the state-specific sales tax regimes unfortunately is typically not available from online sources in any complete or consistent form.<sup>24</sup> Similar to the VAT regime, we therefore rely on two publications containing multiple volumes of state documents and tax rate schedules from 2000 and 2002 (Publishers 2000; Publishers 2002). We digitize this information to get a database of prevailing sales tax rates in 2002, before any state implemented the tax reform, as well as registration thresholds for firms. Unfortunately, the publications are missing for some of the small states or Union Territories. Sales tax rate information is unavailable for Meghalaya, Tripura, Dadra and Nagar Haveli, and Daman and Diu. Sales tax threshold information is missing for Meghalaya, Nagaland, Sikkim, Tripura, Chandigarh, Dadra and Nagar Haveli, and Daman and Diu. These data gaps do not affect many firms in our database because all of these are either very small north-eastern states or Union Territories.

Figure 1 provides an example of a sales tax schedule page (one of twenty-five pages) for

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<sup>24</sup>It is typically possible, for example, to find the original sales tax Act, often going back to the 1950s, but almost no state has updated schedules and legal documents for the time period shortly before the VAT introduction. Purohit (2001*a*) provides detailed tables comparing sales tax rates across states, but he focuses on a selected list of products and states.

the Indian state West Bengal. VAT schedules look similar.

Figure 1: Example of One Page from a Tax Schedule

SALES TAX RATES IN WEST BENGAL		26.9
<p align="center"><b>SCHEDULE IV</b>  <i>[Sections 10 and 17(1)(c)]</i>  <b>GOODS ON SALE OF WHICH TAX IS LEVIABLE AT SUCH RATE AS MAY BE  FIXED BY NOTIFICATION UNDER SECTION 18  (SINGLE-POINT LEVY) READ WITH SUB-CLAUSE (a)  OF CLAUSE (40) OF SECTION 2  (As amended up to 2002)</b>  <b>PART A</b></p>		
<i>Sl. No.</i>	<i>Description of goods</i>	<i>Rate of tax (per cent)</i>
(1)	(2)	(3)
1.	Aerated water including soda water and non-alcoholic beverage (excluding fruit juice, fruit concentrate, fruit squash, fruit syrup and fruit cordial) when sold in sealed containers including sealed polythene bottles, pouches or packets.	Seventeen
1A.	Fruit juice, fruit concentrate, fruit squash, fruit syrup and fruit cordial when sold in sealed containers including sealed polythene bottles, pouches or packets	Seven
2.	Air-conditioner and air-cooler.	Twelve
3.	(a) Aluminium in all its forms, namely, aluminium ingots, slabs, bars, rods, pipes, tubes, wires, coils, sheets, plants, circles, sections, channels, angles, joists, extrusions, including aluminium scraps but excluding aluminium foils	Five
	(b) Aluminium pipes and tubes	Seven
4.	Aluminium foils including aluminium foils backed or interleaved with paper or any other substance.	Five
5.	Betel nuts known locally as supari, whole, broken, perfumed or otherwise treated or of any other form or description whatsoever.	Twelve
6.	Binocular, telescope and opera glass.	Four
7.	Biscuits of all varieties, except those specified in any other Schedule	Ten
8.	Bleaching powder of all varieties and descriptions	Five
9.	Bulldozer, excavator, pipe-layer and scrapper.	Twelve
10.	<i>[Omitted]</i>	
11.	Cathode ray tubes used in televisions and commonly known as picture tubes.	Fifteen

From Publishers (2002). This figure shows one page from West Bengal's sales tax schedule, which we digitize. West Bengal's schedules amount to over twenty five pages in length.

Overall, we therefore create the first extensive database of state-specific sales tax and VAT panel information on registration thresholds and tax rates from 2001 to 2016. Beyond the uses in this paper, the richness of the data set has potential applications to many future research projects.

## 4.2 Firm Data and Matching with Tax Information

Our firm data comes from the Annual Survey of Industries (ASI), a well-known survey of establishment-level data from Indian manufacturing firms.<sup>25</sup> India generally defines “manufacturing” much more broadly than other countries, so the database contains firms producing a wide variety of products at various stages. The ASI is the only source of regular, high-quality data on firms in India. We use the panel version of the database, which allows us to track firms over time based on factory identifiers from the financial year 1998-99 to the year 2012-13.<sup>26</sup> Large firms with more than 100 employees (more than 200 employees from 1998-2003) are interviewed every year, whereas smaller firms are sampled every three to five years. Sample weights make observations in any given year representative of the state distribution of firms registered under the Factories Act. This excludes small firms with fewer than 10 workers (or fewer than 20 workers for factories that do not use electricity), which are not required to register and therefore are not in our database. While this is a well-known limitation of the database, excluding about 80 percent of the workforce in the manufacturing sector (Hsieh and Klenow, 2009), these small firms contribute only about one third to total output in the sector (Sincavage, Haub and Sharma, 2010). These small firms are highly unlikely to have high enough turnover to require registration under sales tax and VAT regimes, whereas many firms in our database will be directly affected by the tax reform. However, lack of data on these firms poses challenges for using registration thresholds when they are small. Crucial for our analysis, the survey contains information on revenue, employment and input costs, as well as detailed industry identifiers. Firms are asked to list the specific goods used as main inputs as well as the products they produce.

This detailed information on firm inputs and outputs makes it possible to merge in tax threshold and tax rate information from our created databases. Because the sales tax and

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<sup>25</sup>Some studies recently using the ASI include Boehm, Dhingra and Morrow (2016), Boehm, Dhingra and Morrow (2017), Allcott, Collard-Wexler and O’Connell (2016), Hsieh and Klenow (2009), and Hsieh and Klenow (2014).

<sup>26</sup>In India, the financial year begins on April 1 and ends on March 31 of the next calendar year. Virtually all firms in our database have synced their accounting periods with the financial year.

VAT schedules do not conform to any product classification system and may contain state-specific products and spelling differences, we have to use name matching algorithms as well as extensive manual matching of firm information and tax databases. To do this, we first use fuzzy match algorithms to match products in the tax data to the firm data. This may yield false matches or non-matches, which we resolve by manually checking every matched item and then manually matching all remaining products.

## 5 Descriptive Evidence

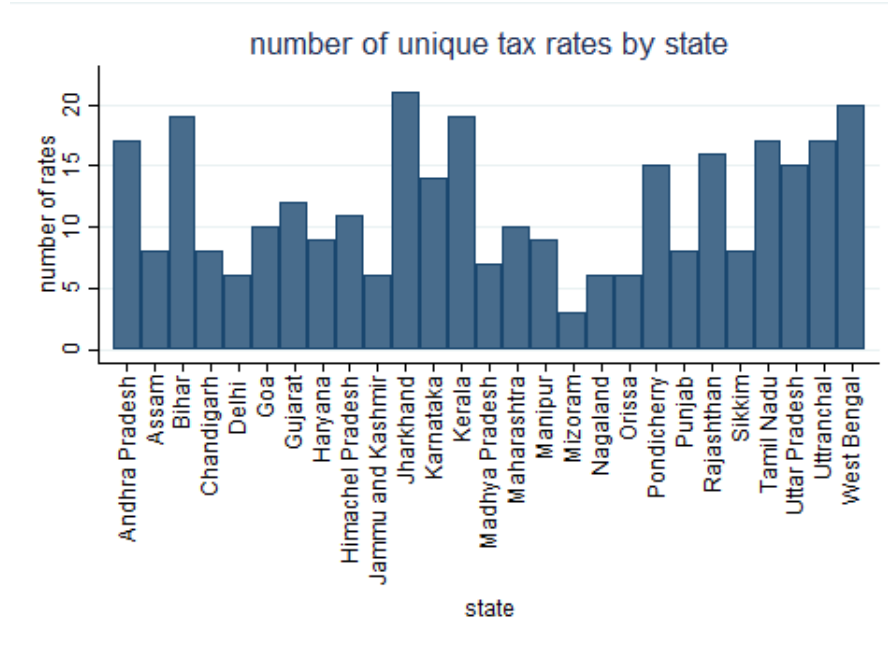
One key characteristic of the sales tax regime in India was its high degree of complexity. This complexity vastly increases the compliance costs for firms. Because tax rates are state- and product-specific, firms need to keep track of many different tax rates. This requires complex accounting, but may also lead to tax evasion and distortions in production and location decisions. The introduction of the VAT system reduced the number of tax categories, but tax rates remained product- and state-specific. In this section, we summarize this complexity and how it changed under the VAT, in order to shed light on some mechanisms influencing our reduced form estimates.

### 5.1 Tax Rates and Tax Categories

Our constructed tax databases give us the unique opportunity to systematically explore the complexity of the Indian tax system before and after the reform. Figure 2 shows the number of unique tax rates on different commodities for 27 states under India's sales tax system in 2001. States have anywhere between three to 23 different tax rates, with Jharkhand being the most complex by this metric. Thirteen states, almost half of the states in the sample, have more than 10 tax rates.

Of course, the number of tax rates applicable in a given state is only one measure of how costly it is for firms to comply with the tax code. Other characteristics such as the

Figure 2: Sales Tax Rates by State



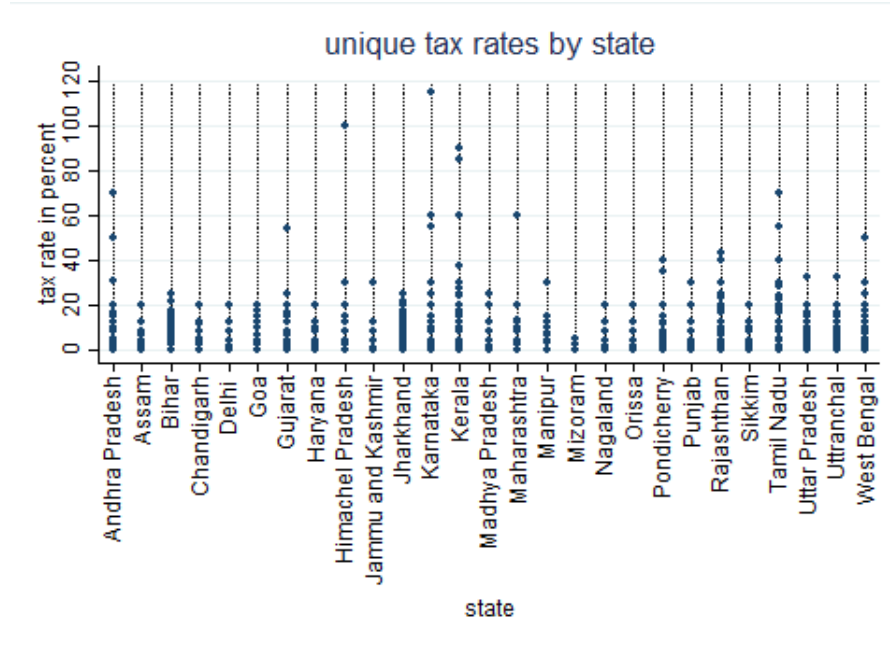
This figure shows the number of unique tax rates in 2001 under the sales tax regime. Data are derived from Publishers (2002).

average tax rate in a state or the range of tax rates across commodities influence output and compliance responses. In Figure 3, each dot represents a different tax rate on a commodity or a set of commodities in 2001. As can be seen in the graph, Karnataka has tax rates ranging from zero to 115 percent while in Mizoram the rates only range from zero to five percent.<sup>27</sup> The median tax rate in a given state ranges from 2 percent in Mizoram to 18 percent in Tamil Nadu.

The introduction of the VAT affected the tax system in multiple ways. Figure 4 shows the number of unique tax rates for a number of states at the three points in time: The number of tax rates under the sales tax system, corresponding to the information from Figure 2, is depicted by red diamond symbols. The number of tax rates in the first year of the VAT system, which depends on each state's implementation start date, is shown in orange circles, and the tax rates in 2016, the last year of our VAT database, are plotted as green triangles. As the figure shows, most states experienced a drop in the number of tax

<sup>27</sup>The very high tax rates are often levied on certain types of liquors.

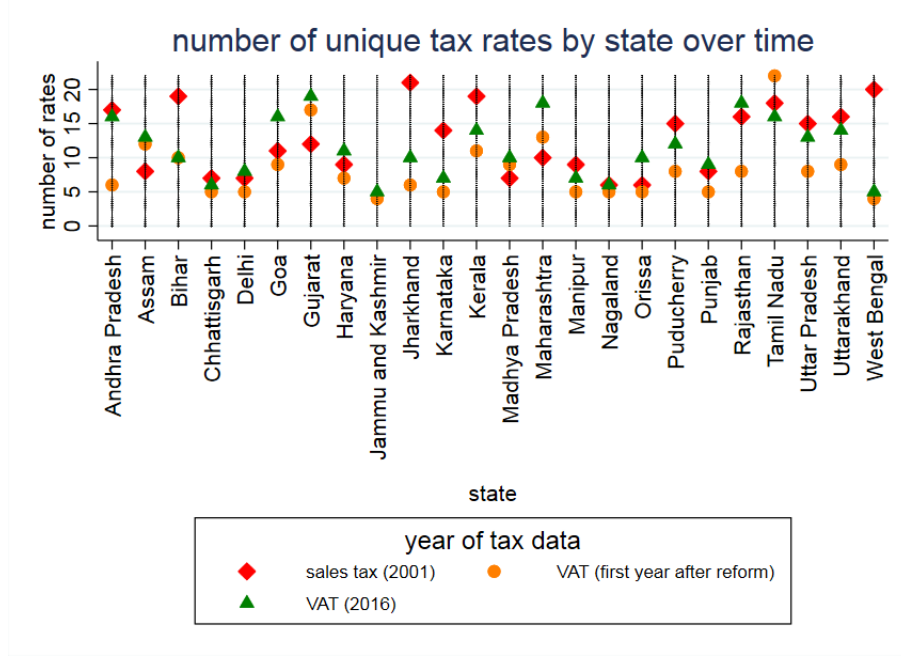
Figure 3: Variation of Tax Rates in 2001 Under the Sales Tax Regime



This figure shows the variation of ax rates in 2001 under the sales tax regime. Data are derived from Publishers (2002).

categories when moving from the sales tax to the VAT regime, although there is substantial state heterogeneity. In addition to an exempt category, most states had tax rates of one, four, and 12.5 percent. But states continued to have considerable flexibility regarding which category a product would fall under, and remained free to charge other tax rates on specific commodities. Almost all states levied higher tax rates on items such as diesel, alcohol or narcotics, for example. Nevertheless, in contrast to the sales tax system, most states in Figure 4 have initial VAT systems with less than 10 different categories. The most radical change occurred in West Bengal, where the state went from a sales tax system with 20 different rates to a VAT system with only 4 categories in the first year of implementation. This measure increased in Assam, Maharashtra and Tamil Nadu, which had by far the most complex tax system after the reform with 22 unique tax rates in the first implementation year. Figure 4 also shows, however, that the number of rate schedules under the VAT system increased over time, and most states had a similar number of tax rates in 2016 as before the reform in 2001.

Figure 4: Tax Rates by State and Time



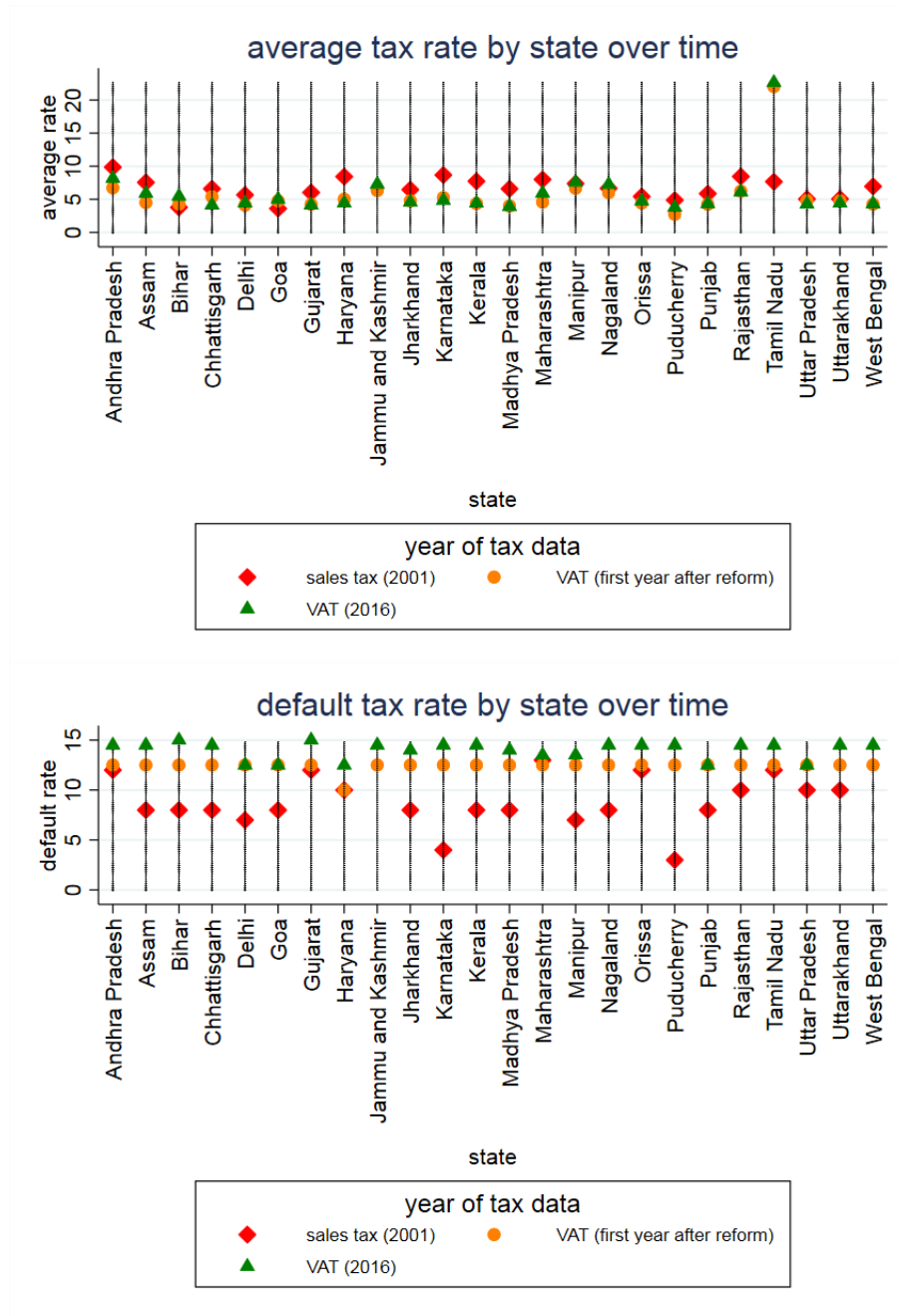
Legend: This figure shows the number of unique tax rate categories by state and time.

Figure 5 shows changes in the average tax rate of all the goods specified in the schedules over time for the same three time periods. The calculation keeps the number of products under the VAT regime constant, so any tax rate changes over time are not driven by changes in product categories. Most states saw a decrease in the average tax rate with the introduction of the VAT, from an average sales tax rate of 6.49% across states to a mean VAT rate of 5.87%. By 2016, the average tax rate had increased to 6.26%. The big outlier among all the states is Tamil Nadu, which levies extremely high tax rates of well over 200 percent on different types of alcohol, leading to very high average tax rates with the introduction of the VAT.

Because the average tax rate is calculated over all the goods explicitly listed on the schedule, the average gives more weight to more detailed schedules. This is potentially misleading because all states have a default tax rate that applies to all goods that are not explicitly mentioned in any of the schedules. This tax rate is just one entry on the list, but may apply to a large number of products. Figure 5 therefore plots the default rate separately



Figure 5: Tax Rates by State and Time



Legend: The upper panel of the figure shows the average tax rate by state and the lower panel shows the default tax rate by state. The average tax rate is calculated over the items in the tax schedule meaning that very detailed schedules get additional weight relative to less specific schedules within the state. For this reason, we plot the default tax rate separately. The default tax rate is the rate that applies to all goods not explicitly listed in the schedule. (Under the average figure, this rate would get a weight of one item out of hundreds, but it applies to many goods.)

as well. The graph shows that the default rate went from 8 to 10% in most states to 12.5% in the initial year of the VAT, and then increased to anywhere between 12.5 to 14.5% by 2016.

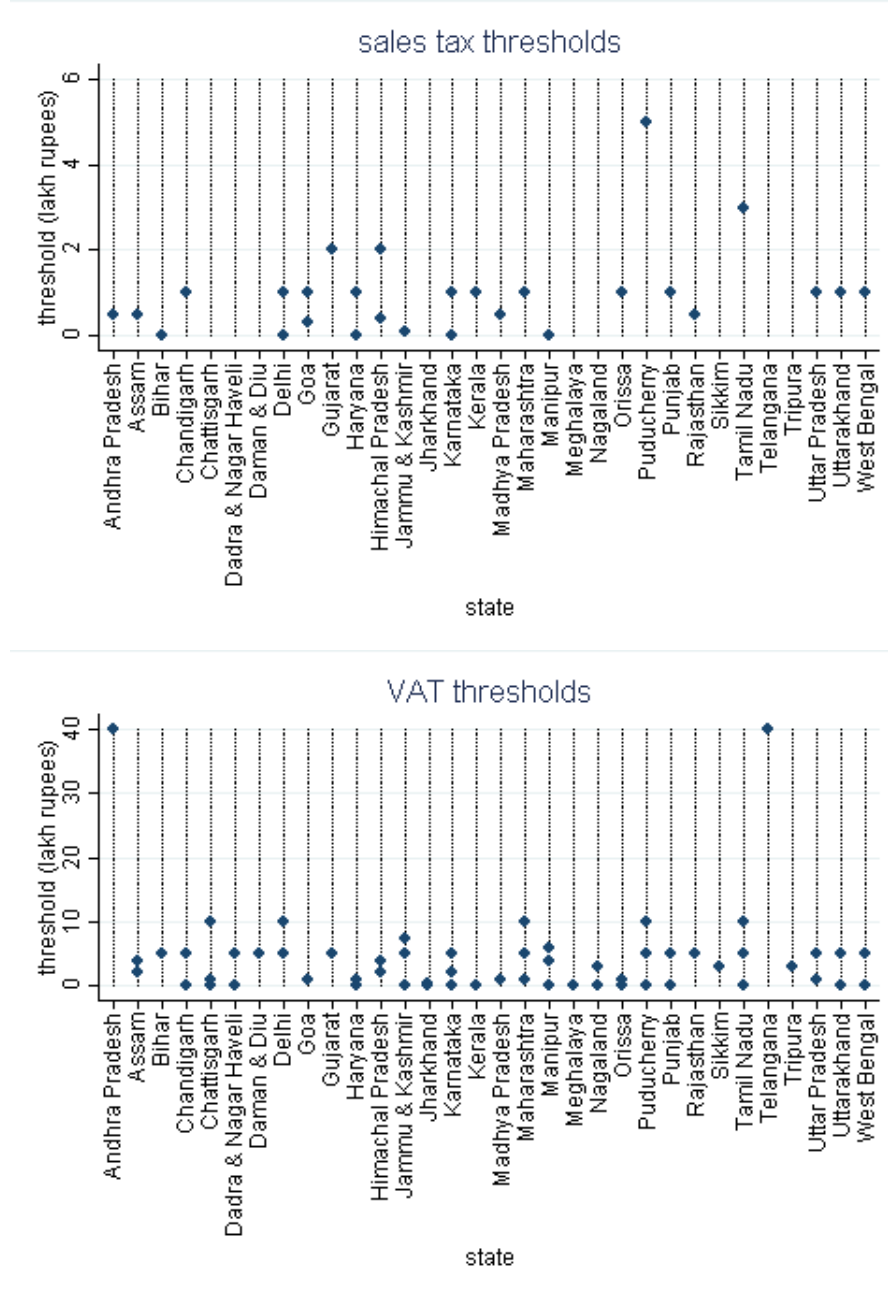
The switch to the VAT initially achieved a lowering in complexity. But the figures also reveal that state governments continued to exercise their power to set their own tax rates, leading to a divergence in VAT rates over time. These actions contribute to the high compliance costs of India's tax system, and even under the value-added tax system may have created opportunities for fraud relating to inter-state commodities or substitutions towards lower-tax products. Such effects lower the expected benefits of the VAT system because distortions persist.

## 5.2 Thresholds

In order to reduce tax complexity, many states have registration requirement thresholds whereby firms with a taxable turnover below the threshold need not register for the value added tax or the sales tax. In Figure 6 we display these tax thresholds separately for the sales tax and VAT regimes. Some states have multiple points on each figure, which is the result of two different sources of variation. First, in constructing these schedules we display any thresholds that were in place over the course of our data, so that if a state changed its threshold, it would have multiple observations on the graph. Second, even if the state has no temporal changes, it may still have multiple points because thresholds often differ by firm characteristics (such as importers, specific industries, or whether the dealer deals in exempt products).

The figures make one observation clear: thresholds are higher under the VAT regime than under the sales tax regime. Furthermore, thresholds vary more under the sales tax regime. In addition to these thresholds, we collect data on turnover tax thresholds, which illustrate similar patterns across states but are often higher than these thresholds.

Figure 6: Registration Thresholds under the Sales Tax and VAT Regimes



The upper panel of the figure shows the registration thresholds by state under the sales tax regime while the lower panel focus on the VAT regime. For each state we show all thresholds that ever existed in the state either because of temporal changes or because of preferential thresholds by industry. Notice the difference in the vertical axis scale. Some states contain multiple thresholds, which may result for various reasons. First, the state may have industry specific thresholds that differ across firms. Second, the threshold may have changed over time, in which case we plot it in this graph. Under the retail sales tax, some states do not have any thresholds because our primary sources (Publishers 2000; Publishers 2002) do not contain these states.

## 6 Identification of Production & Evasion Responses

### 6.1 Output Responses: Event Studies

We use temporal and cross-state variation to study production responses from the tax system shift. Replacing a sales tax with a VAT generates production responses because the VAT reduces the double taxation of inputs that distorts production and removes the harmful effects of a single first-point-of-sale tax. Our data allows us to observe the gross sales of firms; taxes are recorded, but this variable is often reported as zero perhaps because of evasion or difficulty reporting this item. We exploit the staggered implementation of the VAT across states in India to implement a difference-in-differences design relying on variation in treatment timing across the states (Goodman-Bacon 2018a).<sup>28</sup>

Letting  $f$  index firms,  $s$  index states,  $i$  index industry and  $t$  index time, we estimate an event study specification

$$z_{f(s),t} = \nu_t + \zeta_f + Treat_s \times \left[ \sum_{y=-8}^{-2} \pi_y \mathbf{1}_{\{t-t_i^*=y\}} + \sum_{y=0}^9 \gamma_y \mathbf{1}_{\{t-t_i^*=y\}} \right] + \mathbf{X}_{s,t}\beta + \varepsilon_{f(s),t}, \quad (1)$$

where firm  $f$  is defined such that it is always located in state  $s$ .<sup>29</sup> Our outcome of interest  $z_{f(s),t}$  is (gross) production which is deflated using state-industry-time specific price indexes,  $\nu_t$  are time fixed effects, and  $\zeta_f$  are firm fixed effects. The vector  $\mathbf{X}_{s,t}$  are state-specific time-varying controls including the state GDP growth rate, (log) population, (log) federal highway distance in the state, (log) per capita crimes, and (log) foodgrains.<sup>30</sup> The variable  $Treat_s$  indicates whether the firm's state adopts a VAT within our sample such that this variable equals one for states adopting VAT and zero for states not adopting.<sup>31</sup> This specification

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<sup>28</sup>Briand and Hoseini (2016) exploit the staggered implementation of the reform along with forward and backward linkages to study the effect on registration.

<sup>29</sup>We use firms that remain in the same state over the sample.

<sup>30</sup>If a state is missing data for all years, which is the case for one variable, we use the average of the neighboring states as controls. Missing years are linearly interpolated.

<sup>31</sup>Only Andaman & Nicobar Islands and Lakshadweep do not adopt. The latter of these has no firms in the data and the former only has several hundred. Thus, this variable is effectively always unity with a few exceptions, which in turn are assigned to the omitted event year.

allows for future robustness checks where  $Treat_s$  may measure the (continuous) intensity of treatment rather than the binary indicator. When moving to a continuous measure, this variable may be firm specific and may relate to the effective tax rate faced by the firm, given that we expect production responses to be most dramatic in industries that a priori were in high-tax and high-tax states. The indicator variables  $\mathbf{1}_{\{t-t_i^*=y\}}$  measure time relative to the time of VAT adoption  $t_i^*$  (i.e., the index  $y$  is time since the event). Thus,  $\pi_y$  represents the differential evolution of  $z_{f(s),t}$  in the treated states in the years prior to the reform while  $\gamma_y$  represent the differential evolution of  $z_{f(s),t}$  for the years after the reform. The year (immediately) prior to the event is omitted from the regression so all coefficients are relative to that year. Firms in states never experiencing a treatment are in the omitted category. Identification of the effects follows a difference-in-differences approach with variation in treatment timing where states not experiencing a treatment at the same time act as a control for states that experience a treatment. This, in turn requires the timing of the event to be conditionally random. As discussed in the institutional details section, there were many haphazard reasons as to why some state adopted earlier or later and it is unlikely that firms anticipated the date of the reform. In particular, the timing of adoption is unlikely to be related to economic factors within the state.

This flexible approach allows us to test the assumption that the firms in different states are on parallel trends prior to the reform. This more flexible specification also allows us to see the dynamic response of output following the reform, which given information and complexity may take time to adjust. Standard errors are clustered at the state level as treatment status occurs at this level.

Several notes are in order. First, firm fixed effects are critical to our identification strategy. Although aggregation to the state level could be a possible way of identifying production responses, such an approach would ignore several factors. First, firms display a substantial amount of heterogeneity in the cross-section. While estimates do not exist for India, Wildasin (2001) suggests that tax cascading can result in between a 0% or 100% change in the effective

sales tax rate. Second, firm fixed effects allow us to identify off of within firm variation in the adoption of VAT. Although the ASI is a reputable survey, firms may more or less accurately respond to the survey. Firm fixed effects allow us to account for any time-invariant forms of misreporting.

As noted above, the massive amount of variation across sectors and states in terms of its tax rates provides us with substantial room to exploit differential responses of high-tax sectors versus low-tax sectors. Assuming that tax cascading involves the same fundamental processes in different sectors or states, all else equal, higher tax firms and states should see more tax cascading. The data collection documented above will allow such a classification. The binary treatment that we are using for the current analysis provides us with an initial average effect of the reform. Replacing  $Treat_s$  with a continuous measure of the treatment intensity follows Goodman-Bacon (2018b).

Second, in the presence of dynamic treatment effects, estimation of (1) will be preferred to the estimation of a simple difference-in-difference approach with a pre- and post-reform dummy variable.<sup>32</sup> For this reason, a simple average of the post-reform coefficients and construction of appropriate standard errors is preferred to identify the average post-reform treatment effect. When doing this, we focus on balanced event dummies so that our treatment effects do not capture sample composition changes from one event year to another.

Finally, we need to discuss the construction of the timing of event dummies. Data in the ASI are based on firm financial years which run starting in April. We classify the omitted event year, event year -1, as the financial year prior to the VAT reform where the *entire* financial year was subject to the sales tax regime. The implication is that the first year of the reform, event year 0, includes some states that switched to the VAT at the start of the financial year (and are treated for the full year) and some states that switched to the VAT at the end of the financial year (and are partially treated for only some of the year). We do this so that the omitted year is not contaminated by partial treatment; the implication is

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<sup>32</sup>See Goodman-Bacon (2018a) for a discussion of these issues.

that event year zero may show a smaller response than other years because some firms are only exposed to the VAT reform for a limited number of months in the year.

## 6.2 Evasion: Bunching

As noted above, the Indian sales and VAT systems have thresholds designed to simplify the tax system for small businesses. First, every state has a minimum threshold of turnover for which sales or VAT registration is required. Firms below this threshold are not required to register for sales or VAT, but firms with a turnover above this threshold are required to register. As shown in Liu et al. (2018) this may lead to bunching at the registration threshold even in the presence of voluntary registration below the threshold. The situation is further complicated in India by the presence of turnover tax thresholds which specify a range where vendors must pay turnover tax even if required / not required to register for sales tax or VAT; the maximum turnover tax threshold may exceed the sales tax or VAT thresholds, in which case the turnover tax is in lieu of VAT or sales taxes. This may lead to bunching at two points – the mandatory registration threshold and the turnover tax threshold.

We construct a running variable that equals gross sales minus the firm-specific threshold for every firm in the database.<sup>33</sup> Each firm’s running variable,  $r_{f(s),t}$ , is given by

$$r_{f(s),t} = z_{f(s),t} - \bar{z}_{f(s),t} \quad (2)$$

where  $z_{f(s),t}$  is gross sales and  $\bar{z}_{f(s),t}$  is the registration or turnover threshold, depending on the specification. Notice that  $\bar{z}_{f(s),t}$  are subscripted by  $(f, t)$  and not just  $(s, t)$ , i.e, the thresholds are not just state-year specific, but rather also exploit firm-specific information that may affect the threshold (such as importer status, industry classification, or other characteristics of the firm as specified in the laws). This running variable may contain some measurement error resulting from the threshold being defined on the basis of firm characteristics that we

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<sup>33</sup>Although some states use net sales or another measure of turnover, we either do not have data to construct these or are unwilling to rely on the sales tax numbers reported in the ASI.

do not observe in the data and because the definition of taxable turnover used may differ slightly across states and for which we use sales.

To estimate bunching at the threshold, we focus on whether there is a discontinuity in the distribution of firms around the threshold. This differs from the convention in the literature which estimates the excess mass around the threshold. This discontinuity-based approach is necessary because many of these tax thresholds occur at very small turnover levels and our database oversamples larger firms. This creates a major issue: under standard bunching approaches, firms outside of the bunching window – on both sides of the threshold – are used to construct a counterfactual density. While we have substantial amounts of firms above the threshold to estimate the counterfactual, we do not have much room below the threshold. For example, consider a threshold at 1 lakh rupees (approximately \$1400 today), which is a common threshold in our data. This represents a very small amount of sales for a firm in the ASI data where the average sales are 5800 lakh rupees. Although large firms are tracked regularly in the data, the ASI attempts to sample small firms, which means we do observe some firms below the threshold. However, we have no ability to distinguish the bunching region from the counterfactual region below most thresholds in the data.<sup>34</sup> Second, because we need to pool observations across states to have significant power to identify a bunching and because states differ in their thresholds, estimating a counterfactual density raises several issues because firms with higher thresholds will have a larger region below the threshold, which means that the counterfactual density will be influenced unduly by states with high thresholds.

To overcome these issues, we focus on a discrete jump in the distribution near the threshold in the spirit of McCrary (2008). It allows us to test whether there is bunching on one side of the threshold, and therefore provides a useful test of whether these tax notches encourage evasion and/or real productive responses. Given that the point estimate of the McCrary (2008) cannot be converted to an excess mass elasticity, we instead focus on visual evidence

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<sup>34</sup>Using large thresholds, we can follow standard bunching procedures but only select states have large thresholds and even these thresholds are still not very large relative to the average firm in the data.



relating to the amount of bunching at the threshold. A limitation of this approach is that many thresholds are round numbers, which may generate bunching mechanically (Kleven and Waseem 2013). We verify this is not the case by conducting placebo tests at the same round numbers in years where the threshold did not exist.

Following McCrary (2008), we estimate the density distribution around the thresholds. We then bin the density distribution data into forty bins around the threshold and fit a quadratic polynomial to the left and the right of the threshold. This polynomial is not designed to show the distribution of the counterfactual, but rather the actual distribution. Visually, the graphs then indicate the presence of bunching just to the left or to the right of the threshold.<sup>35</sup>

While bunching at the threshold may pick up both real responses and evasion responses, it is likely that our methodology mostly identifies evasion. The reason is similar to Best et al. (2015): below the threshold firms face a very low rate turnover tax while above the tax they face the generally higher tax rate. Thus, the low turnover rate makes it so that the distortion to real production around the kink will be small. Nonetheless, some of what we capture may include real responses and this may differ across industries depending on the VAT tax rate.<sup>36</sup>

## 7 Results

### 7.1 Output: Event Study

Figure 7 plots the coefficients from the event dummies in (1). The dependent variable of interest is (log) gross sales. Results are almost identical if we use (log) net sales, which are equal to sales net of sales taxes / VAT reported by the firm. In this initial figure we focus on

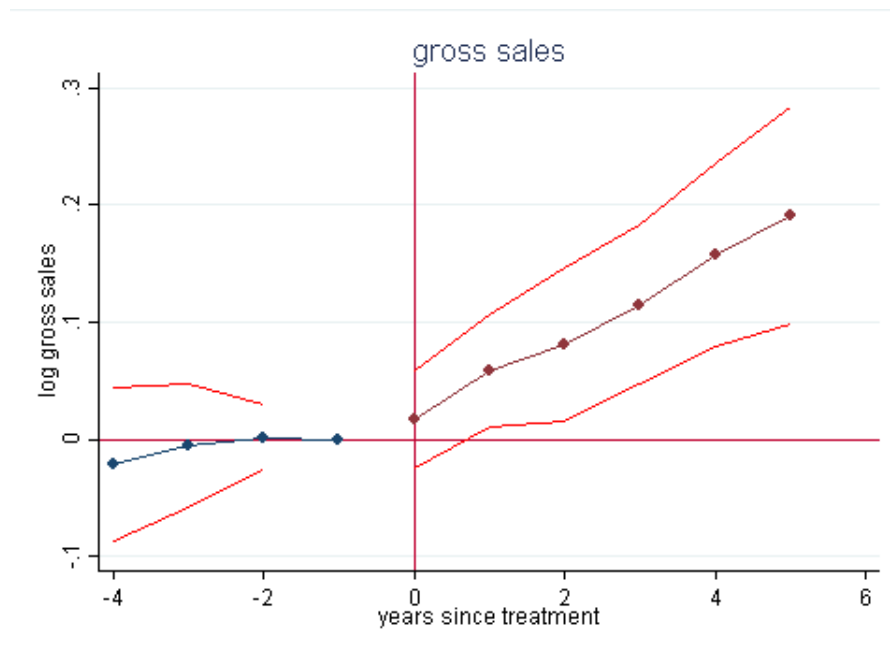
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<sup>35</sup>Of course, more flexible approaches could be used, which is why we visualize the binned data so that the reader can visually inspect for the presence of bunching nonparametrically. Results are not sensitive to this parametric form.

<sup>36</sup>See also Waseem (2018c), Velayudhan (2018), and Gadenne, Nandi and Rathelot (2018) for other studies that exploit registration thresholds in developing countries.

an unbalanced sample of firms, exploiting over 400,000 firm-year observations. That is, we estimate (1) using firms that are resampled in each year and firms that only appear every several years. In this way, identification relies on firms that were sampled in the omitted year. This approach is appealing because of its external generalizability – the effects are identified off of both large firms and small firms. The approach, however, has the downside that each of the event dummies are unbalanced. We address this issue in subsequent results by focusing on a sample of balanced firms.

Figure 7: Effect of VAT Reform Using an Unbalanced Sample of All Firms



This figure shows the effect of the adoption of VAT using a set of all firms in the ASI database. Standard errors are clustered at the state level and the figure shows 95% confidence intervals; period -1 is the omitted category so no confidence bands are included. Period -1 is the year prior to the VAT reform, where the entire year was subject to the sales tax regime. The implication is that period 0 includes some states that switched to the VAT at the start of the financial year (and are treated for the full year) and some states that switched to the VAT at the end of the financial year (and are partially treated for only some of the year).

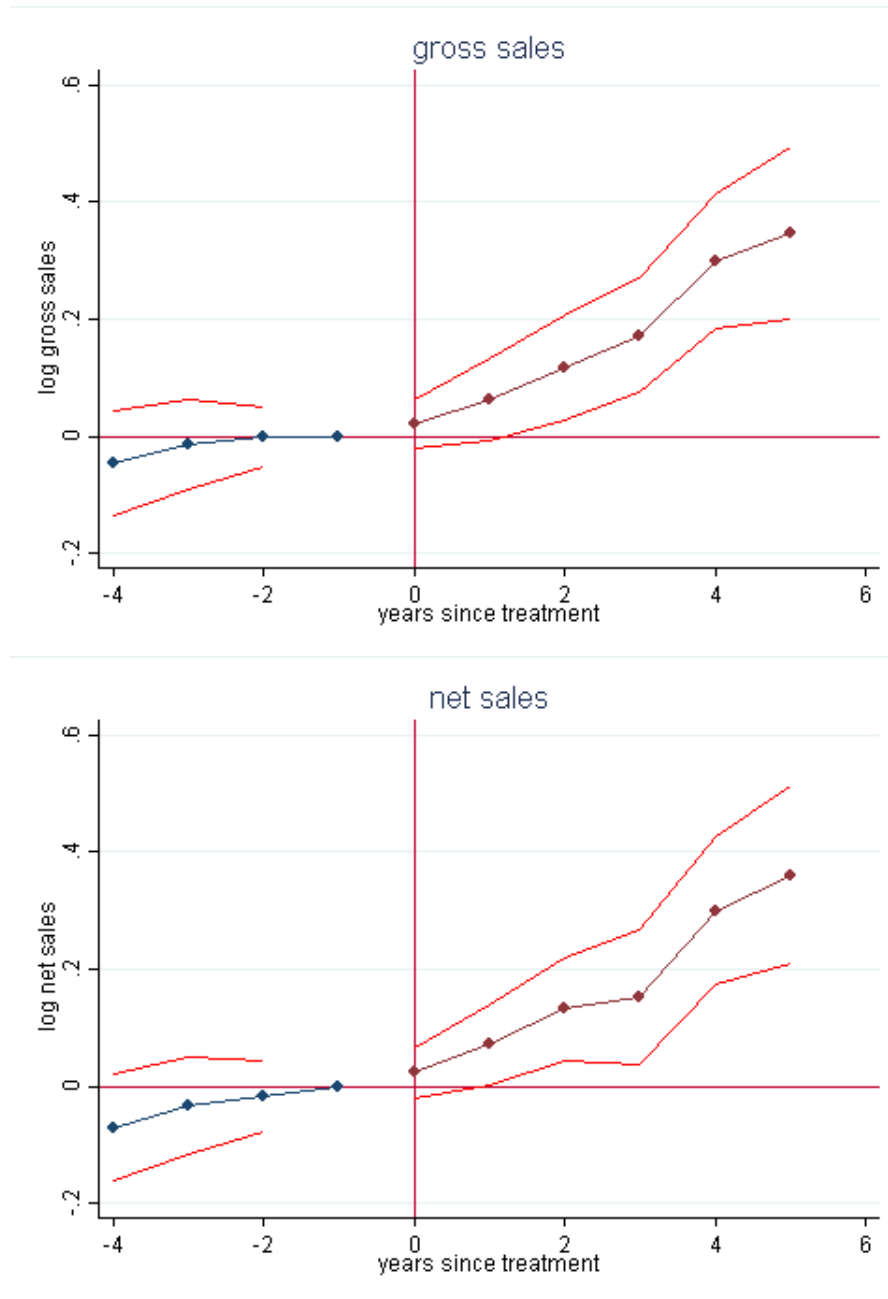
The results show a gradual increase in productive efficiency following the VAT reform, but show no evidence of pre-trends in production prior to the reform. In particular, the results suggest that by five years after the adoption of the VAT, gross sales have increased by almost 16% relative to the pre-reform levels. Given the coefficients on the event dummies are relative to this omitted year, this represents a cumulative effect. Two other features

of the graph are worth noting. First, in the initial year of the reform, the change in gross sales is indistinguishable from the omitted event year. This could be a result of the way we have coded our event time where some firms are treated for only a partial year in event year 0 and it is not until event year 1 that all firms are treated for the *full* financial year. It could also be the case that firms initially were uncertain about the details of the reform and may face frictions in adjusting their production processes immediately following the reform. Second, the pattern of event dummies suggests that the dynamic treatment effects are important. In particular, the VAT reform shifts up production but this occurs gradually in the years following the reform. This is consistent with frictions and learning critical to the firm adjusting their production process. We now turn to our preferred estimation using a balanced set of firms.

Figure 8 shows the effect using a balanced sample of firms. This set of firms are those that appear in the ASI for all 15 years of data that we have, which yields a total of over 32,000 firm-year observations. Although appealing from the perspective of the event study design, these balanced firms are distinctly different from the unbalanced panel since only large firms are sampled every year in the ASI. A simple comparison of means indicates that the average sales are 5800 lakh rupees in the unbalanced sample, but are 31,200 lakh rupees in the balanced sample. While this lowers the generalizability of the results, it allows us to have the same set of firms in each event year as in the omitted year. The figure indicates similar results that are larger than the prior results. In particular, by five years after the reform gross sales have increased by 31%. Results for gross sales and net sales are similar. Key is that the dynamic path of production responses is the same as the prior figure during the post-period.

Figure A.3 indicates that the results are not sensitive to adjusting for covariates. The non-existence of statistically significant pre-trends is also apparent in all figures. Finally, Table 1 reports all of the coefficients and standard errors corresponding to the figures in the text.

Figure 8: Effect of VAT Reform Using a Balanced Sample



This figure shows the effect of the adoption of VAT using a set of balanced firms. Standard errors are clustered at the state level and the figure shows 95% confidence intervals; period -1 is the omitted category so no confidence bands are included. Period -1 is the year prior to the VAT reform, where the entire year was subject to the sales tax regime. The implication is that period 0 includes some states that switched to the VAT at the start of the financial year (and are treated for the full year) and some states that switched to the VAT at the end of the financial year (and are partially treated for only some of the year).

Table 1: Event Study Coefficients

Gross or Net Sales	(1) G	(1') N	(2) G	(2') N	(3) G	(3') N
$\pi_{-4}$	-0.021 (0.033)	-0.026 (0.034)	-0.045 (0.046)	-0.070 (0.046)	-0.062 (0.059)	-0.083 (0.060)
$\pi_{-3}$	-0.006 (0.027)	-0.007 (0.027)	-0.013 (0.039)	-0.033 (0.042)	-0.023 (0.046)	-0.040 (0.050)
$\pi_{-2}$	0.002 (0.014)	0.0001 (0.014)	-0.002 (0.026)	-0.016 (0.031)	-0.009 (0.029)	-0.021 (0.033)
$\pi_{-1}$	-	-	-	-	-	-
$\gamma_0$	0.017 (0.021)	0.024 (0.022)	0.021 (0.022)	0.023 (0.022)	0.026 (0.023)	0.026 (0.024)
$\gamma_1$	0.059** (0.025)	0.062** (0.025)	0.063* (0.036)	0.071** (0.034)	0.072* (0.037)	0.076** (0.036)
$\gamma_2$	0.080** (0.033)	0.085** (0.035)	0.118** (0.046)	0.132*** (0.045)	0.129** (0.049)	0.139*** (0.049)
$\gamma_3$	0.115*** (0.034)	0.124*** (0.036)	0.172*** (0.050)	0.152** (0.059)	0.184*** (0.053)	0.159** (0.061)
$\gamma_4$	0.158*** (0.040)	0.165*** (0.041)	0.300*** (0.059)	0.300*** (0.065)	0.315*** (0.057)	0.310*** (0.062)
$\gamma_5$	0.191*** (0.047)	0.198*** (0.049)	0.348*** (0.075)	0.359*** (0.077)	0.366*** (0.075)	0.372*** (0.077)
Year FE?	Y	Y	Y	Y	Y	Y
Firm FE?	Y	Y	Y	Y	Y	Y
Controls?	Y	Y	Y	Y	N	N
Balanced?	N	N	Y	Y	Y	Y
Observations	407,584	407,584	32,594	32,594	32,594	32,594
$R^2$	0.891	0.866	0.916	0.853	0.916	0.853

This table presents coefficient estimates from the estimation of (1). All regressions are run using a full set of event dummies, but we report only the more limited set that are balanced in columns (2) and (3); event year -1 is the omitted year. Column (1) corresponds to the unbalanced sample, column (2) is the balanced sample of firms and column (3) is the balanced sample, not adjusted for covariates. Columns without a prime use gross sales as the dependent variable while columns with a prime use net sales as the dependent variable. All regressions are weighted with the sampling weights in the ASI. Standard errors are clustered at the state level. \*\*\*99%, \*\*95%, \*90%.

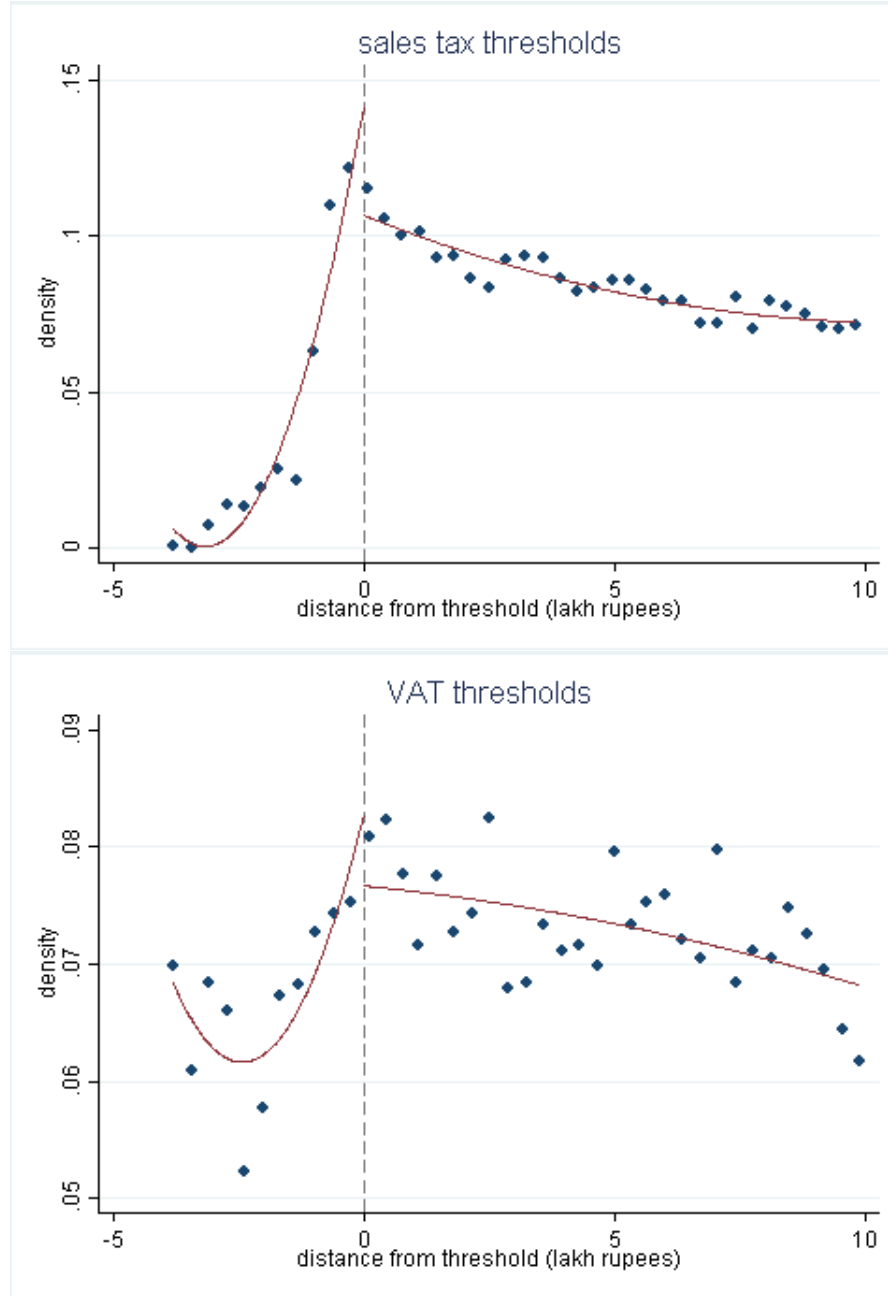
Overall, we conclude that the VAT increases output growth by reduce tax rates, reducing complexity and reducing inefficient double taxation.

## 7.2 Evasion: Bunching

To find evidence of bunching, we present binned density graphs. Figure 9 pools all thresholds and shows no evidence of bunching under either the sales tax registration thresholds or the VAT registration thresholds. Several notes are important. First, the dramatic fall off to the left of the threshold is a result of several factors, but the main reason is that many thresholds are very low (while the manufacturing firms in the ASI are usually larger firms) and because each distance from the threshold may have a different composition of states. For example, if there were two thresholds at  $\bar{z}_{f(s),t}$  equals two and five across two states, then a distance  $r_{f(s),t} < -2$  would only contain observations from the state-firm category with the larger threshold; distances  $r_{f(s),t} \geq -2$  would contain both states. For this reason, as noted above, we focus on detecting evidence of bunching by using a limiting argument where  $r_{f(s),t} \rightarrow 0$ . Taking such a limit removes these problems and still shows no evidence of bunching.

Although the limiting argument deals with issues related to state composition, it does not deal with the fact that these thresholds are very small and we may not have power in the ASI among small firms to identify these effects. To deal with this issue, we focus on firms that have  $\bar{z}_{f(s),t} \geq 10$  lakh rupees with the largest threshold being 40 lakh rupees in two states. The left panel of Figure 10 shows a significant discontinuity consistent with bunching to the left of this threshold. This discontinuity of extra mass of firms appears to persist for several lakh rupees below the threshold. This is consistent with registration for the VAT creating evasion responses, although some of this response may also include real responses. One concern may be that because there are less of these thresholds we might be coincidentally picking up something else that happens at these thresholds. To rule out this possibility, we rerun our threshold calculator using years when the VAT was not in place. This generates what a firm operating under the sales tax regime would face if the VAT were

Figure 9: Bunching at Sales Tax and VAT Registration Threshold



This figure shows the bunching at the sales tax and VAT threshold. To construct the figure, we estimate the densities following McCrary (2008) and plot the density in forty bins. We plot a quadratic polynomial to the data for visual aid. Thresholds are in lakh rupees, which we normalize to zero and we pool the thresholds across states-years but estimate the effect separately for sales tax and VAT years. Many thresholds are at very low levels, especially under the sales tax regime, so much of the decline in density to the left of the threshold is a result of states not being in the data any more because firms cannot have negative sales. For this reason we focus on visual inspection of the existence of a discontinuity around the threshold.

in place in that year.<sup>37</sup> This placebo exploits the state-specific nature of the thresholds but also the firm-specific component, meaning that a firm subject to a large threshold in a state because it has certain characteristics would be assigned the VAT threshold under the sales tax regime, but another firm in that same state, but not satisfying those characteristics would not. The placebo distribution indicates that there is no discontinuity at the placebo threshold, which suggests that the VAT threshold discontinuity identified is a true effect of mandatory registration. At this point, one might wish to compare the results in the upper panel of 10 to observed large thresholds under the sales tax regime. Unfortunately, as indicated in Figure 6, there are no “large” sales tax thresholds. This limits us from being able to compare the amount of bunching under the VAT to the sales tax.

Finally, many states operate a turnover tax regime. The maximum thresholds for the turnover tax option may equal the registration requirement in some states, but often are in excess of those levels. Thus, these thresholds are often distinct from the VAT thresholds studied in Figure 10. Focusing on the turnover tax thresholds that are large ( $\bar{z}_{f(s),t} \geq 10$ ), Figure 11 shows even more bunching below the turnover threshold than at the VAT registration threshold. At this point, one might like to see if turnover taxes have different effects under the sales tax or the VAT regime, but identifying such an interaction is not possible using the sample of large thresholds because most turnover tax thresholds were smaller under the sales tax regime.

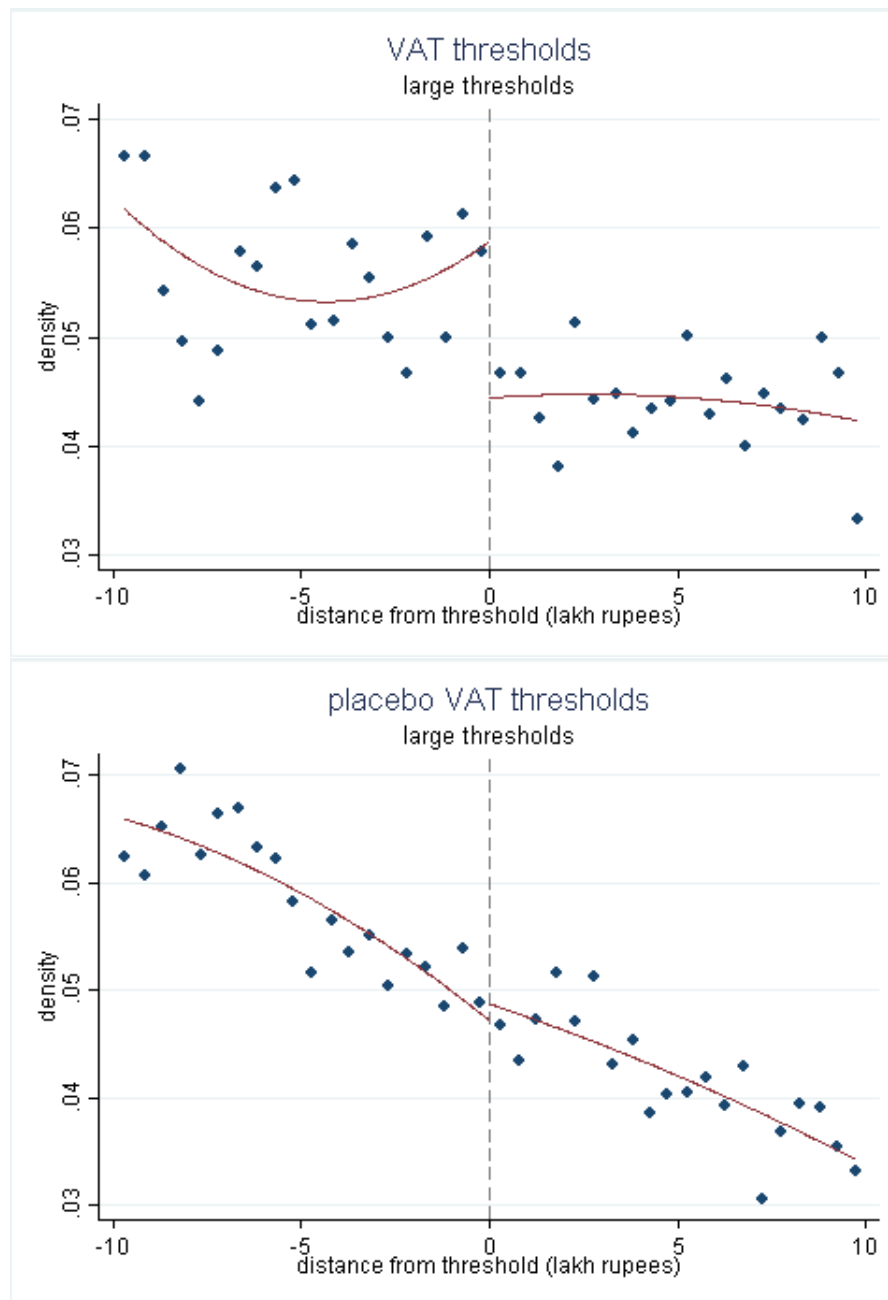
Figure A.4 shows a bit of a local discontinuity when focusing on all turnover tax thresholds – small and large. However, the same caveats as above apply. Finally, India’s commodity tax systems feature many other thresholds that make firms required to pay other additional taxes and fees. We identify as many of these thresholds as possible and study them in Figure A.5. All in all we conclude that there exists evidence of bunching at large thresholds, but we are underpowered to identify such effects at smaller thresholds.

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<sup>37</sup>Note that the largest sales tax threshold is 5 lakh rupees, so moving these large VAT thresholds to the sales tax regime will not result in any coincidental correlation with the sales tax thresholds.

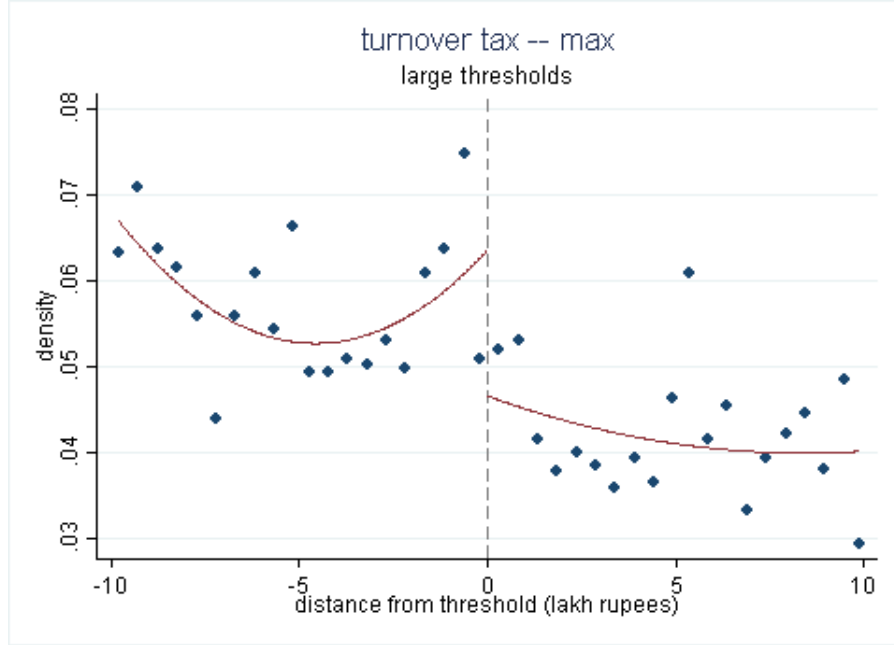


Figure 10: Bunching at VAT Registration Threshold Using Large Thresholds Compared to Pre-VAT Years



The upper panel of the figure shows the bunching at the VAT threshold where we restrict the sample to state-years where the VAT threshold is  $\geq 10$  lakh rupees. The right figure provides a placebo test by using the same threshold levels for firms in a given state but in years prior to the VAT reform. To construct the figures, we estimate the densities following McCrary (2008) and plot the density in forty bins. We plot a quadratic polynomial to the data for visual aid. Thresholds are in lakh rupees, which we normalize to zero and we pool the thresholds across states-years.

Figure 11: Bunching at Big Turnover Tax Thresholds



The figure shows the bunching at the turnover tax thresholds. Turnover taxes often have multiple thresholds. When turnover taxes are due for firms with sales between two values, these are for the upper threshold. We focus on state-years where the turnover tax threshold is  $\geq 10$  lakh rupees. To construct the figure, we estimate the densities following McCrary (2008) and plot the density in forty bins. We plot a quadratic polynomial to the data for visual aid. Thresholds are in lakh rupees, which we normalize to zero and we pool the thresholds across states-years. We do not allow turnover taxes to have different effects under the VAT and sales tax regime, which means we estimate bunching at turnover taxes using both the sales tax and VAT regimes. Most of the larger thresholds occur under the VAT regime, however.

## 8 Conclusion and Future Research

We conduct a comprehensive and detailed data collection procedure in order to digitize India's sometimes arcane, complex, and rapidly evolving sales and value added tax systems. This data collection effort involves collecting tax rates, registration thresholds, and other pertinent information for all 29 states and 7 union territories within India from 2001 to 2016. India's tax system features product specific tax rates, which means for most Indian states we need to digitize hundreds of commodities and their appropriate tax rates along with tracking the precise date of change over this fifteen year period. Following the initial data collection, we need to match these tax data to product classification codes in the ASI database. This data collection procedure allows us to construct the most comprehensive tax database ever assembled concerning the Indian commodity tax system.

Our paper provides the first empirical evidence on how the switch from a sales tax to a value added tax output and and tax evasion in an environment with limited state capacity. Exploiting our newly constructed database along with the staggered implementation of VAT across Indian states, we show:

1. Switching to a value added tax improves production efficiency resulting in a 16% increase in gross sales by five years following the adoption of VAT. This gain in production efficiency arises because of the elimination of inefficient double taxation, which has been argued to comprise 35-40% of sales tax revenue prior to the reform, in addition to reductions in tax rates and complexity.
2. We document very little bunching at tax thresholds, because our firm data are comprised of large manufacturing firms and these thresholds are much lower in the sales distribution. However, for the select group of large thresholds, we find bunching below the threshold under the VAT regime. This is consistent with the possible tax evasion at these thresholds.

Beyond the contributions in this paper, our tax data set will provide ample room to study other tax-related issues in India. But, focusing on the contributions of our paper, the results have important implications for the recent reforms adopted by the central government that further simplify the VAT system. These simplifications, which remove many aspects of decentralization, work towards a common economic market and may have further output effects.

## References

- Agrawal, David R., and Mohammed Mardan.** 2019. “Will Destination-based Taxes Be Fully Exploited When Available? An Application to the U.S. Commodity Tax System.” *Journal of Public Economics*, 169: 128–143.
- Agrawal, David R., and William H. Hoyt.** 2018. “Tax Incidence in a Multi-product World: Theoretical Foundations and Empirical Implications.” SSRN Working Paper.
- Allcott, Hunt, Allan Collard-Wexler, and Stephen D. O’Connell.** 2016. “How Do Electricity Shortages Affect Industry? Evidence from India.” *American Economic Review*, 106(3): 587–624.
- Amodio, Francesco, Jieun Choi, Giacomo de Giorgi, and Aminur Rahman.** 2018. “Bribes vs. Taxes: Market Structure and Incentives.” Working Paper.
- Avittathur, Balram, Janat Shah, and Omprakash K. Gupta.** 2005. “Distribution Centre Location Modelling for Differential Sales Tax Structure.” *European Journal of Operational Research*, 162: 191–205.
- Bagchi, A., and Study Team.** 1994. *Reform of Domestic Trade Taxes in India: Issues and Options*. National Institute of Public Finance and Policy.
- Besley, Timothy, and Torsten Persson.** 2013. “Taxation and Development.” *Handbook of Public Economics*, 5: 51–110.
- Best, Michael, Anne Brockmeyer, Henrik Kleven, Johannes Spinnewijn, and Mazhar Waseem.** 2015. “Production vs Revenue Efficiency with limited Tax Capacity: Theory and Evidence from Pakistan.” *Journal of Political Economics*, 123(6): 1311–1355.
- Boadway, Robin, and Motohiro Sato.** 2009. “Optimal Tax Design and Enforcement with an Informal Sector.” *American Economic Journal: Economic Policy*, 1(1): 1–27.

- Boehm, Johannes, Swati Dhingra, and John Morrow.** 2017. “Product Diversification in Indian Manufacturing.” Working Paper.
- Boehm, Johannes, Swati Dhinra, and John Morrow.** 2016. “Swiming Upstream: Input-Output Linkages and the Direction of Product Adoption.” Working Paper.
- Briand, Oceane, and Mohammad Hoseini.** 2016. “Production Efficiency and Self-Enforcement under the VAT: Empirical evidence from India.” Working Paper.
- Carrillo, Paul, Dina Pomeranz, and Monica Singhal.** 2017. “Dodging the Taxman: Firm Misreporting and Limits to Tax Enforcement.” *American Economic Journal: Applied Economics*, 9(2): 144–164.
- Chelliah, Raja Jesudoss, and Tax Reforms Committee.** 1992. “Tax Reforms Committee: Final Report.” Directorate of Publications, Ministry of Development.
- Cnossen, Sijbren.** 2012. “Introducing a Modern GST in India: Need for Further Debate.” *Tax Notes International*, 66(13): 1267–1283.
- Crawford, Ian, Michael Keen, and Stephen Smith.** 2010. “Value Added Tax and Excises.” In *The Mirrlees Review*. Vol. 4, 276–421. IFS.
- de Paula, Áureo, and Jose A. Scheinkman.** 2010. “Value-Added Taxes, Chain Effects, and Informality.” *American Economic Journal: Macroeconomics*, 2(4): 195–221.
- Diamond, Peter A., and James A. Mirrlees.** 1971. “Optimal Taxation and Public Production I: Production Efficiency.” *American Economic Review*, 61(1): 8–27.
- Emran, M. Shahe, and Joseph Stiglitz.** 2005. “On Selective Indirect Tax Reform in Developing Countries.” *Journal of Public Economics*, 89(4): 599–623.
- Gadenne, Lucie.** 2014. “Non-linear Commodity Taxation in Developing Countries: Theory and an Application to India.” Working Paper.

- Gadenne, Lucie.** 2018. “Can Rationing Increase Welfare? Theory and an Application to India’s Ration Shop System.” Working Paper.
- Gadenne, Lucie, and Monica Singhal.** 2014. “Decentralization in Developing Economies.” *Annual Review of Economics*, 6: 581–604.
- Gadenne, Lucie, Tushar K. Nandi, and Roland Rathelot.** 2019. “Taxation and Supplier Networks: Evidence from India.”
- Gadenne, Lucie, Tushar Nandi, and Roland Rathelot.** 2018. “Taxation in Supplier Networks: Evidence from India.” Working paper.
- Goldberg, Pinelopi K., Amit K. Khandelwal, Nina Pavcnik, and Petia Topalova.** 2009. “Trade Liberalization and New Imported Inputs.” *American Economic Review: Papers & Proceedings*, 99(2): 494–500.
- Goldberg, Pinelopi K., Amit K. Khandelwal, Nina Pavcnik, and Petia Topalova.** 2010a. “Imported Intermediate Inputs and Domestic Product Growth: Evidence from India.” *Quarterly Journal of Economics*, 125(4): 1727–1767.
- Goldberg, Pinelopi K., Amit K. Khandelwal, Nina Pavcnik, and Petia Topalova.** 2010b. “Multiproduct Firms and Product Turnover in the Developing World: Evidence from India.” *Review of Economics and Statistics*, 92(4): 1042–1049.
- Goodman-Bacon, Andrew.** 2018a. “Difference-in-differences with Variation in Treatment Timing.” Vanderbilt Working Paper.
- Goodman-Bacon, Andrew.** 2018b. “Public Insurance and Mortality: Evidence from Medicaid Implementation.” *Journal of Political Economy*, 126(1): 216–262.
- Hsieh, Chain-Tai, and Peter J. Klenow.** 2009. “Misallocation and Manufacturing TFP in China and India.” *Quarterly Journal of Economics*, 124(4): 1403–1448.

- Hsieh, Chang-Tai, and Peter J. Klenow.** 2014. “The Life Cycle of Plants in India and Mexico.” *Quarterly Journal of Economics*, 129(3): 1035–1084.
- Kanbur, Ravi, and Michael Keen.** 1993. “Jeux Sans Frontières: Tax Competition and Tax Coordination When Countries Differ in Size.” *American Economic Review*, 83(4): 877–892.
- Kanbur, Ravi, and Michael Keen.** 2014. “Thresholds, Informality, and Partitions of Compliance.” *International Tax and Public Finance*, 21(4): 546–559.
- Keen, Michael.** 2008. “VAT, Tariffs, and Withholding: Border Taxes and Informality in Developing Countries.” *Journal of Public Economics*, 92: 1892–1906.
- Keen, Michael.** 2012. “Targetting, Cascading and Indirect Tax Design.” Raja Chelliah Memorial Lecture Series.
- Keen, Michael.** 2014. “Lessons for the GST from International Experience: Possibilities and Pitfalls.” *India Tax Insights*, 3: 12–14.
- Keen, Michael, and Ben Lockwood.** 2010. “The Value Added Tax: Its Causes and Consequences.” *Journal of Development Economics*, 92: 138–151.
- Khan, Adnan Q., Asim I. Khwaja, and Benjamin A. Olken.** 2016. “Tax Faming Redux: Experimental Evidence on Performance Pay for Tax Collectors.” *Quarterly Journal of Economics*, 131(1): 219–271.
- Khan, Adnan Q., Asim I. Khwaja, and Benjamin A. Olken.** 2019. “Making Moves Matter: Experimental Evidence on Incentivizing Bureaucrats through Performance-Based Postings.” *American Economic Review*, 109(1): 237–270.
- Kleven, Henrik J., and Mazhar Waseem.** 2013. “Using Notches to Uncover Optimization Frictions and Structural Elasticities: Theory and Evidence from Pakistan.” *Quarterly Journal of Economics*, 128(2): 669–723.

- Kopczuk, Wojciech, and Joel Slemrod.** 2011. "Taxation and Family Firms." IGC Working Paper.
- Kumler, Todd, Eric Verhoogen, and Judith A. Frias.** 2015. "Enlisting Employees in Improving Payroll-Tax Compliance: Evidence from Mexico." National Bureau of Economic Research (NBER) Working Paper No. 19385.
- Liu, Li, Ben Lockwood, Miguel Almunia, and Eddy H. F. Tam.** 2018. "VAT Notches, Voluntary Registration, and Bunching: Theory and UK Evidence." Working Paper.
- McCrary, Justin.** 2008. "Manipulation of the Running Variable in the Regression Discontinuity Design: A Density Test." *Journal of Econometrics*, 142(2): 698–714.
- Ministry of Finance.** 2000. "Economic Survey 1999-00." Government of India.
- Ministry of Finance.** 2001. "Economic Survey 2000-01." Government of India.
- Ministry of Finance.** 2002. "Economic Survey 2001-02." Government of India.
- Ministry of Finance.** 2003. "Economic Survey 2002-03." Government of India.
- Ministry of Finance.** 2005. "Economic Survey 2004-05." Government of India.
- Ministry of Finance.** 2006. "Economic Survey 2005-06." Government of India.
- Ministry of Finance.** 2007. "Economic Survey 2006-07." Government of India.
- Ministry of Finance.** 2008. "Economic Survey 2007-08." Government of India.
- Ministry of Finance.** 2009. "Economic Survey 2008-09." Government of India.
- Mittal, Shekhar, and Aprajit Mahajan.** 2017. "VAT in Emerging Economies: Does Third Party Verification Matter."



- Mukherjee, Sacchidananda, and R. Kavita Rao.** 2015. “Factors Influencing Unincorporated Enterprises to Register Under Value Added Tax (VAT): An Analysis with Enterprises Survey Data.” Working Paper.
- Naritomi, Joana.** 2015. “Consumers as Tax Auditors.” LSE Working Paper.
- OECD.** 2016. “Consumption Tax Trends 2016: VAT/GST and Excise Rates, Trends and Policy Issues.” OECD Publishing.
- Okunogbe, Oyebola, and Victor Pouliquen.** 2018. “Technology, Taxation, and Corruption.” World Bank Policy Research Working Paper 8452.
- Olken, Benjamin A., and Monica Singhal.** 2011. “Informal Taxation.” *American Economic Journal: Applied Economics*, 3: 1–28.
- Piggott, John, and John Whalley.** 2011. “VAT Base Broadening. Self Supply and the Informal Sector.” *American Economic Review*, 91(4): 1084–1094.
- Poddar, Satya, and Ehtisham Ahmad.** 2009. “GST Reforms and Intergovernmental Considerations in India.” Government of India Working Paper 1/2009, Ministry of Finance, Department of Economic Affairs.
- Poirson, Hélène.** 2006. “The Tax System in India: Could Reform Spur Growth?” IMF Working Paper 06/93.
- Pomeranz, Dina.** 2015. “No Taxation Without Enforcement: Deterrence and Self-Enforcement in the Value Added Tax.” *American Economic Review*, 105(8): 2539–2569.
- Pomeranz, Dina, and Jose Vila-Belda.** forthcoming. “Taking State-Capacity Research to the Field: Insights from Collaborations with Tax Authorities.” *Annual Review of Economics*.
- Publishers, Commercial Law.** 2000. *Commercial’s All India Sales Tax Tariff: States’ Sales Tax Rates*. Delhi:Commercial Law Publishers.

- Publishers, Commercial Law.** 2002. *Commercial's All India Sales Tax Tariff: States' Sales Tax Rates*. Delhi:Commercial Law Publishers.
- Purohit, Mahesh C.** 2001a. *Sales Tax and Value Added Tax in India*. Delhi:Gayatri Publications.
- Purohit, Mahesh C.** 2001b. *Value Added Tax - Experiences of India and Other Countries*. Delhi:Gayatri Publications.
- Purohit, Mahesh C., and Vishnu Kanta Purohit.** 2014. *The Oxford Handbook of Tax System in India: Analysis of Tax Policy and Governance*. Delhi:Oxford University Press.
- Rao, M. Govinda, and R. Kavitarao Rao.** 2005. "Trends and Issues in Tax Policy and Reform in India." *India Policy Forum*, 55–122.
- Ring, Jr., Raymond J.** 1989. "The Proportion of Consumers' and Producers' Goods in the General Sales Tax." *National Tax Journal*, 42(2): 167–179.
- Sangal, Balram.** 2005. *Commercial's All India VAT Manual*. Delhi:Commercial Law Publishers.
- Sangal, Balram, and Jagdish Rai Goel.** 2007. *Commercial's All India VAT Manual, Second Edition*. Delhi:Commercial Law Publishers.
- Santra, Sattwik, and Koushik Kumar Hati.** 2014. "India's Move from a Sales Tax to VAT: A Hit or Miss?" Working Paper.
- Shah, Jawad.** 2019. "Computerized Enforcement and Input Tax Evasion in VAT: Theory and Evidence from Pakistan." University of Kentucky Working Paper.
- Sincavage, Jessica R., Carl Haub, and O. P. Sharma.** 2010. "Labor Costs in India's Organized Manufacturing Sector." *Monthly Labor Review*, 133(5): 3–22.

- Slemrod, Joel.** 2005. “The Etiology of Tax Complexity: Evidence from U.S. State Income Tax Systems.” *Public Finance Review*, 33(3): 279–299.
- Slemrod, Joel, Obeid Ur Rehman, and Mazhar Waseem.** 2018. “Pecuniary and Non-Pecuniary Motivation for Tax Compliance.” Working Paper.
- Smart, Michael, and Richard M. Bird.** 2009. “The Impact on Investment of Replacing a Retail Sales Tax with a Value-Added Tax: Evidence from Canadian Experience.” *National Tax Journal*, 62(4): 591–609.
- Sury, M. M.** 2015. *Tax System in India: Evolution and Present Structure*. Delhi: New Century Publications.
- Topalova, Petia, and Amit Khandelwal.** 2011. “Trade Liberalization and Firm Productivity: The Case of India.” *Review of Economics and Statistics*, 93(3): 995–1009.
- Velayudhan, Tejaswi.** 2018. “Misallocation or Misreporting? Evidence from a Value Added Tax Notch in India.” Working Paper.
- Waseem, Mazhar.** 2018*a*. “Information, Assymmetric Incentives, Or Withholding? Understanding the Self-Enforcement of Value-Added Tax.” Working Paper.
- Waseem, Mazhar.** 2018*b*. “Taxes, Informality and Income Shifting: Evidence from a Recent Pakistani Tax Reform.” *Journal of Public Economics*, 157: 41–77.
- Waseem, Mazhar.** 2018*c*. “Using Movement of Exemption Cutoff to Estimate Tax Evasion: Evidence from Pakistan.” Working Paper.
- Wildasin, David E.** 2001. “Financing State and Local Government: Future Challenges and Opportunities.” , ed. David E. Wildasin, Michael T. Childress, Merl Hackbart, Lawrence K Lynch, and Charles W. Martie, Chapter Sales Taxation in Kentucky: Problems and Prospects, 27–38. Kentucky Long Term Policy Research Center.

## A Appendices

### A.1 Additional Institutional Details on India's Commodity Tax Systems

Before the 2017 reform amended the Constitution and introduced a national VAT system, the power to levy taxes on the sale and purchase of goods in their state rested with state governments. The only check on this power was Article 286, which gave the central government the right to impose the following restrictions (Sury, 2015):

1. *No law of a State shall impose a tax on the sale or purchase of goods where such sale or purchases take place: (a) outside the State, or (b) in the course of import of goods into, or export of goods out of, the territory of India.*
2. *Except in so far as the Parliament may by law otherwise provide, no law of a State shall impose a tax on the sale or purchase of any goods where such sale or purchase takes place in the course of inter-State trade or commerce.*
3. *No law made by the legislature of a State imposing a tax on the sale or purchase of any such goods as have been declared by Parliament by law to be essential for the life of the community, shall have effect unless it has been reserved for the consideration of the President and has received his assent.*

This provision introduced an important distinction between goods sold within the same state and goods produced in one state but sold in another state. Intra-state sales were taxed according to a state-specific sales tax (before the state VAT reform from the mid-2000s that we study) or a state-specific VAT (after the state VAT reform until the national VAT reform of July 2017). These taxes have become an increasingly important source of state revenue over time. In 1950, sales tax revenue made up 26 percent of states' own-tax revenue, but by 2013, that share had increased to almost 61 percent (Sury, 2015).

Reforms to the highly complicated sales tax regime were suggested multiple times: In 1984, for example, the Committee of Sales Tax Commissioners had recommended the introduction of common floor level tax rates on 29 products to reduce the harmfulness of tax competition between states.<sup>38</sup> All states agreed to adopt such rates at a meeting in 1989, but an actual implementation stalled.<sup>39</sup> Because a national value-added tax system was deemed to be infeasible because it would have required state approval and an amendment of the Constitution, the Tax Reforms Committee suggested the introduction of a state-level VAT for the manufacturing sector in 1991.

To facilitate a discussion about a state-specific VAT system, the central government developed a VAT Model Act in 1998 that was supposed to serve as a guideline for state governments. In November of 1999, Indian states decided to finally introduce binding floor tax rates for the sales tax from January 1, 2000, to phase out sales tax concessions, and to introduce a streamlined VAT system on April 1, 2001 (Ministry of Finance, 2000).<sup>40</sup> Because many states were afraid of short-run revenue losses from the move to a completely new tax system, the central government promised to compensate state governments for any such losses. A standing committee of the State Finance Ministers was supposed to coordinate the VAT reform process.

The timeline proved to be too ambitious to settle all issues surrounding the tax reform. At a committee meeting in July 2001, state governments agreed on a new VAT introduction date of April 1, 2002, and the committee suggested the following key elements for the new system (Ministry of Finance, 2001; Sury, 2015):

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<sup>38</sup>Minimum tax rates have the potential to be revenue enhancing (Kanbur and Keen, 1993).

<sup>39</sup>Problems occurred even at the regional level, where a similar agreement among North Indian states from 1994 was not implemented.

<sup>40</sup>Continuing tax competition had created large revenue losses for a number of states. The floor rates were 0 percent, 1, percent, 4 percent, 8 percent, 12 percent and 20 percent depending on the product. As is common for India's tax system, goods were put into specific categories based on very specific descriptions: A zero tax rate was reserved for commodities considered to be essential, for example grains, dairy products and water. Products such as edible oils, processed vegetables, chemicals and fertilizers received a 4 percent floor rate, whereas electronics, drugs and medicines and cooking gas were subject to an 8 percent rate. Products such as diesel, phone equipment, TVs and air-conditioners received the highest floor rate of 12 percent. A 1 percent tax rate was reserved for gold and silver, whereas a 20 percent special tax rate applied to petrol, liquor and narcotics (Sury, 2015).

1. *The VAT system will eliminate the cascading burden of taxation by setting off the tax paid on inputs against that on output.*
2. *It will reduce distortions in the economy caused by double taxation.*
3. *It will end market fragmentation with a uniform regime of taxation followed in all the States.*
4. *There will be one category of tax-exempted commodities for all the States.*
5. *There will be two VAT rates: a uniform 4 percent for all States on goods of basic necessities and a uniform floor rate of 10 percent for other commodities (except a few items such as bullion and liquor).*
6. *A uniform set of procedures for VAT assessment will also be followed by all the States, including the use of permanent account number (PAN) as a common business identifier.*
7. *The States which do not implement 100 percent uniform floor rates of sales tax by July-end 2001 should be penalised by discontinuing Central Government assistance.*
8. *The Centre has undertaken to make good any revenue loss to States on their switch over to VAT. A committee of State Finance Secretaries would evolve clear and measurable criteria for judging revenue loss, if any, due to the introduction of VAT. It will also recommend the manner and quantum of compensation.*

The central government had also created an Advisory Group on Tax Policy and Tax Administration, which made the following recommendations in their final report from 2001 (Ministry of Finance, 2002):

1. *States should adopt a consumption type VAT i.e. there should be no distinction between raw materials and capital goods in allowing VAT credit. Only this VAT variant is equivalent to a retail sales tax. The consumption base must be as wide as possible and*

*must comprehensively include manufacturers and dealers of all goods indicated in sales tax schedule.*

- 2. A two floor VAT rate structure in addition to the zero rate; one for essential commodities and another for all other items would be best.*
- 3. The States must draw up a common exemption list.*
- 4. Unprocessed food articles, life-saving drugs and commodities with negative externalities whose consumption needs to be checked should be exempted from State VAT.*
- 5. All concessions with regard to the sales tax should be eliminated under the State VAT and benefits if any should be given only in exceptional circumstances through budget based subsidies.*
- 6. Small dealers whose annual turnover does not exceed Rs. 15 lakh should be exempt from the liability of VAT but subjected to a sales tax of one percent.*
- 7. All international exports should be zero-rated.*
- 8. Commodities with negative externalities whose consumption needs to be checked should, however, be subject to the Special Additional Tax (SAT) against which no input tax credit should be granted.*
- 9. Luxuries should not be taxed under the SAT. Instead, it would be better to have a common, high, third VAT rate for luxuries.*
- 10. The local VAT rates should be close to uniform across States.*
- 11. A destination based VAT is recommended for the Indian State level VAT.*

Both of these sets of recommendations for the VAT system required all states to harmonize their widely different systems, when not even all states had fully implemented the floor rates on the sales taxes. To provide more time to prepare for the reform, the introduction of the

VAT was therefore pushed back to April 1, 2003 at meetings of the State Finance Ministers in 2002 (Ministry of Finance, 2002, 2003). To ensure a harmonization of all the important features of the VAT systems across states, the model VAT Bill created a template for state legislation. The central government also agreed to compensate states for any reform-related losses in the first three years.<sup>41</sup>

The VAT introduction date of April 1, 2003, again was not kept by any state with the exception of the state of Haryana, mostly due to delays in the legislative process and the administrative changes required for the reform.<sup>42</sup> In June 2004, the finance ministers of central and state governments agreed on April 1, 2005 as the new implementation start date (Ministry of Finance, 2005). Because opposition to the reform remained among state governments as well as the trading community, a new template of a VAT Act dialed down the required level of harmonization across states. It now sought to harmonize a few key features of the VAT system while allowing state governments a lot more freedom to adjust the VAT Act to state-specific concerns. A white paper on State-level value added tax was circulated on January 17, 2005 by the Empowered Committee of State Finance Ministers and contained the following provisions (Ministry of Finance, 2005):

1. *Introduction of VAT would help avoid cascading nature of sales tax.*
2. *Present multiple rates and taxes can converge into a few rates and a single VAT.*
3. *Transparency in the system of tax administration through simple self-assessments and departmental audit.*
4. *Rationalisation of taxes to result in lower tax burden and higher tax revenues.*
5. *To avoid tax competition, the design of State VAT needs to be harmonized even as the distinctive needs of individual States are recognized.*

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<sup>41</sup>Compensation was supposed to be 100 percent of revenue loss in the first year, 75 percent in the second year, and 50 percent in the third year (Sury, 2015).

<sup>42</sup>“The consensus arrived at to introduce VAT from April 1, 2003 could not be adhered to as States were not fully prepared both in terms of legislative requirements as well as administrative infrastructure required for the purpose.” (Ministry of Finance, 2005).



6. *State VAT to have two basic rates of 4 percent and 12.5 percent and to cover 550 commodities. About 270 commodities will be under 4 percent rate.*
7. *46 items, comprising of natural and unprocessed products in unorganized sector, items legally barred from taxation and items having social implications, are exempt from VAT.*
8. *Gold and silver ornaments subject to a special VAT rate of 1 percent and other commodities to attract a general VAT rate of 12.5 percent.*

The central government later summarized the actual common features of the state VAT system like this (Ministry of Finance, 2007; Sury, 2015):

1. *Rates of VAT on various commodities shall be uniform for all the States/UTs. There are 2 basic rates of 4 percent and 12.5 percent, besides an exempt category and a special rate of 1 percent for a few selected items. The items of basic necessities have been put in the zero-rate bracket or the exempted schedule. Gold, silver and precious stones have been put in the 1 percent schedule. There is also a category with 20 percent floor rate of tax, but the commodities listed in this schedule are not eligible for input tax rebate/set off. This category covers items like motor spirit (petrol), diesel, aviation turbine fuel, and liquor.*
2. *Model VAT design makes provision for eliminating the multiplicity of taxes. In fact, all the State taxes on purchase or sale of goods (excluding entry tax in lieu of octroi) are required to be subsumed in VAT.*
3. *Provision has been made for allowing input tax credit, which is the basic feature of VAT. However, since the VAT being implemented is intra-State VAT only and does not cover inter-State sale transactions, input tax credit will not be available on inter-State purchases.*
4. *There are provisions to make the system more business-friendly. For instance, there is provision for self-assessment by the dealers. Similarly, there is provision of a threshold*

*limit for registration of dealers in terms of annual turnover of 5 lakh rupees. Dealers with turnover lower than this threshold limit are not required to obtain registration under VAT and are exempt from payment of VAT. There is also provision for composition of tax liability up to annual turnover limit of 50 lakh rupees.*

- 5. Regarding the industrial incentives, the States have been allowed to continue with the existing incentives, without breaking the VAT chain. However, no fresh sales tax/VAT-based incentives are permitted.*
- 6. Exports will be zero-rated, with credit given for all taxes on inputs/purchases related to such exports.*

## A.2 Additional Tables and Figures

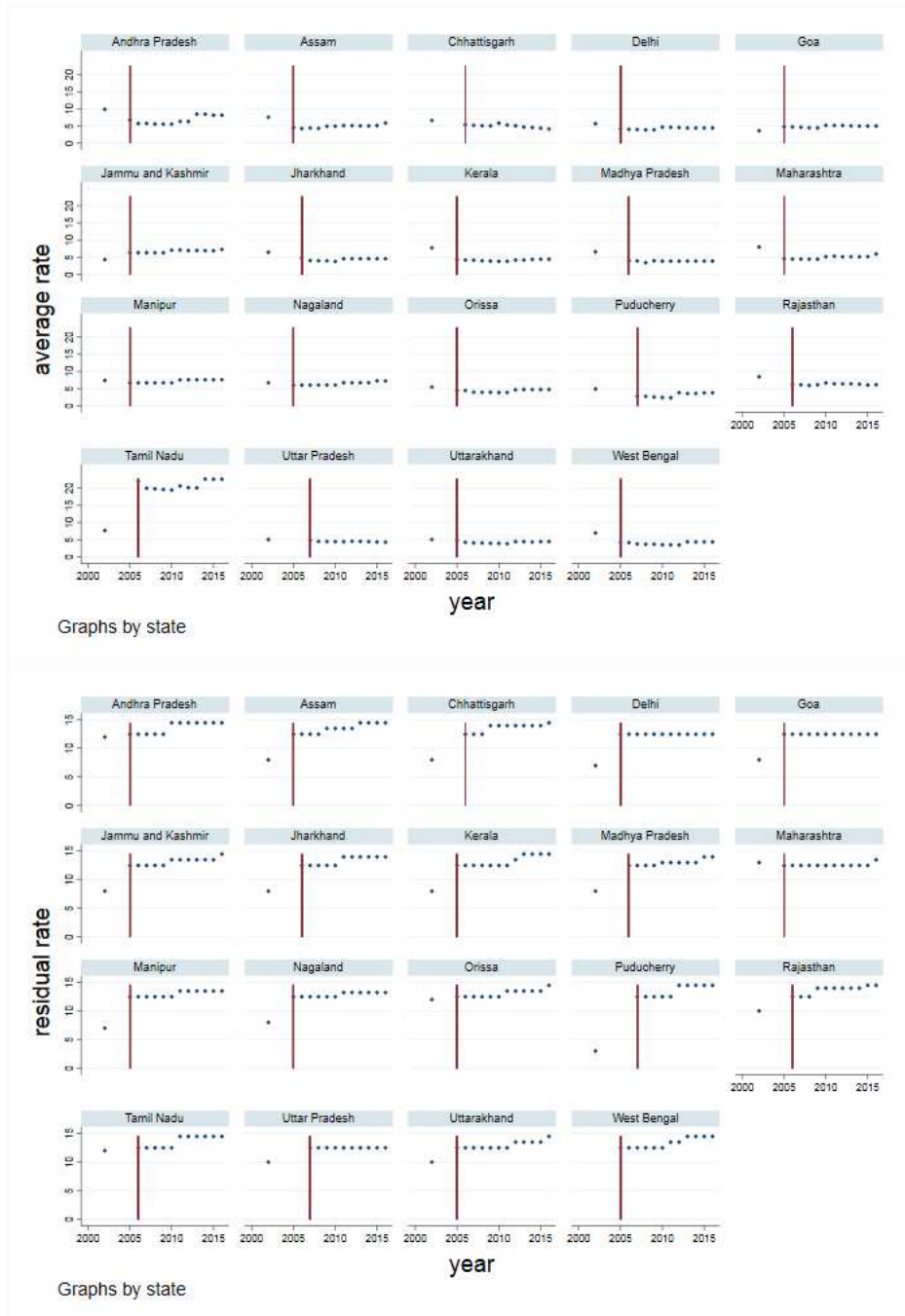
This section presents additional tables and figures, all of which are discussed in the main text of the paper.

Table A.1: Date of VAT introduction in Indian States

State	Month	Day	Year
Andhra Pradesh	4	1	2005
Arunachal Pradesh	4	1	2005
Assam	5	1	2005
Bihar	4	1	2005
Chandigarh	12	15	2005
Chhattisgarh	4	1	2006
Dadra and Nagar Haveli	4	1	2005
Daman and Diu	4	1	2005
National Capital Territory of Delhi	4	1	2005
Goa	4	1	2005
Gujarat	4	1	2006
Haryana	4	1	2003
Himachal Pradesh	4	1	2005
Jammu and Kashmir	4	1	2005
Jharkhand	4	1	2006
Karnataka	4	1	2005
Kerala	4	1	2005
Madhya Pradesh	4	1	2006
Maharashtra	4	1	2005
Manipur	8	1	2005
Meghalaya	5	1	2005
Mizoram	4	1	2005
Nagaland	4	1	2005
Orissa	4	1	2005
Puducherry	4	1	2007
Punjab	4	1	2005
Rajasthan	4	1	2006
Sikkim	4	1	2005
Tamil Nadu	1	1	2007
Telangana	4	1	2005
Tripura	4	1	2005
Uttar Pradesh	1	1	2008
Uttarakhand	10	1	2005
West Bengal	4	1	2005

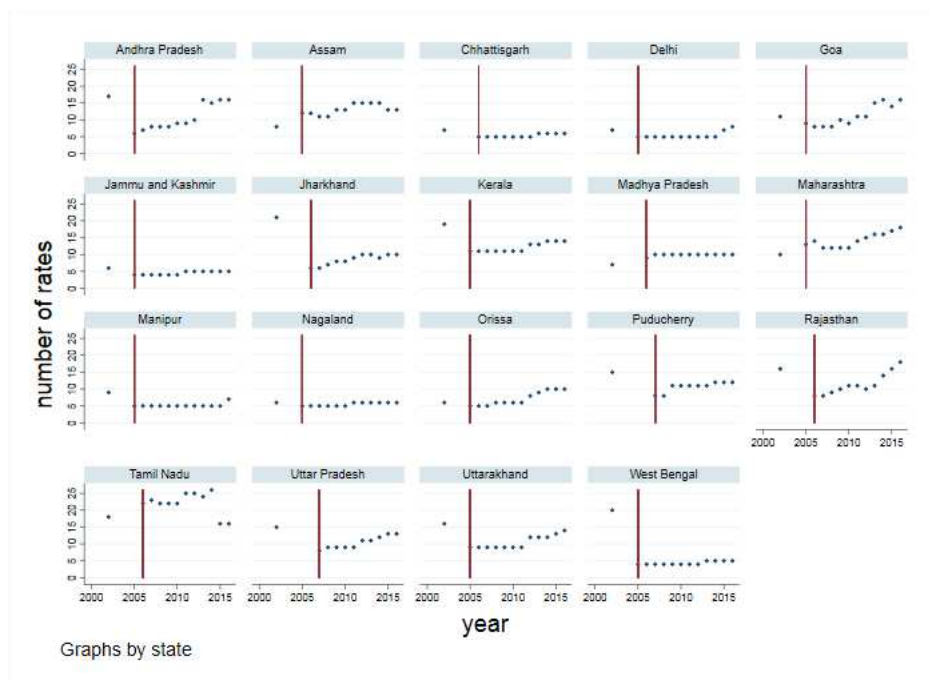
Note: Two states or Union Territories, Andaman and Nicobar Islands and Lakshadweep, have never had a sales tax and did not introduce a VAT.

Figure A.1: Tax Rates by State and Time



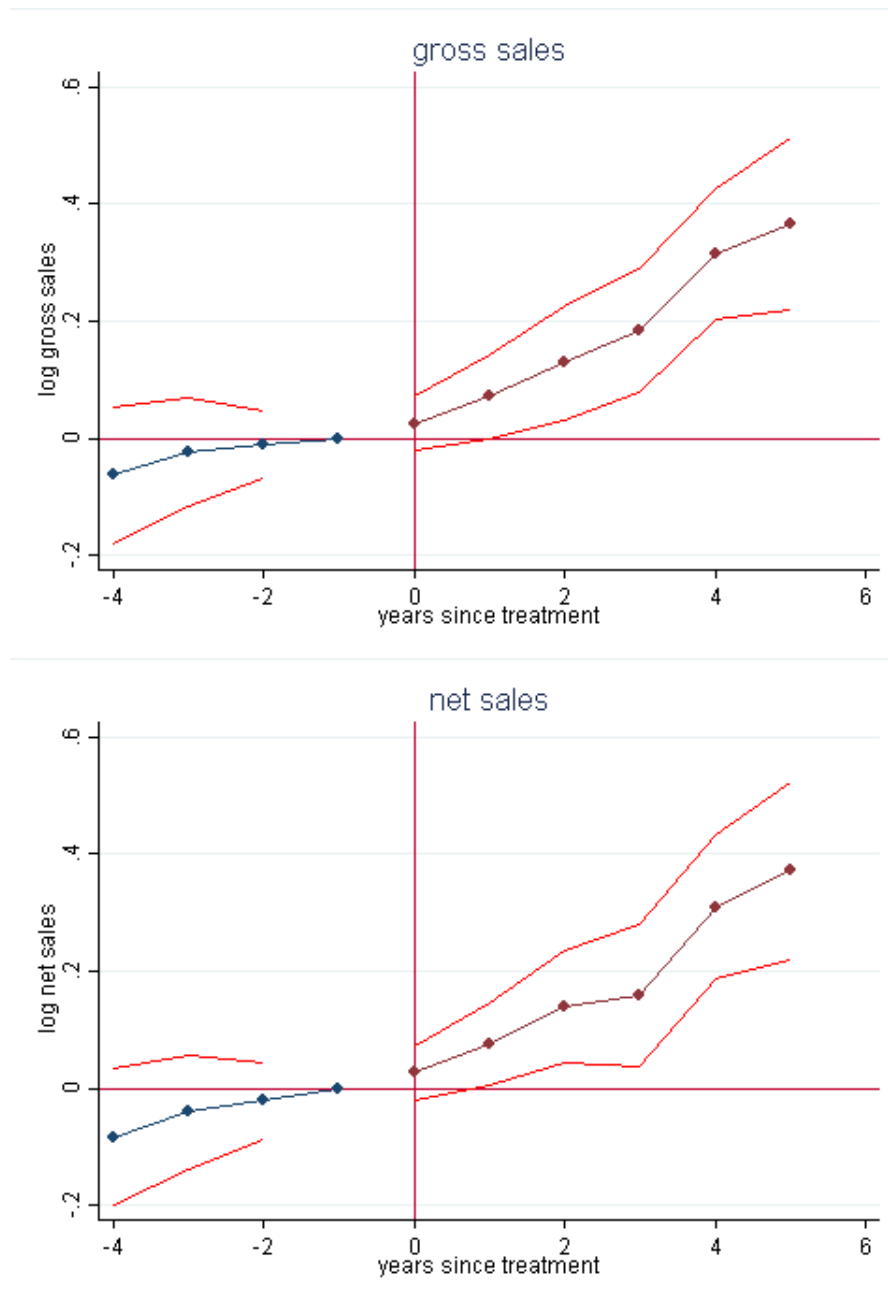
Legend: This figure is analogous to that in the text except it shows all of the temporal variation. The year the state switched to the VAT regime is given as a vertical red line. The upper panel of the figure shows the average tax rate by state and the lower panel shows the default tax rate by state. The average tax rate is calculated over the items in the tax schedule meaning that very detailed schedules get additional weight relative to less specific schedules within the state. For this reason, we plot the default tax rate separately. The default tax rate is the rate that applies to all goods not explicitly listed in the schedule. (Under the average figure, this rate would get a weight of one item out of hundreds, but it applies to many goods.) We are in process of merging the tax rate data to industry codes which will allow for more appropriate weighting.

Figure A.2: Number of Tax Rates by State and Time



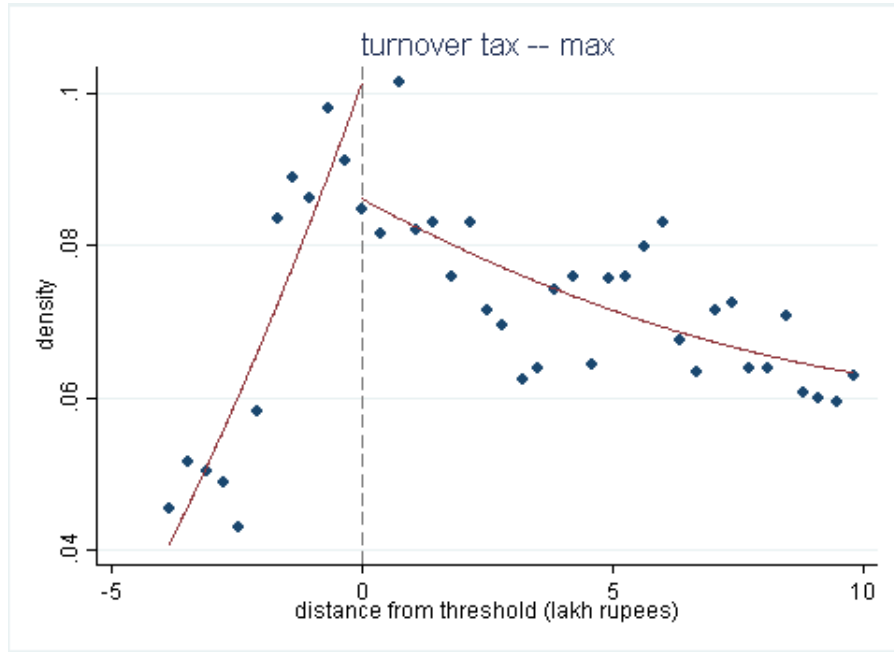
Legend: This figure is analogous to that in the text except it shows all of the temporal variation. The year the state switched to the VAT regime is given as a vertical red line. This figure shows the number of unique tax rate categories by state and time.

Figure A.3: Effect of VAT Reform Using a Balanced Sample, Not Adjusted for Covariates



This figure shows the effect of the adoption of VAT using a set of balanced firms. Unlike the results presented in the main text, these coefficients are not adjusted for covariates. Standard errors are clustered at the state level and the figure shows 95% confidence intervals; period -1 is the omitted category so no confidence bands are included. Period -1 is the year prior to the VAT reform, where the entire year was subject to the sales tax regime. The implication is that period 0 includes some states that switched to the VAT at the start of the financial year (and are treated for the full year) and some states that switched to the VAT at the end of the financial year (and are partially treated for only some of the year).

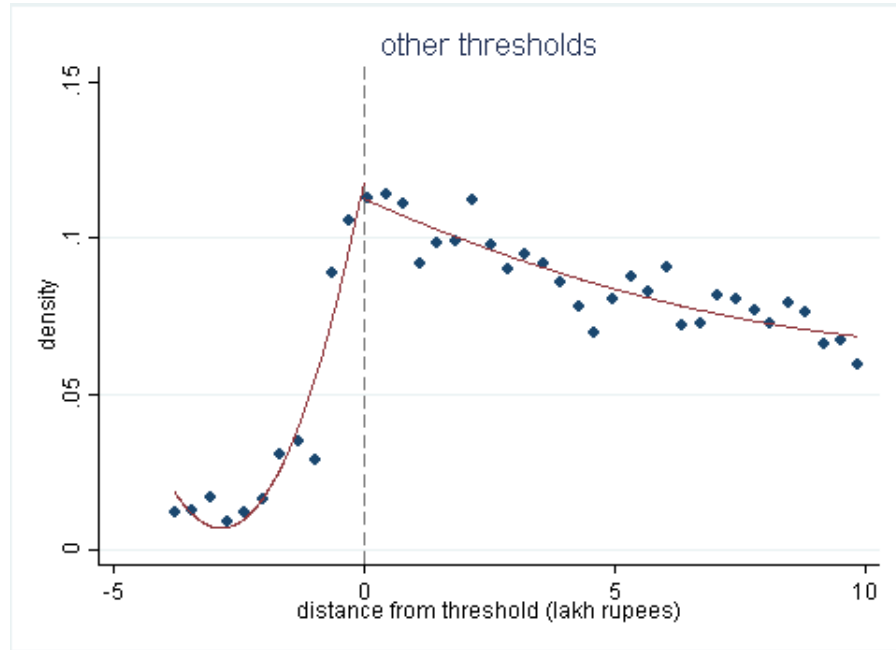
Figure A.4: Bunching at Turnover Tax Thresholds



The figure shows the bunching at the turnover tax thresholds. Unlike the figure in the text, this figure uses both large and small thresholds. Turnover taxes often have multiple thresholds. When turnover taxes are due for firms with sales between two values, we focus on the max. When only one threshold is given, the max is that threshold. To construct the figures, we estimate the densities following McCrary (2008) and plot the density in forty bins. We plot a quadratic polynomial to the data for visual aid. Thresholds are in lakh rupees and we pool the thresholds across states-years. We do not allow turnover taxes to have different effects under the VAT and sales tax regime, which means we estimate bunching at turnover taxes using both the sales tax and VAT regimes. Many thresholds are at very low levels, so much of the decline in density to the left of the threshold is a result of states not being in the data any more because firms cannot have negative sales. For this reason we focus on visual inspection of the existence of a discontinuity around the threshold.



Figure A.5: Bunching at Thresholds Other than Those for Sales, VAT or Turnover Taxes



The figure shows the bunching at the thresholds other than those used for VAT/sales/turnover taxes. To construct the figures, we estimate the densities following McCrary (2008) and plot the density in forty bins. We plot a quadratic polynomial to the data for visual aid. Thresholds are in lakh rupees and we pool the thresholds across states-years. Many thresholds are at very low levels, especially under the sales tax regime, so much of the decline in density to the left of the threshold is a result of states not being in the data any more because firms cannot have negative sales. For this reason we focus on visual inspection of the existence of a discontinuity around the threshold.

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