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# Using Computerized Information to Enforce VAT: Evidence from Pakistan

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## Abstract

*I test the claim that VAT's in-built third-party information trail, together with electronic filing, deters tax evasion automatically. Using a reform which utilizes information beyond VAT trail and authorizes a computerized risk analysis system to accept or reject tax credits in real time, my difference-in-differences estimates show that claims declined by fifty percent. Based on firm heterogeneity, the response ranges from thirty to ninety percent. Ten percent of treated firms were fake, created for missing trader fraud. Lower bound estimate of increase in net VAT collection at country level is ten percent. I find that traditional VAT enforcement mechanisms of cross matching, audit and recovery fail to deter evasion in developing countries but a risk based real time enforcement system is effective. Because this system eliminates the need for reverse charge, its tax policy implications extend to developed countries. (JEL H25, H26, H32, O17)*

**Keywords:** Value Added Tax, Tax Evasion, Missing Trader Fraud, Enforcement, Information Reporting, Firm Behavior, Informal Economy

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Developing countries have a very low tax to GDP ratio compared to developed countries. A key explanation is the limited enforcement capacity of tax administrations in developing countries (IMF 2011). For this reason, in tax policy debates, enhancement of administration and enforcement capacity of developing countries with large informal sectors, is considered pivotal to collecting adequate taxes (Slemrod 2019; Waseem 2018; Slemrod and Gillitzer 2014). In the last several decades, over 160 countries -- including many developing countries -- have introduced value added tax (VAT). The prime motivation is the supposedly superior tax enforcement properties of VAT due to cross-checking of information across various stages of production. Each stage of production reports the value of outputs and inputs, which means that the output of an early stage of production acts as an input for the next stage of production. As these inputs and outputs are reported by unrelated firms, they create a paper trail that tax authority can exploit for enforcement.

Contrary to the popular belief that VAT immediately provides a way of enhancing revenue efficiency, these enforcement advantages of VAT may not work in low state capacity countries. The conventional wisdom is that information flows created by arm-length transactions between unrelated parties make it easier for the government to enforce tax. This argument ignores tax administration's ability to process information flows and assumes that governments have the administrative capacity to utilize this information and recover evaded tax. However, when tax administration does not have the capacity to utilize this information to enforce recovery in real time<sup>1</sup>, enforcement-facilitating mechanism built into VAT would not be effective (Emran and Stiglitz 2005; Keen 2008). I study VAT in both low enforcement capacity normal regime and high enforcement capacity real time regime in Pakistan to answer an important question in public finance: what is the effect of a real time enforcement system on tax evasion? To preview the results: real time enforcement decreases tax credit claims by half.

Recent literature on tax enforcement has focused on third-party information, scrutiny and cross-matching of invoices (Waseem 2023; Almunia et al. 2022). The focus of this literature is on two issues- mechanical effect of cross matching and

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<sup>1</sup>The "real time" in context of this paper means that as soon as a return is filed, it is scrutinized and dubious tax claims are denied up front without the need for a normal audit.

audit. In this literature, If taxpayer knows that her data would be cross-matched with her buyers and suppliers, the evasion would go down because auditors can now raise demand against these discrepancies. Firms can, however, circumvent these checks by resorting to more sophisticated strategies and exploiting the fact that audit may not be an optimal way to enforce recovery, especially in limited state capacity regimes. A firm can either render mechanical cross matching ineffective or assume that recovery conditional on detection is a low-probability outcome. It implies that a substantial evasion may persist despite electronic filing of returns and cross matching of invoices. Furthermore, rate of recovery after audit could be as low as two percent (Best, Shah, and Waseem 2021). VAT evading firms use fake invoices as input tax credit to lower their tax liability and assume that probability of paying back this amount is negligible. These invoices are managed in a way that they would easily pass normal cross-checking of a fully automated system.<sup>2</sup> Even in the developed countries, Missing Trader Intra Community (MTIC) or “Carousel” fraud is rampant. EU almost gave up the destination based taxation principle as it could not cope with large volume of revenue leakage through carousel fraud (Crawford, Keen, and Smith 2010; Keen and Smith 2006). Still EU had to modify standard VAT and introduce reverse charge mechanism (Buettner and Tassi 2023).<sup>3</sup> These sophisticated frauds are unique to VAT and may only be tracked through a real time system which can audit and recover tax in a fast and efficient manner.

In this paper, I exploit quasi experimental setting created by a Pakistani reform which authorized a software based risk analysis system named CREST<sup>4</sup> to deny suspicious input tax claims in real time. CREST has access to data other than VAT

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<sup>2</sup>In normal cross-matching, computer system can only check basic information such as registration and filing status etc. but cannot go beyond this information and flag invoices on the basis of risk criteria.

<sup>3</sup>Annually, more than hundred billion Euros worth of taxes are lost in EU. Therefore, it is not hard to imagine the scope of difficulties faced by revenue administrations of countries with large informal economies in curbing fraudulent practices. Also, in these countries VAT frauds become easier to execute because of lax enforcement.

<sup>4</sup>CREST stands for Computerized Risk-Based Evaluation of Sales Tax. In Pakistan, VAT is legally called sales tax because this law was introduced as an amendment to existing statute of sales tax and not as a new law to comply with the constitutional requirements.

returns, can go few steps back in chain<sup>5</sup> and uses in-built risk parameters to establish the authenticity of each and every invoice. It reduces the role of the “*taxman*” (auditors) and replaces these traditional enforcement mechanisms-- plagued with inefficiency, corruption and delays (Davoodi and Tanzi 2000; Khan, Khwaja, and Olken 2016)-- with an efficient, transparent and real time enforcement system. In particular, starting July 2013, CREST software rejects input credits automatically by performing an invoice wise scrutiny. This reform eliminated the need to adopt a long and tedious process starting from audit selection, completion, framing a case based on audit, ensuring “over the years” that the case reaches its logical end and, critically, evaded tax is recovered from the defaulting unit. It took away the opportunity from tax evaders to use various loopholes in this process.

I develop a general conceptual framework for VAT input tax evasion in the spirit of tax evasion model introduced by Allingham and Sandmo (1972). In this standard model, probability of detection is represented in a reduced form way as a single parameter. However, probability of detection depends on the product of probability of audit and probability of *recovery* conditional on being audited. The reform raised expected cost of evasion by substantially increasing probability of *recovery*. I, therefore, use two different probabilities in my theoretical model to capture this effect. From theoretical model, I conclude that unless governments invest in improving recovery, increasing deterrence through cross matching and audits would not deter evasion materially.

Turning to the empirical analysis, CREST reform affected non-exporting firms only as exporting firms were already subject to identical scrutiny, thereby facilitating a generalized difference-in-differences identification strategy. I use administrative data<sup>6</sup> for the universe of monthly VAT returns (9.9 million in total) filed in financial years 2009 to 2016<sup>7</sup> to study input tax evasion. I divide my analysis into

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<sup>5</sup>It means the software can cross check invoices and then checks suppliers of the supplier and so on which enables it to crunch data and raise a red flag immediately. It can also cross check import and export records, income tax returns and excise duty declarations etc.

<sup>6</sup>See also Waseem (2023) Waseem (2020), Slemrod, Ur Rehman, and Waseem (2020), Waseem (2019), Waseem (2018), Best et al. (2015) and Kleven and Waseem (2013) for recent empirical evidence using administrative data from Pakistan.

<sup>7</sup>In Pakistan financial year starts on July 1st and ends on June 30th, accordingly tax year 2009 means the financial year starting on July 1, 2008 and ending on June 30, 2009.

four parts. First, I determine the extent of evasion through manipulation of input tax credits . Using exporting firms as the comparison group and domestically operating firms as the treatment group, I find that input tax claims fell by 2.36 million Pakistani Rupees per treated firm which represents a decline of fifty percent on average. In gross aggregate terms, it represents a decline of PKR 86 billion or USD 860 million in input tax credit claims. Lower bound estimate of increase in net VAT collection at country level is ten percent because a significant number of credits were generated to mask fraudulent activity as explained in Appendix A.2. Second, I estimate the impact by business type (company, sole proprietorship or partnership). I find that these large post-reform effects are not limited to or driven by individually operated firms only. The claims of corporations and partnership firms also fell by thirty to fifty percent. Companies, who would otherwise be expected to refrain from outright fraud, follow behavior similar to partnership and sole proprietorship firms. Third, I measure the effect across business categories (manufacturers vs. non-manufacturers) which ranges from thirty percent for manufacturers to seventy percent for non-manufacturers. Last, I find that thirteen percent of treated firms who were active before reform stopped claiming any input tax credit post reform. Conditional on input tax credits falling to zero, seventy five percent firms show zero sales pointing to substantial presence of invoice mills. More than seventy percent of these fake firms are registered as sole proprietorships and non-manufacturers with a tendency to use relatively small to medium turnover for missing trader type firms.

This paper adds to three different strands of literature. First, it adds to the literature on enforcement capacity of the developing countries which have large informal sectors and its implications for tax evasion through misreporting of purchases (Naritomi 2019; Carrillo, Pomeranz, and Singhal 2017; Pomeranz 2015; Best et al. 2015; Slemrod and Gillitzer 2014; Crawford, Keen, and Smith 2010; Paula and Scheinkman 2010; Keen 2008; Emran and Stiglitz 2005; Piggott and Whalley 2001). Second, this paper contributes to the literature on the effectiveness of invoice summaries in VAT using administrative data. This literature is limited to the effects of simple cross matching and e-filing which is a first stage verification (Waseem 2023; Almunia et al. 2022; Okunogbe and Pouliquen 2022; Waseem 2020; Fan et al. 2018). My paper examines effect of second stage verification of invoices which

goes beyond simple cross matching of invoices <sup>8</sup>. Third, this research is relevant to the debate on destination versus origin based commodity taxation and their impact on evasion in presence of sophisticated frauds (Agrawal and Mardan 2019; Fath, Goulder, and Williams 2015; Bird and Gendron 2007; Keen and Smith 2006; Bickley 2003). I provide extensive empirical evidence on the prevalence, dynamics and working of missing trader fraud with return level data. Empirical evidence on carousel fraud in a few available studies is limited in scope (see Buettner and Tassi 2023; Waseem 2023; Mittal, Reich, and Mahajan 2018). The reform worked and can be modified to any other country or setting facing rampant missing trader fraud. Many variants of VAT such as a compensating VAT (CVAT) and Viable Integrated VAT (VIVAT) have been proposed to deal with intra community and sub-national implementations (Bird and Gendron 2000). The paper shows that a standard destination based VAT can utilize computerization for real time verification to improve compliance and prevent fraud without any need for modifications such as reverse charge.

## 1 Institutional Setting

To understand the context of Pakistani reform, I first elaborate fake invoice phenomenon in VAT. Typically, fake firms register with VAT administration and without actually carrying out any business activity, they issue invoices which can be later claimed by the operating units. These fake firms then disappear without remitting the tax due. Therefore, this type of fraud is often called “missing” trader fraud. The operation and extent of MTIC fraud varies from one VAT regime to another but the central idea is same. A group of traders purchases and sells goods between themselves in a manner that one or several of them vanish without remitting the tax collected, thereby forcing tax authority to allow credit for the amount which was

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<sup>8</sup>First stage verification means that invoices are only cross checked to ensure that any credit claim is based on an actual invoice. This verification is analogous to verification of income tax withholding certificate issued by employers and contractors in which only the amount of withholding is cross checked. Second stage verification of VAT credit invoices deals with ascertaining whether the transaction reported to tax authorities by buyer and seller actually took place or it was only part of a potential fraudulent activity. I explain this mechanism in detail in Appendix [A.2](#).

never deposited in the first place.<sup>9</sup>

In European countries, carousel fraud relies on trade within EU because the tax administrations do not collect tax at import stage on imports originating from member countries (see Figure A.3).<sup>10</sup> But in most developing countries, who charge tax on every import without any exception to a particular origin, domestic variants of carousel fraud may exist (Keen and Smith 2006). Consequently, tax authorities come up with a variety of enforcement and legal measures to curb this phenomenon (Crawford, Keen, and Smith 2010). I refer to this type of fraud as “Domestic Missing Trader” or DMT fraud. Pakistan has a large informal sector, therefore, many firms want to show purchases from informal sector as purchases from VAT registered firms to claim excess credit. I explain this phenomenon in the context of Pakistani VAT regime at Appendix A.2.

## 1.1 Legal Framework and the CREST Reform

VAT is the principal source of revenue for Pakistan’s Federal Government and FBR is the agency that administers VAT. The governing legislation is an Act of Parliament hereinafter referred as “the Act”. The Act allows executive branch to make rules which provide the administrative framework to implement VAT. These rules lay out administrative procedures such as the registration rules which govern registration and deregistration of firms. “Refund” rules are also part of this statute and outline the mechanism for filing, processing and sanctioning of refund claims against zero rated (mainly export) supplies. The bulk of refund claims, more than 97 percent in value, relate to exports. Under these “Refund” rules, firms file their monthly claim electronically and provide supporting documentation to the concerned refund processing division. CREST cross matches the information provided with refund claim including purchase and sale invoices with the data available in the system. It generates risk based assessment on each purchase invoice pointing out

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<sup>9</sup>VAT invoice is similar to an income tax deduction certificate for a buyer. The invoice shows that tax has been collected by seller and buyer is now entitled to deduct this amount from any sales made during the same tax period. If the tax deducted at purchases is more than the tax required to be deposited on sales then firms can either carry it forward to next period or seek refund.

<sup>10</sup>Keen and Smith (2006) elaborate the operation of carousel fraud in EU. Figure A.3 is adapted from the discussion in their article.



the type and nature of discrepancy. It explicitly states whether an invoice is “valid” or “invalid” along with the reason (see Appendix A.2 for more details on CREST).

Ironically, no provision was available in any law to apply information obtained from CREST to check the firms who are not claiming refund prior to financial year 2014. This implied that as long as a firm did not claim refund, tax authorities had little room to check proactively whether the tax against which credit is being claimed had actually been deposited in treasury by the supply chain of this firm. Furthermore, there was no legal cover because refund rules applied only to refund claimants and any proceeding against firms operating domestically and based solely on CREST would be legally void. FBR had this information since 2008 through CREST but it had no meaningful way of using this third party information to prevent evasion in firms operating domestically. The usual mechanism of selection for audit and the pace on which an audit proceeds meant that fraudsters could go unchecked for years causing staggering losses to the exchequer. The absence of a legal cover and the lack of administrative impetus to check this phenomenon in real time meant that the refund claimants and non-claimants were essentially operating under two different audit and enforcement regimes. The revenue cost of a fake invoice is same in either case but the firms who did not file refund claims could only be caught through an audit.

From 1st July 2013, through a change in the Act, Parliament made objection raised by CREST a valid criterion to reject input claim.<sup>1112</sup> This implied that tax administration could reject input tax credits of non-refund claimants proactively and initiate proceedings using the information obtained from CREST. Instead of the low probability selection for audit, domestic suppliers relying on fake invoices now faced a real time challenge. The long and tedious process of audit selection and recovery which took years previously could now be done instantaneously. Suspicious supply chain became a valid ground of rejection through CREST and domes-

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<sup>11</sup>The law does not require a further proof from the tax authority. If CREST terms an invoice “invalid” then the onus shifts to the firm to establish genuineness of invoice. Most importantly, CREST can raise objection based on suspicious supply chain against an individual invoice or transaction and reject input tax credit involved therein.

<sup>12</sup>New financial year starts on 1st July. Therefore 1st July 2013 is the start date of financial year 2014 in Pakistan.

tic firms as well as exporting firms faced identical scrutiny post reform should they choose to evade. FBR forcefully implemented the reform by introducing instructions to administrative units to check input invoices on monthly basis and point out the discrepancies. FBR could now check the networks of fake suppliers and deny input tax credit through this software.<sup>13</sup>

In short, the reform discretely increased enforcement capacity from low to high. Prior to the reform, FBR could detect fraud but statutory limitations on number of audits and traditional “by hand” audit approach failed to translate in meaningful recovery conditional on detection. The reform substantially increased probability of recovery conditional on detection. It transformed a low enforcement capacity VAT regime into high enforcement capacity regime for domestically operating firms.<sup>14</sup>

## 2 Theoretical Model

I develop a model of input tax evasion based on model of Allingham and Sandmo (1972), hereinafter referred simply as A-S model. Although this model is based on income tax evasion, but the intuition employed in A-S model is applicable to present case of input tax evasion in VAT. Tax evasion literature on developing countries has widely used A-S model (for example-Carrillo, Pomeranz, and Singhal 2017), but only for output tax evasion. I use the basic intuition in this model and modify it to input tax evasion. A-S model uses only one parameter for the probability of detection, which includes probability of recovery conditional on detection. In VAT, however, probability of detection and the probability of recovery conditional on detection can vary differently. The reform only changed probability of recovery conditional on audit. Therefore, I use separate parameters to capture the effect of

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<sup>13</sup>In case a firm believes that CREST objection is incorrect or there was some error and the invoice should be valid then it can easily correct that error by removing it in electronic filing system. CREST would then validate the invoice automatically. Therefore, there is a sufficient room to correct legitimate errors and a legit filer would not be at a disadvantage except for this extra compliance cost.

<sup>14</sup>This requires an understanding of the black market where these invoices are sold on a cost proportional to the fake credit involved which is discussed in detail later. However, in short, the suppliers of fake invoices had a greater risk that their invoices would be caught before an input tax is claimed by the beneficiary which meant that suppliers of these invoices would receive zero payment (and even retribution!) plus lose whatever they have already invested.

recovery conditional on detection. Consequently, my model predicts large effect of the reform on input tax evasion because of higher probability of recovery. Net tax gain to the government, though substantial, would be less than the total fall in input tax credit claimed because a good chunk of this observed drop could be driven by fake units.<sup>15</sup>

Firm's choice to evade relies on a simple decision. If the expected benefit of claiming excess input tax exceeds the expected cost then a firm has an economic motivation to evade. Consider a firm which has taxable output  $y$ , and a taxable input  $x$ . For simplicity, I assume that both input and output are taxed at uniform rate  $\tau$ . Input tax can be divided into two parts based on whether a legitimate VAT invoice is available for that or not. Therefore,  $x$  is composed of two components  $x_1$  and  $x_2$  which represent the real input tax and the fake input tax respectively. Then firm's VAT liability for a certain tax period is given by:  $Z = (y - x_1 - x_2)\tau$ . I denote the firm's actual tax liability,  $(y - x_1)\tau$  by  $Y$  and fake input  $x_2\tau$  by  $F$ . If the firm's profit is  $W$ , then any fake input tax claim adds to its profit.

A-S model of evasion is based on probability of detection,  $p$ , through an investigation. In income tax, if the tax authority detects undeclared income then you have to pay tax on undeclared income. In limited state capacity regimes, relation between detection and recovery is not straight forward. The firm which relies on fake invoices often gets away with fraud because the "shady" link between buyer and seller is difficult to prove in courts. Tax authorities have to credit the input claimed in fraudulent manner because they are unable to trace or prove the case against fake suppliers. Therefore, detection does not automatically translate to recovery. Firms are aware of these loopholes and would take into account probability of detection,  $p_1$ , as well as recovery,  $p_2$ . I, therefore, use two different probabilities to capture this effect of the reform.

The expected cost of evasion is composed of three components: a) cost of obtaining fake input tax invoices (b) the recovery in case of detection which includes penalty (c) legal fees associated with audit and litigation incurred by a firm whether

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<sup>15</sup>Keen and Slemrod (2017) suggest an alternate way to model the response by using the elasticity of tax revenue with respect to an intervention. It would be empirically difficult to determine this elasticity in this case because of this missing trader response.

the revenue authorities make or fail to make any recovery. I use separate parameters for cost components associated with traditional legal fees and the cost of obtaining a fake invoice. Penalty,  $\pi$ , is proportional to the tax evaded.<sup>16</sup> Similarly the cost of obtaining fake invoices,  $\theta$ , and legal expenses incurred,  $l$ , are also assumed proportional to the tax evaded.

A firm will choose  $F$  to maximize the expected utility given by:

$$E(U) = \underbrace{(1 - p_1)U(W + F - \theta F)}_{\text{No detection}} + \underbrace{(p_1 - p_1 p_2)U(W + F - \theta F - lF - l\pi F)}_{\text{Detected but not recovered}} + \underbrace{p_1 p_2 U(W + F - \theta F - lF - l\pi F - \pi F)}_{\text{Full recovery including penalty}} \quad (1)$$

where  $0 \leq \theta, l, p_1, p_2 \leq 1$ . The limits on probabilities are obvious. Value of  $\theta$  greater than 1, shall imply that the cost of obtaining input invoices, before a return is filed, is more than the tax involved in those invoices. Similarly, legal fees cannot be more than the actual tax plus penalty demanded because the firm would then simply pay the amount detected. For notational convenience, I denote functional terms other than  $W$  in (1) by  $G^a, G^b$  and  $G^c$  where

$$G^a = F - \theta F, G^b = F - \theta F - lF - l\pi F, G^c = F - \theta F - lF - l\pi F - \pi F \quad (2)$$

so that

$$E(U) = (1 - p_1)U(W + G^a) + (p_1 - p_1 p_2)U(W + G^b) + p_1 p_2 U(W + G^c)$$

and the first and second order conditions are then

$$(1 - p_1)(1 - \theta)U'(W + G^a) + (p_1 - p_1 p_2)(1 - \theta - l - l\pi)U'(W + G^b) + p_1 p_2(1 - \theta - l - l\pi - \pi)U'(W + G^c) = 0 \quad (3)$$

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<sup>16</sup>The modification of A-S model given by Yithzaki (1974) uses a penalty rate proportional to the tax evaded, and in most countries including Pakistan, this is a standard practice.

$$(1 - p_1)(1 - \theta)^2 U''(W + G^a) + (p_1 - p_1 p_2)(1 - \theta - l - l\pi)^2 U''(W + G^b) \\ + p_1 p_2 (1 - \theta - l - l\pi - \pi)^2 U''(W + G^c) = 0 \quad (4)$$

The second order conditions are satisfied because the utility function is concave. For interior maxima, I would need to evaluate marginal utility at points  $F = 0$  and  $F = Y$  which gives following two relationships (here  $B = (1 - \theta - l - l\pi)$  for notational convenience).

$$\frac{\partial E(U)}{\partial F} \Big|_{F=0} (1 - p_1)(1 - \theta)U'(W) + (p_1 - p_1 p_2)BU'(W) \\ + p_1 p_2 (B - \pi)U'(W) > 0 \quad (5)$$

$$\frac{\partial E(U)}{\partial F} \Big|_{F=Y} (1 - p_1)(1 - \theta)U'(W + (1 - \theta)Y) + (p_1 - p_1 p_2)BU'(W + BY) \\ + p_1 p_2 (B - \pi)U'(W + (B - \pi)Y) < 0 \quad (6)$$

The conditions from (5) and (6) can be rewritten as

$$\pi p_1 p_2 < (1 - \theta) - p_1 l \pi - p_1 \pi \quad (7)$$

$$\pi p_1 p_2 > B[p_1 p_2 + (1 - p_1)(1 - \theta) \frac{U'(W + (1 - \theta)Y)}{U'(W + (B - \pi)Y)} \\ + B(p_1 - p_1 p_2) \frac{U'(W + BY)}{U'(W + (B - \pi)Y)}] \quad (8)$$

The terms on the right side of (7) and (8) are positive and less than one.<sup>17</sup> There-

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<sup>17</sup>The assumption here is that  $(1 - \theta - l - l\pi) > 0$  which is intuitive. A firm would only obtain fake invoice if the benefit of a fake invoice exceeds the cost of obtaining the fake invoice plus any associated legal fees on detection.

fore, (7) and (8) together give positive parameter values which are sufficient for an interior solution.

I use the relations derived above to model the response of a firm to DMT. The main relationship is given by (7). Revenue authority wants to increase the cost component or  $\theta$ . If they increase the cost of registering a new firm, it would create more difficulties for genuine businesses and hence should be ruled out as a possibility. Tax authorities, instead, minimize the cost of registration to reduce compliance cost. “Invoice mills” normally charge a fixed percentage of the tax involved in fake invoices supplied to beneficiary firms,. Legal fees are assumed proportional to the tax and penalty demanded in audit observations. Theoretically, tax rate  $\tau$ , penalty rate  $\pi$ , increasing  $p_1$  through more audits, and ensuring recovery after detection thereby increasing  $p_2$ , are the only options available to revenue authorities. As tax rate  $\tau$  decreases, benefit of evasion also decreases and cost component dominates but small tax rate cannot generate adequate revenue. This rules out major decrease in tax rate. In Pakistan, penalty for tax fraud is 100 percent of the tax evaded which means  $\pi = 1$ . Therefore the product  $p_1 p_2$  should be sufficiently small for evasion to occur, which implies that if either  $p_1$  or  $p_2$  is small the missing trader fraud becomes economically feasible. Because it is easier for tax authority to detect fraud after a certain interval of time, the  $p_1$  factor remains relatively high. In fact it is the inability of an enforcement regime to recover tax post detection (low  $p_2$ ), which provides an environment conducive to this type of fraud. Missing trader fraud in Europe exploits the lack of sufficient inter country coordination or low  $p_2$ . Similarly, DMT in Pakistani case relies on legal loopholes and complexity of territorial jurisdictions which make the post detection recovery, a very low probability event.

FBR had all the information to conduct audit and frame a case before this reform. Cost of generating fake invoices  $\theta$ , legal fees  $l$  and penalty on fraud  $\pi$  also stayed the same. CREST reform only raised  $p_2$ , or the probability of recovery con-

ditional on detection. <sup>18</sup> Substituting  $\pi = 1$  reduces (7) to:

$$p_1 p_2 < \frac{1 - \theta}{1 + l} - p_1 \quad (9)$$

Probability is a non-negative number, therefore,  $p_1 p_2 > 0$  which would imply  $p_1 < \frac{1 - \theta}{1 + l}$  is the minimum condition for input tax evasion to occur. In other words, this condition on probability of detection,  $p_1$  can be expressed as:

$$p_1 < \frac{\text{Net benefit per unit fake input tax}}{\text{Gross benefit plus legal cost per unit fake input tax}}$$

and by rewriting (9), condition on probability of recovery  $p_2$  can be written as:

$$p_2 < \frac{\text{Net benefit per unit fake input tax}}{(\text{Gross benefit plus legal cost per unit fake input tax}) * p_1} - 1$$

### 3 Data

A major contribution of this paper is to analyze VAT fraud using rich administrative return data.<sup>19</sup> I use the administrative return data for full universe of monthly VAT returns filed for financial years 2009 to 2016, 9.69 million returns in total. Data covers each field in the return which gives more than hundred variables (see Appendix A.3).<sup>20</sup> Return columns capture all possible purchase and sales transactions with separate columns for zero rated, reduced rate, special and exempt transactions etc. I can use this information to observe a firm's response by disentangling possible confounding transactions which is not possible in absence of individual returns data.

The variable of interest is domestic input tax credit claimed by firms. Domestic

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<sup>18</sup>The cost of generating invoice remained the same. The real time cross verification and audit makes it difficult for the chain of suppliers to operate because CREST detects suspicious chain before the beneficiary unit claims fake invoice. But, CREST itself does not impact cost of registering a new unit and supplying invoices.

<sup>19</sup>There are a few papers such as Waseem (2023), Buettner and Tassi (2023), and Mittal, Reich, and Mahajan (2018) who have examined missing trader fraud but they are either based on aggregate data or limited in scope.

<sup>20</sup>For the importance of administrative data in measuring compliance and enforcement, see Slemrod (2016).

input tax credit arises from domestic taxable purchases only and does not include input tax credit from direct imports. Total input tax is a sum of domestic and imported input tax credit. In case, monthly input tax credit exceeds output tax then firm can either claim refund or carry forward this input tax to next period.<sup>21</sup> Table A.1 presents descriptive statistics for VAT returns on a financial yearly basis. Number of returns filed increases each year which represents the entry of firms in VAT regime. Exit of firms cannot be inferred from the data because firms that apply for deregistration have to file nil returns for six months and should complete a deregistration audit which renders official deregistration a costly business for the firm as well as the tax administration. Therefore, firms who are no longer in business either stop filing returns or keep filing nil returns long after they have gone out of business. These non-active or dormant units should not be part of my analysis but the return data includes such units because many businesses obtain registration and then fail to translate into an actual operative firm. Furthermore, I drop the firms which claim total domestic input tax credit of less than PKR 10,000 (which equals \$100) over the course of five years before the reform. This criterion automatically drops inactive firms, commercial importers and any other firms which never claimed any substantial domestic input tax credit from both comparison and treatment groups. Table 1 provides descriptive statistics for the three categories along with their mean domestic monthly input tax credit. The excluded firms have a negligible domestic input tax credit.

Some firms file returns on quarterly basis, therefore, I use quarter as my time period of analysis because the data does not differentiate between quarterly and monthly returns and tags it to the month for which return is filed. Quarterly returns are filed for the quarters ending in March, June, September and December. Therefore, monthly time periods would inaccurately inflate the figures for months of March, June, September and December. After converting to quarters and dropping observations as explained above, I perform main analysis on 2.35 million observations in terms of quarters, but the results are robust to alternate specifications

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<sup>21</sup> Although there is a bar on adjusting more than 90 percent of input tax against output tax but this restriction does not apply to wholesalers, wholesalers-cum-retailers and distributors vide S.R.O. 647(I)/2007 dated 27th June, 2007.



(see Table A.7, and Table A.8).

Table 1: Descriptive Statistics

	Domestic Firms	Exporters	Others
	(Treatment)	(Comparison)	
All Firms			
Domestic Input Tax (Mean)	706,928	4,093,938	5
Std. Deviation	36,900,000	68,800,000	126
# Observations	6,214,612	626,090	2,617,535
Manufacturers			
Domestic Input Tax (Mean)	1,140,941	3,003,698	7
Std. Deviation	32,400,000	55,600,000	162
# Observations	1,791,292	546,030	411,623
Non-Manufacturers			
Domestic Input Tax (Mean)	531,167	11,500,000	5
Std. Deviation	38,600,000	126,000,000	118
# Observations	4,423,320	80,060	2,205,912
Companies			
Domestic Input Tax (Mean)	4,825,110	12,300,000	5
Std. Deviation	110,000,000	122,000,000	137
# Observations	679,688	197,840	231,599
Partnerships			
Domestic Input Tax (Mean)	217,788	230,911	5
Std. Deviation	1,943,833	934,920	124
# Observations	1,156,853	199,296	498,439
Sole Proprietorships			
Domestic Input Tax (Mean)	183,904	329,014	5
Std. Deviation	1,458,975	8,198,891	125
# Observations	4,376,500	228,615	1,887,235
Government Agencies			
Domestic Input Tax (Mean)	35,700,000	1,880,429	1
Std. Deviation	376,000,000	2,633,667	0
# Observations	1,607	228,615	262

Notes: Domestic input tax figures are in Pakistani Rupees (100 PKR = 1 USD). Comparison firms are the ones who had claimed cumulative refund in excess of 1 million PKR for five year period before the reform, making all the remaining firms treatment group except “Others”. “Others” column shows the firms who had very little or no input tax credit for the five year period before the reform (less than 10,000 PKR in total) and therefore, remain out of the purview of analysis for this paper.

## 4 Empirical Strategy

I use difference-in-differences (DID) design to study impact of the reform. It requires two key assumptions. First, a suitable comparison group is available to study the change. Second, the reform is exogenous such that the only change affecting treatment group is the policy intervention itself and neither treatment group nor comparison group changes its behavior in anticipation of the reform. CREST reform is a law change introduced by the legislature in budget<sup>22</sup> and plausibly exogenous keeping in view how the budget process works in Pakistan.<sup>23</sup> Moreover, the reform does not restrict scrutiny to a particular cut-off date. Firms would not get any benefit from modifying behavior in anticipation of the change. Tax authorities can raise a demand on invoices claimed earlier because the statutory period of limitation is five years. Therefore, there is no benefit for any firm to claim more input tax credit in anticipation of the reform. CREST was operational for five years and FBR was already using invoice data to raise audit observations against the fraudulent units, to blacklist and suspend registrations etc. In pre reform world, the demand could only be raised through an audit which is a low probability outcome. Even if a firm is audited, the recovery of evaded tax was a low probability outcome (for details see Waseem (2023) and Best, Shah, and Waseem (2021)). Additionally, CREST was applicable to refund claimants for at least five years prior to the reform, which makes refund claimants an appropriate comparison group for DID design. An ideal DID design also assumes that the reform does not affect comparison group and only treatment group experiences effect of the reform. Because CREST was already applicable to refund claimants, reform has no effect on comparison group.

A firm is assigned to comparison group if the total refund claimed for the period July 2008 to June 2013 exceeded one million PKR<sup>24</sup>. I select this threshold because

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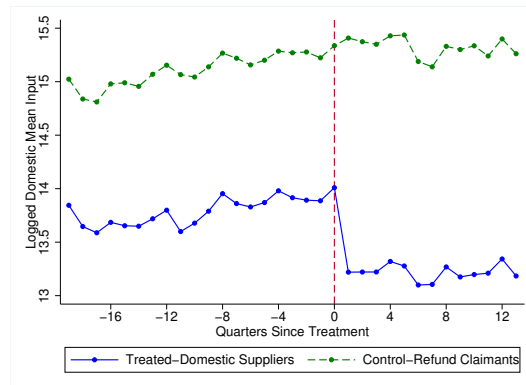
<sup>22</sup>The budget for financial year 2014 was presented on 12th June, 2013 and the reform was applicable from 1st day of July 2013.

<sup>23</sup>FBR prepares revenue budget under secrecy and finance bill is only unveiled when Finance Minister introduces it in legislature, in the first or second week of June. Legislature passes finance bill before 30th June because it is applicable from the first day of July. In present case, this process effectively rules out any behavioral change after the reform is announced and before it is implemented.

<sup>24</sup>The exchange rate for Pakistani Rupees to US Dollars was approximately 100:1 on 1st July 2013, therefore for ease of reference PKR 1 million translates to 10,000 US \$.

I do not expect a firm to claim refund through CREST if the total amount claimed over a period of five years is less than 10,000 US\$.<sup>25</sup> This threshold also helps exclude the refunds which do not arise on account of exports or zero rated supplies. Although some of these non-export refund claims are processed through CREST but they do not require normal cross matching done for zero rated supplies.

Figure 1: Raw Data- Quarterly Domestic Input Tax Credit



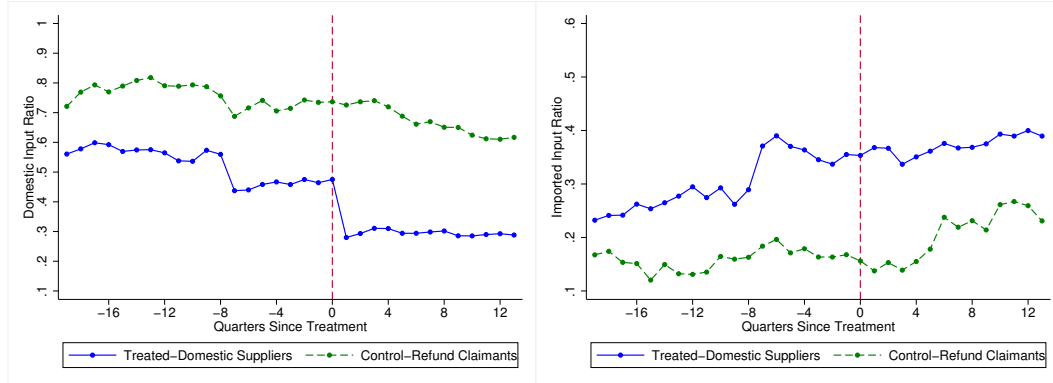
Notes: The graph shows parallel trend by plotting logged mean quarterly domestic input tax credit of control and treated groups in PKR millions. The reform occurs at dashed vertical line (quarter April-June 2013) which is then used as a reference to show lead and lag quarter time periods. The drop is sudden and the treated group again follows the control group but with a bigger mean difference giving support to the identification strategy especially with reference to common shock assumption. Decline is approximately 70 log points or 50 percent.

I address three possible concerns over suitability of refund claimants as comparison group. First, Can the exporters be a good comparison group for domestic firms? There is an important difference between a refund claimant on account of exports and a totally exporting enterprise. The refund claimants can be firms who carry out most of their sales to domestic firms but still claim refund on the portion related to their exports. Moreover, even if the exports increase or decrease disproportionately, it would result in a corresponding increase or decrease of sales to these exporting firms by domestically operating suppliers, thereby inducing a similar economic trend in the treatment group. Second, can the exporting firms which are larger in size with higher mean input tax credits have different attributes which materially confound identification? The exporting firms are definitely bigger firms

<sup>25</sup>Although some firms may not be present for all eight years and more importantly in the years prior to reform but still it is realistic to assume that they would not venture to go through CREST voluntarily if the benefit is economically low to negligible compared to a high compliance cost.

Figure 2: Domestic and Import Input Credits' Ratio to Total Credits

(a) Raw Data-Ratio of Domestic to Total Credit (b) Raw Data- Ratio of Imported to Total Credit



Notes: The reform occurs at dashed vertical line which is then used as a reference to show lead and lag quarter time periods. (Panel A) The graph shows pre-reform parallel trend by plotting the ratio of mean quarterly domestic input tax credit to total input claimed by both comparison and treated groups. Sudden post-reform drop for the treatment group shows that domestic credit claims declined as a percentage of total claims by approximately 50 percent. (Panel B) The graph of ratio of imported input tax credit to total input tax shows that the imports remained stable for both groups which provides evidence that the trend is not driven by a reduction in business or other factors which should normally affect purchases in overall terms both domestic as well as imported.

on average but this makes them better comparison group for manufacturers which also have larger size. In fact, manufacturers in both groups have same size across different business types as shown in figure A.1. Also, there is no reason for a larger firm not to take advantage of loopholes in enforcement differently in a VAT regime (See Waseem 2018; Pomeranz 2015). Third, can an already treated group be a good comparison? Kotchen and Grant (2011) use a natural experiment in Indiana to study the effect of Daylight Saving Time (DST) on electricity consumption by difference in differences method. They use DID approach when some counties were always treated (had DST) to the counties which were compulsorily switched to DST by the state in 2006. They argue that once a group that was treated way back in time period such that it can be assumed to be always treated then DID can measure the causal effect of policy change by making it a comparison group. Same analogy fits here because CREST was applicable to refund claimants at least 20 quarters before this reform. I plot all the graphs with raw data and lead of 19 quarters to show that the trends are parallel (see figure 1 and figures in Appendix A.1, A.2).<sup>26</sup> Thus, in

<sup>26</sup>All regression specifications are run on actual reported numbers in returns without converting

absence of the reform, trends should stay parallel. Figure 1 also shows that after a dip attributed to the reform, trends again become parallel albeit with a higher differential. This after trend substantiates the common shock assumption for treatment and comparison groups.

An additional concern could be that the firms are switching from domestic purchases to imports during the aforesaid period. To rule out this possibility, I plot ratios of domestic input tax credit and imported input tax credit to the total input credit claimed in figure 2 to show that the trend is solely driven by reduction in domestic input tax without a change in imported input tax credit claims. I also control for imported input tax in all the regressions and they all have statistically non significant coefficients for imported input tax with point estimates which are also close to zero.

My analysis follows a simple difference-in-difference design at firm level with time and firm fixed effects. The equation of interest can be written as:

$$Y_{it} = \alpha_0 + \sum_{j \neq k} \delta_j (\text{treated} * I(t = j)) + \phi_i + \psi_t + X' \gamma + \varepsilon_{it} \quad (10)$$

The dependent variable  $Y_{it}$  denotes domestic input tax credit for a firm in a given quarter;  $\delta_j$ s are the coefficients on the interaction dummy for all quarters excluding the first quarter before the change and they track evolution of trend over time;  $\phi_i$  and  $\psi_t$  are firm and quarter fixed effects respectively and  $\gamma$ s are the coefficients on control variables<sup>27</sup>. The above equation is a generalized form of difference-in-differences and  $\delta_j$  for all  $j < k$  (last quarter before the reform) capture the placebo effect for all pre time periods included in the analysis. Similarly, all  $j > k$  would capture the evolution of trend over time in post reform period.

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them to natural log because of presence of significant number of zeros as discussed in sections 3 and 5.3. However, trends based on aggregate quarterly basis are shown in logged specification for ease of comparison.

<sup>27</sup>I only use imported input tax credit as control variable for the regressions plotted in figures and tables.

## 5 Results

Prior to CREST reform, FBR had all the information but could only proceed against suspected firms if they were randomly selected for audit, a very low probability outcome as no more than 1-5 percent firms are audited in a given fiscal year. Moreover, FBR publishes this audit schedule on its website which can easily forewarn these suppliers and they can just go missing or become non-compliant thereby denying the department any meaningful audit (Best, Shah, and Waseem 2021). The other option is to institute a criminal proceeding through an investigation but the criteria for obtaining this approval and finalizing these proceedings are strict and time consuming. In practical terms, even with a high  $p_1$ ,  $p_2$  remains very low which keeps the term on left side of specification (9) very small. The reform increases  $p_2$  substantially by authorizing a software to accept or reject the tax credit.

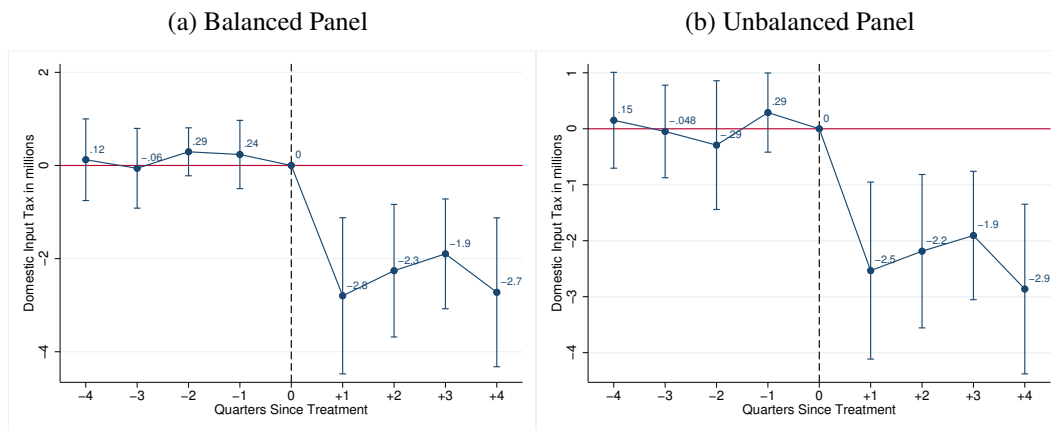
I restrict my main regression based analysis to four pre and post quarters to guard against any behavioral changes over time as I take firm fixed effects with standard errors clustered at firm level. To address the concerns on parallel trend assumption, I plot interaction dummies with their 95% confidence intervals in figures 3 to 8. I omit the reform quarter dummy to avoid perfect collinearity. The lead coefficients are statistically and economically zero but there is a significant change post reform. The results are similar for both balanced and unbalanced panels. Tables 2 to A.6 show the regression results for overall regression estimates and firm heterogeneity by manufacturing and business type. All regressions discussed below control for the imported input tax. The increased probability of recovery results in a sudden and lasting drop in input tax claims across the board.

### 5.1 Aggregate Impact

The reform decreased input tax claims by PKR 2.22 million on average for the unbalanced and PKR 2.36 million for the balanced panel. This amounts to a decline of 50 percent compared to pre reform levels for the balanced panel. Figure 3 plots coefficients of interaction dummies (post June-2013\*domestic suppliers) for the specification at equation (10) for all firms. All interaction coefficients are close to zero and statistically non-significant pre reform but are significant post reform.

It shows that both groups had parallel trends prior to the reform. Post reform, input tax credit claims fall significantly for both balanced and unbalanced panels. Coefficient for balanced panel is slightly higher (approximately 5 percent) than unbalanced panel. Balanced panel comprises of firms who filed returns in all nine quarters starting from April-June 2012 to April-June 2014. Therefore, balanced panel has only those firms which operated both before and after the reform. On the other hand, unbalanced panel has all the firms before and after the reform whether they filed returns in all quarters or not. As discussed above, entry is always more than exit which implies that more firms enter the unbalanced panel post reform when compared to number of firms who exit pre reform. Hence, coefficients on unbalanced panels are slightly lower than the balanced panel coefficients but they do not differ much in magnitude.

Figure 3: Aggregate Effect of CREST on Domestic Input Tax Claims



Notes: The figure plots point estimates of DD dummies for quarter specific interactions with 95% confidence level to rule out any pre trend (for details see Table 2). The dependent variable is input tax against domestic purchases and the regression controls for input tax against imports. The regression covers the period from April 2012 to June 2014 such that Lead 4 is the quarter April -June 2012 and Lag 4 is the quarter April -June 2014. Panels A & B show the results for a balanced and unbalanced panel respectively. Standard errors are clustered at firm level.

I observe two effects here, a “sudden” drop and a large change in magnitude of domestic input tax claims. These results show that the reform was effective in blocking fake input tax claims immediately and the pre-reform volume of evasion was huge. The sudden impact means that the reform acted as a big shock to large

number of firms involved in fraudulent practices. CREST reform only gives an express legal cover to an already existing administrative tool. The denial of input tax is no longer dependent upon costly and time consuming audits which could only cover small fraction of these units and even when these audits materialized in establishing something concrete against one supplier they would have no legal effect for the firms down in the chain. Post reform, a fake supplier cannot easily circumvent the system because, unlike the pre-reform state, tax authorities can declare its purchases invalid without any need of a formal audit. If this supplier now issues sales invoices to another supplier in next months, then these sales would also be invalid immediately. In this way, networks of fake suppliers collapse because CREST has already invalidated the invoices which would have been used by beneficiary units down in the chain. It increased the probability of recovery substantially. This explains the “sudden” drop in domestic input tax credit claims. It shows that firms were buying inputs from unregistered sectors and were using fake invoices to claim input tax credits to lower their tax liability. Assuming same cost of obtaining a fake invoice, the specification at (9) experienced a jump on left side of inequality without affecting the right side. A rise in  $p_2$  was enough to make evasion non-feasible.

A natural question arises as to why such action was not taken earlier. But it should be noted here that the success of reform depended on three crucial factors. First, Pakistan had switched to compulsory electronic filing of returns and annexes a few years before the reform. Prior to that both manual and electronic filings were allowed. Data entry of monthly returns and its annexes took a while before they could be fed in the system. Second, the tax machinery had gained necessary expertise over the years through steady roll out of computerized information solutions. This made the task of whole scale implementation easier by providing necessary human resource on the ground. Third, Pakistan had up to date IT infrastructure at all tax and customs offices owing to a decade long tax reform program supported by the World Bank. This computerized system cannot work in absence of mandatory e-filing, elaborate IT infrastructure, or administrative capacity to operate information solutions. . Computerization at all tax and custom offices integrated with banks is a prerequisite for undertaking a similar program anywhere else.

The implications of these results also extend in two other directions. First, the



Table 2: Revenue Impact of CREST Reform

Domestic Input Tax (PKR in Millions)				
	(1)	(2)	(3)	(4)
	Balanced	Balanced	Unbalanced	Unbalanced
DD (Post June 13 × Domestic Input Tax)	-2.36		-2.22	
	(0.66)		(0.64)	
Lead 4		0.12 (0.45)		0.15 (0.44)
Lead 3		-0.06 (0.44)		-0.05 (0.42)
Lead 2		0.29 (0.26)		-0.29 (0.59)
Lead 1		0.24 (0.37)		0.29 (0.36)
Lag 1		-2.80 (0.86)		-2.53 (0.81)
Lag 2		-2.26 (0.73)		-2.19 (0.7)
Lag 3		-1.90 (0.6)		-1.91 (0.59)
Lag 4		-2.72 (0.82)		-2.86 (0.77)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Clustered Standard Errors	Yes	Yes	Yes	Yes
Number of Groups	43,928	43,928	115,669	116,038
N	395,352	438,539	670,213	717,469

Notes: Table displays the main coefficients as well as coefficients on quarter specific interaction dummies for firm level regressions. Monthly return data is used to compute quarterly values, therefore N denotes the quarterly number of observations. The variable DD is defined as an interaction between the dummy for suppliers who were not claiming refund before July 2013 and the dummy which equals one for the period July 2013 onward. The dependent variable is the input tax against domestic purchases and the regression controls for input tax against imports. Leads and lags variables are DD dummies for quarter specific interactions to rule out any pre trend (for plot see figure 3). The regression covers the period from March 2012 to June 2014 such that Lead 4 is the quarter March-June 2012 and Lag 4 is the quarter March-June 2014. Column (1) (2), and (3) (4) show the results for a balanced and unbalanced panel respectively. Standard errors are clustered at firm level and shown in parenthesis. See Table A.8 for robustness checks. All post coefficients are significant at 1% level.

unregistered sector does not get registered because their buyers can manage invoices. An indirect implication of the reform is a pressure on informal sector to get registered because they face stronger competition from the registered sector when they fail to give an invoice to their buyers who can no longer buy invoices from invoice mills. This extensive margin response is not observable at individual firm level because we cannot assume ex post that increased entry and return filing as reflected in Table A.1 for tax year 2014 is related to this reform. Second, the tax

machinery could focus on other enforcement tasks instead of fruitless and incomplete audits, investigations and litigation. Best, Shah, and Waseem (2021) find that traditional VAT audits yield no short or long term behavioral change in audited firms. Obviously, the results of this paper cannot measure these positive spillovers.

The reform had significant impact on revenues. Aggregate amount of reduction in input tax claims is 86 Billion PKR or 860 million USD measured at exchange rate prevalent at the time of reform. This represents 10% of total VAT collection in tax year 2013, last year before the reform. At least two to four invoice mills are used at the back end of supply chain before an operative unit claims input tax (for detailed discussion and analysis see section 5.3). This implies that net revenue impact should be around 25-30% of aggregate decline in input tax claims. Because these estimates are quarterly, even a lower bound of 25% represents 10 percent net VAT collection at country level. Underlying assumption is that CREST had already eliminated this phenomenon in export related refunds, therefore net gains would be even higher than 10 percent. Revenue gains of a computerized risk based analysis system are significant for developing countries who are struggling to improve their tax to GDP ratio.

## 5.2 Firm Heterogeneity Analysis

Firms differ from each other in many respects. Firm's structure and business type, affect the firm behavior. I analyze effect of the reform based on firm heterogeneity on account of these factors. I divide firms into manufacturers and non-manufacturers by their structure and also study firm behavior by business type. The firms have three options for their business type: i) Sole proprietorship (ii) AOP (Association of Persons or partnership) or a (iii) Company. These categories arise from income tax statutes because three different types are taxed at different brackets. Sole proprietorship is taxed on the individual's income tax return. AOP has a different income tax rate bracket and companies are taxed at the corporate tax rates.<sup>28</sup> A firm files for VAT registration under one or many of the following categories determined by nature of her business; 1) Manufacturer (2) Wholesaler (3) Distributor

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<sup>28</sup>Companies are also governed by the Companies Ordinance, 1984 and regulated through Securities and Exchange Commission of Pakistan (SECP).

(4) Exporter (5) Importer (6) Retailer (7) Service provider (8) Others. However, registration as manufacturer requires physical visit by tax inspector to verify the address, machinery installed, utilities connections and numbers etc. Although, the law does not bar tax authorities from visiting premises of non-manufacturers but their physical visit is rare. VAT registration requires additional information regarding nature of business and general classification of products which the firm intends to sell but they are free to sell any goods. These heterogeneous characteristics of firms lead to two predictions from theoretical model. First, all fake suppliers would prefer to register as Sole Proprietors. Sole proprietorship has the lowest cost of registration because it has fewer documentation and regulatory requirements compared to AOPs and companies. From (1) & (7) above and for a given  $p_1$ ,  $p_2$ ,  $\pi$  and  $l$ , we have  $\theta_{sole} < \theta_{AOP} < \theta_{company}$  which implies that  $G^a$ ,  $G^b$  and  $G^c$  are higher. Hence from (1), the expected utility would be higher if a sole proprietorship is used as fake invoice supplier. Intuitively, it also makes sense to use lowest registration cost category to issue fake invoices. Second, non-manufacturer status is ideal for a fake invoice supplier. VAT registration as manufacturer requires physical visit and verification by the tax authorities, therefore, for a fake supplier  $\theta_{non-manufacturer} \ll \theta_{manufacturer}$ . Therefore, supplier of fake invoices would not register as manufacturer.

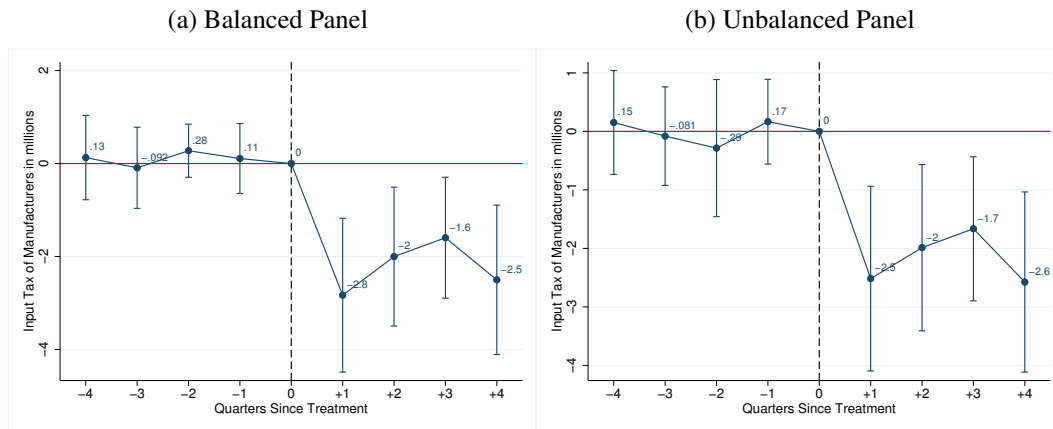
**(Manufacturer vs. Non-manufacturer):** The behavior of the manufacturing firms differs from non-manufacturers. In the context of missing trader fraud, fake suppliers are non-manufacturing units whereas final beneficiary of the fraud is often a manufacturing unit.<sup>29</sup> However, the possibility of using these networks of fake suppliers by non-manufacturing entities cannot be ruled out ab initio, especially for retailers, service providers, exporters and distributors. Figures 4 & 5 together with Table A.2 and Table A.3 show the balanced and unbalanced panel results for manufacturers and non-manufacturers respectively. The comparison group remains the same i.e. all firms claiming refunds against exports. Coefficients on interaction dummies for four pre-quarters show parallel trend. Domestic input tax claims for

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<sup>29</sup>The definition of manufacturer in the law is very broad and thus even a very small processing or repackaging activity etc. changes firm's category to manufacturer.

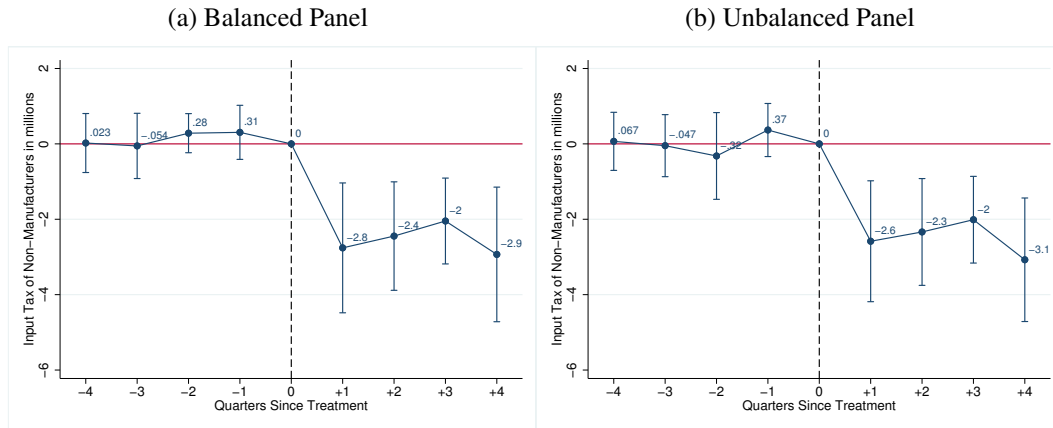
both categories drop immediately after the reform. Panels A & C of figure A.1 plot the raw averages of domestic input tax claims of manufacturers in different categories. Manufacturers in both treatment and comparison group are of similar size. But manufacturers are on average twice the size of a non-manufacturer in the treated group and if the behaviors were identical, the drop in manufacturer's input tax claims should be twice as large compared to non-manufacturers. But manufacturer's input tax fell by 2.15 million PKR for the balanced panel whereas it dropped by 2.47 million PKR for the non-manufacturers. This result supports theoretical prediction. The higher drop by non-manufacturing units can only be explained by the underlying missing trader fraud (discussed in more detail at section 5.3). Non-manufacturers in the treatment group can have many missing traders who are generating fake input tax so that they can show a corresponding output tax in their returns which can be ultimately utilized by their buyers as input tax. Figure A.1 shows a drop in input tax claims for both manufacturers and non-manufacturers. The drop for non-manufacturers based on heterogeneity by business types ranges from 40 to 90 percent with an average effect of approximately 70 percent.

Figure 4: Effect on Domestic Input Tax Claims of Manufacturers



Notes: The figure plots point estimates of DD dummies for quarter specific interactions with 95% confidence level to rule out any pre trend (for details see Table A.2). The comparison group is same as for previous figure but only the manufacturers from treatment group are included. Input tax against domestic purchases is dependent variable and the regression controls for input tax against imports. The regression covers the period from April 2012 to June 2014 such that Lead 4 is quarter April -June 2012 and Lag 4 is quarter April -June 2014. Standard errors are clustered at firm level.

Figure 5: Effect on Domestic Input Tax Claims of Non-Manufacturers



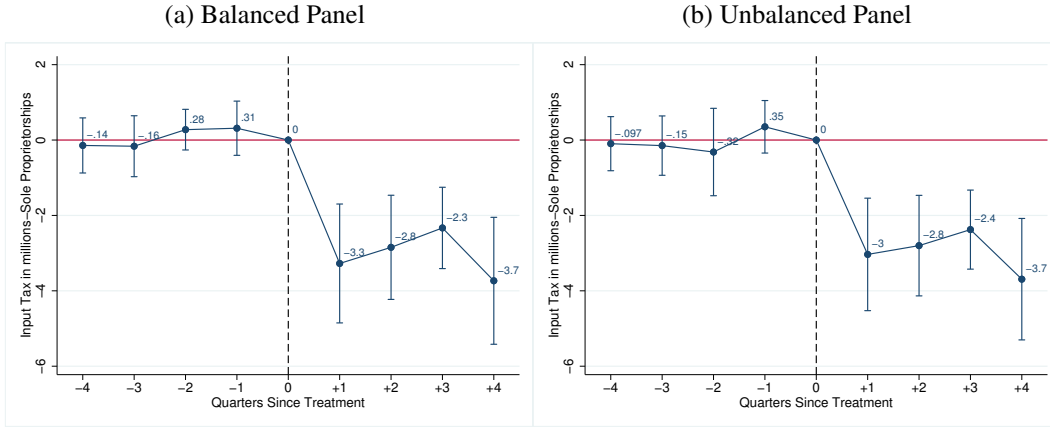
*Notes:* The figure plots point estimates of DD dummies for quarter specific interactions with 95% confidence level to rule out any pre trend (for details see Table A.3). The comparison group is same as for previous figure but only the non-manufacturers from treatment group are included. Input tax against domestic purchases is dependent variable and the regression controls for input tax against imports. The regression covers the period from April 2012 to June 2014 such that Lead 4 is quarter April -June 2012 and Lag 4 is quarter April -June 2014. Standard errors are clustered at firm level.

**(Heterogeneity by Business Type):** Business types allowed in the law are “AOP” (Association of Persons), “Company” (any incorporated entity), “Individual” (Sole proprietorship) and “FTN” (Free Tax Number or Government Agencies) (see Appendix A.2 for definitions). FTNs are omitted in the plots as they are special numbers issued to governments such as provincial and local governments for purchasing goods for their own use.<sup>30</sup> Input tax claims drop across each category which shows that fraud is rampant across all business types. Figure A.2 plots the trends for these business types based on raw data. Panel A shows trends for the comparison (or control) group. These firms remain largely unaffected with a small increase in mean logged input tax for companies and a very small drop in domestic input tax claims of sole proprietorships and AOPs. Panel B shows that domestic input claims for companies in the treated group declined significantly.

The estimates of empirical specification at 10 are listed at Tables A.4, A.5, A.6 and coefficients are plotted in figures 6 to 8. Figures 6 and 7 plot the evolution

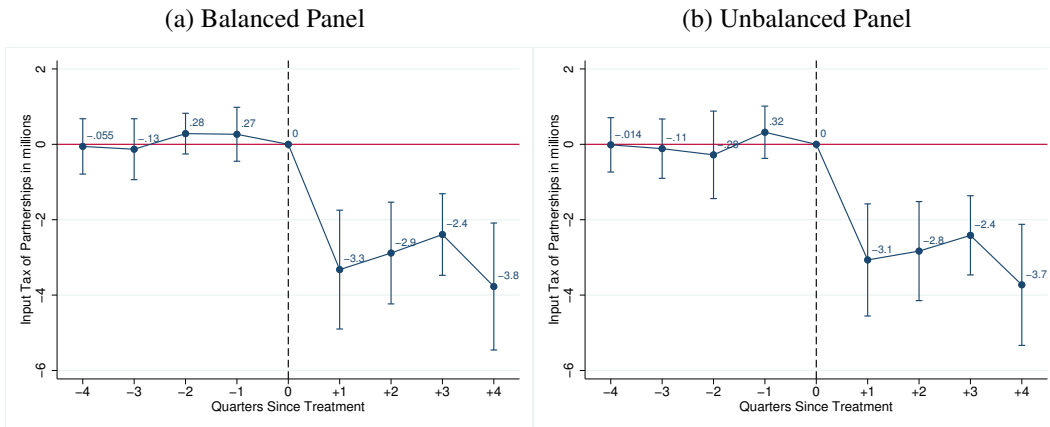
<sup>30</sup>Government agencies do not have an incentive to evade tax and they are also required to withhold VAT at the time of purchase which ensures deposit of true input tax at the time of purchase.

Figure 6: Effect on Domestic Input Tax Claims of Sole Proprietorships



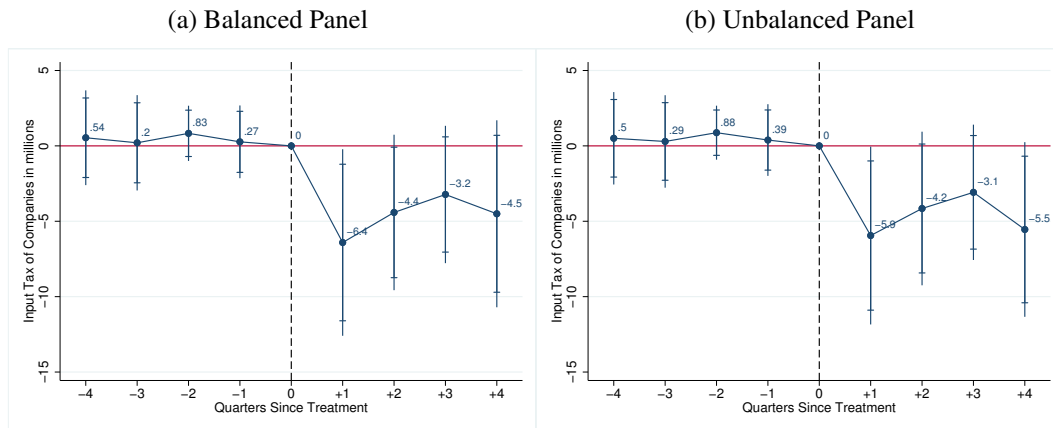
Notes: The figure plots point estimates of DD dummies for quarter specific interactions with 95% confidence level to rule out any pre trend (for details see Table A.5 ). The comparison group is same as for previous figure but only the sole proprietorships (businesses owned by only one individual) from treatment group are included. Input tax against domestic purchases is dependent variable and the regression controls for input tax against imports. The regression covers the period from April 2012 to June 2014 such that Lead 4 is quarter April -June 2012 and Lag 4 is quarter April -June 2014. Standard errors are clustered at firm level.

Figure 7: Effect on Domestic Input Tax Claims of Partnerships



Notes: The figure plots point estimates of DD dummies for quarter specific interactions with 95% confidence level to rule out any pre trend (for details see Table A.4). The comparison group is same as for previous figure but only the firms registered as partnerships from treatment group are included. Input tax against domestic purchases is dependent variable and the regression controls for input tax against imports. The regression covers the period from April 2012 to June 2014 such that Lead 4 is quarter April -June 2012 and Lag 4 is quarter April -June 2014. Standard errors are clustered at firm level.

Figure 8: Effect on Domestic Input Tax Claims of Companies



*Notes:* The figure plots point estimates of DD dummies for quarter specific interactions with (90% and 95% confidence level) to rule out any pre trend (for details see Table A.6). The comparison and treatment groups both have the firms registered as companies only. The comparison group is same as for previous figure but only the non-manufacturers from treatment group are included. Input tax against domestic purchases is dependent variable and the regression controls for input tax against imports. The regression covers the period from April 2012 to June 2014 such that Lead 4 is quarter April -June 2012 and Lag 4 is quarter April -June 2014. Standard errors are clustered at firm level.

of trend for sole proprietorships and partnerships through interaction dummies of four pre and post quarters. For sole proprietorships and AOPs, the drop is 60-70 percent compared to their pre-reform levels. These two categories show fairly similar decline in tax credit claims. Massive drop in the claims of sole proprietors partially supports prediction by theoretical model which suggested that only sole proprietors would be indulging in missing trader fraud as invoice mills. But the decline in domestic input tax credits of partnerships is also very large. Presence of invoice mills in these firms cannot be ruled out. Compared to pre-reform base levels, some categories (distributors and wholesalers) within these firms show drops as high as 90% on average.

Results also support the involvement of bigger firms such as companies in fraudulent behavior. Traditional models for developed countries do not predict fraudulent behavior by companies. But my results show that the same may not be true in developing countries. The incorporated entities were not immune from the market pressure exerted by VAT evasion. Their input claims fell by a massive PKR 4.6

million per entity on average within the first quarter of the reform which is approximately 30 percent of pre-reform levels. These results support findings in Best et al. (2015) who found that companies paid 70 percent less tax when they switched from turnover to profit and loss based corporate tax. Their results showed that the companies are inflating purchases to reduce profits. My results show that they are also using fake input tax invoices to lower their VAT liability. Together these results, point to a very high evasion in the formal private sector. There are two possible explanations for this behaviour. First, corporations in developing countries are still largely controlled by individuals or families and lack sufficient internal corporate controls. Second, in discussions with FBR staff, it was revealed that many large corporations do not buy goods from sellers who do not supply a VAT invoice. Their sellers, who themselves may be partnerships or companies, indulge in buying invoices to reduce their VAT liability. The category “companies” include many large public sector entities such as the government owned energy sector firms who have no incentive to evade. Conditional on firms being non-state owned, overall figure of 30 percent would be higher. But this estimate is not possible without data on individual ownership of companies.

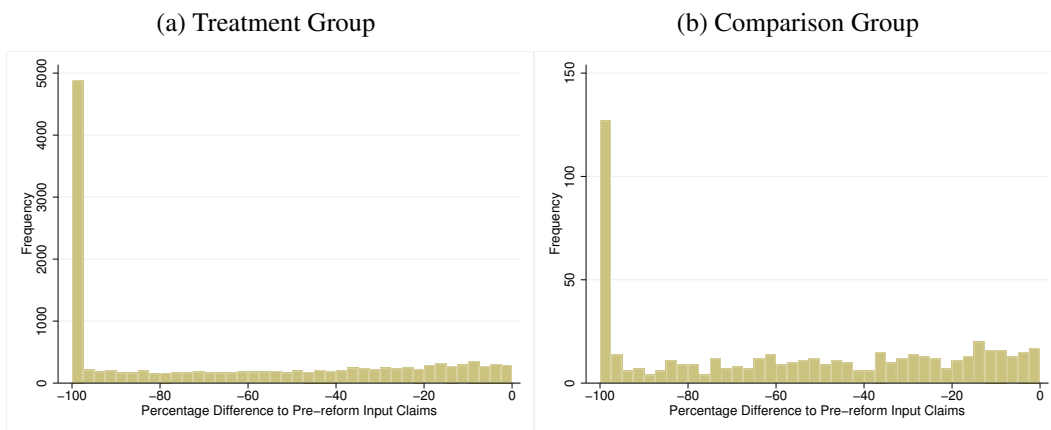
### **5.3 Analysis of Bogus Firms**

The results discussed above point to evasion but they need further scrutiny to analyze whether the drop is only driven by inability of a physically operative firm to claim input tax or by non-existent invoice mills. For this, I look at the balanced panel firms in both comparison and treatment groups. I plot histograms of percentage decrease in their mean quarterly input tax credits in Figure 9 for firms who were active before the reform. Out of a total 37,562 firms in treatment group, 100% decline bin has 4,888 or 13 percent of the total firms in treatment group whereas for the comparison group same bin has only 127 or 2 percent of 6,366 firms. In case this drop was restricted to only input tax credits, it may be argued that the firms themselves were not fake but were claiming all tax credit based on fake invoices. Therefore, I look at the sales activity of these firms both pre and post reform. I find that 3,657 or 75 percent of the firms showing 100 percent input tax decline also



reported 100 percent sales and output tax decline. It implies that these 3,657 firms were only churning out invoices. Had they been operative firms their sales would not decline as a result of the reform but they show hundred percent drop post reform. This analysis provides a clear empirical evidence that these firms were bogus and created for missing trader fraud. Because the reform enabled a computerized system to scrutinize suspicious activity and invalidate claims, it became difficult for these firms to carry on issuing fake invoices. Their purchases and sales both collapsed to zero post reform.

Figure 9: Percentage Decline in Input Tax Credit (Balanced Panel)



Notes: The figure plots number of firms in the balanced panel against the percentage decline in their pre-reform input tax credit claims. Each bin represents 2.5% decline such that last bin is 97.5%-100% decrease bin. Panels A & B show the results for treatment and comparison groups respectively for balanced panel firms.

The next step is to examine heterogeneity within these full input tax decline firms. Table 3 lists the number of firms by category and types in full decline bin of figure 9. These results support theoretical prediction that most suspicious firms would be sole proprietors and non-manufacturers. Approximately sixty percent of firms are both sole proprietorships and non-manufacturers. Separately, seventy two percent are sole proprietorships and seventy five percent are non-manufacturers. Because these categories are very easy to register through online registration and seldom subject to physical visit, they are ideal for generating fake invoices which can then be utilized by operative units to lower their liability. Still, approximately

Table 3: Breakdown of Firms with Zero Input Tax Post Reform

	Sole	Partnership	Company	Total
All	3535	915	438	4888
Manufacturers	655	398	173	1226
Non-manufacturers	2880	517	265	3662

Notes: Table displays the breakdown of firms in full decline bin of figure 9. These firms were showing sale and purchase activity before the reform but stopped claiming any input tax credit post reform.

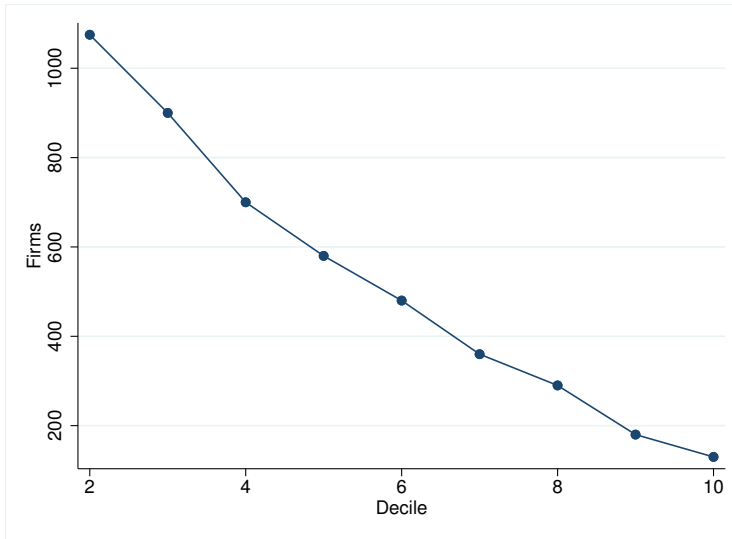
ten percent and twenty percent are companies and partnerships respectively. It is possible that some of the firms shown in table 3 stopped showing activity because of a real business shock but this number should not be more than 1-2% of total firms.

I also examine these firms by size. Figure 10 plots number of firms with their pre-reform input tax decile. A typical suspicious firm is small to medium because large trade volumes without any net payments may raise probability of detection. In my data ninety percent of these firms show equal sales and purchase activity, and do not deposit any net tax with their returns. This also shows that these firms are bogus and their sole purpose is to give sale invoices to other invoice mills or operative units. To lower their own liability, they use either fictitious input tax figures or invoices from other invoice mills to inflate their purchases such that they do not deposit any tax.

## 5.4 Impact on Net Revenue Collection

Decline in input tax credits should result in an increase in net tax payable by treated firms. Comparison group firms are mainly exporters whose supplies are zero rated and they do not pay any output tax. Thus, a difference-in-differences estimate is not possible using the same comparison group. Also, the comparison group and treatment group together constitute full universe of active firms except commercial importers, firms whose only business is to sell imported goods in same state. These importers are not a suitable comparison group because they make no domestic purchases. Therefore, I plot mean tax payable for both pre and post time periods. Figure 11 shows these plots for all treated firms in the balanced panel as well as based on their heterogeneous characteristics. The plotted means are based

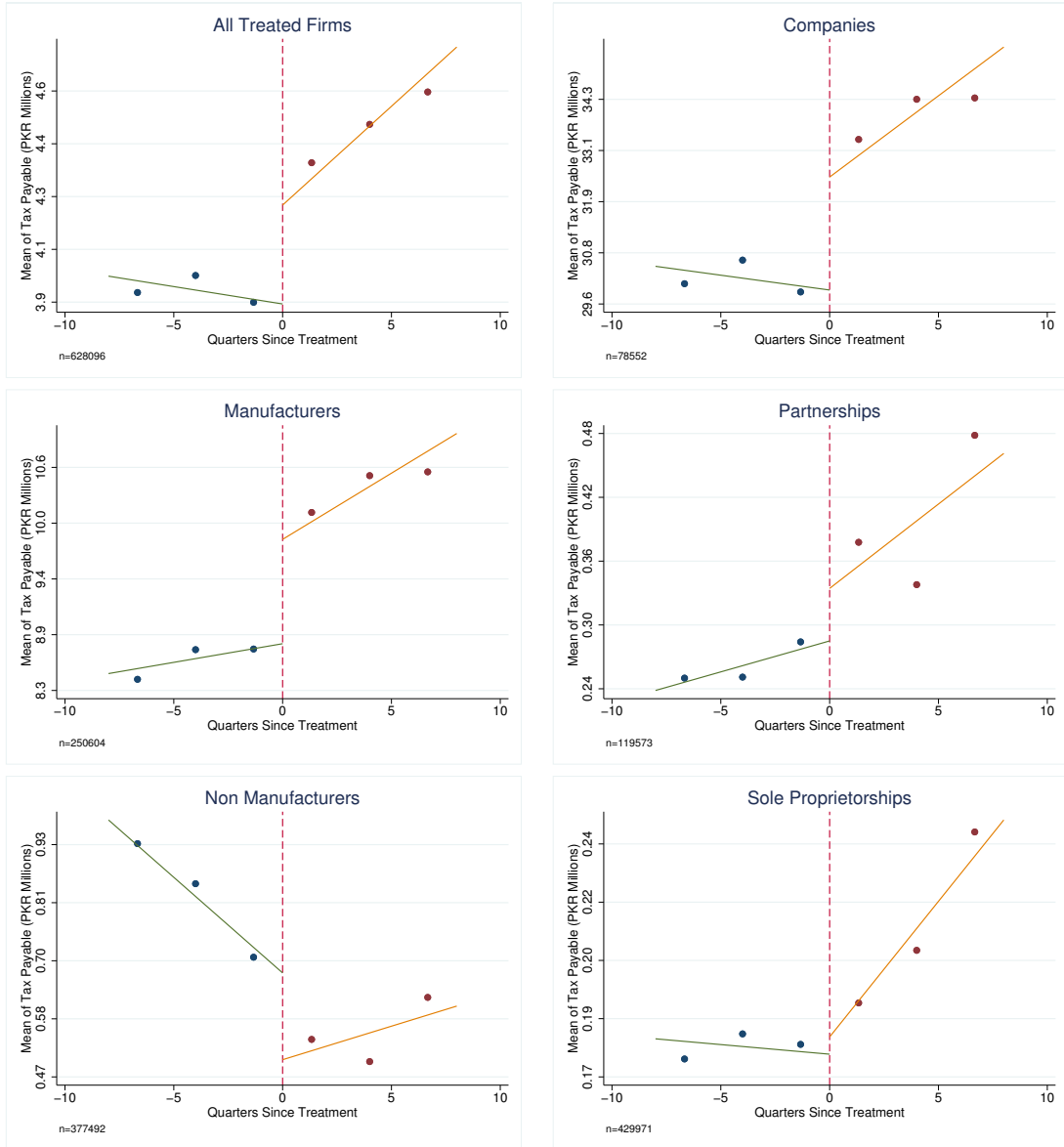
Figure 10: Breakdown of Firms by Pre-reform Input Tax Decile



Notes: The exhibit shows number of firms from second to last decile by pre-reform input tax size. There is a quasi linear decline by size. More than 50% of firms are concentrated in second, third and fourth decile. First decile (not shown here) has approximately 300 firms.

on six binned regressions, three each for pre and post periods. These results further strengthen the analysis of preceding sub sections . Average rise in net tax payable for all treated firms in balanced panel is 13.75% or 0.55 million PKR per firm and 82.6 billion PKR in aggregate for a year. The aggregate increase in net tax is not materially different from an estimate of 86 billion PKR which is for the whole population and not restricted to balanced panel firms. The results are driven by manufacturers whose tax payable rose by 2 million PKR or 20 percent. Tax payable for non-manufacturers had a declining trend pre reform which continued immediately after reform but stabilised in medium term. Because non-manufacturers have high number of invoice mills who pay small amounts of tax (1/10 of manufacturers' tax), they do not have appreciable impact on revenue. Analysing by business types, I find that increased revenue response is driven by companies who remitted 4 million PKR or 13 percent more on average. Tax payments of both partnerships and sole proprietorships rose by a similar percentage but being very small entities compared to companies, the revenue impact is still driven by increased payments from companies.

Figure 11: Impact on Tax Payable



Notes: The graph plots the mean tax payable (difference of output and domestic input tax) in millions PKR for treated firms of balanced panel. The regressed means for observations binned together for three quarters are plotted as a point on the graph. n denotes the number of quarterly observations used. The reform occurs at dashed vertical line (quarter April-June 2013) which is then used as a reference to show lead and lag quarter time periods. Tax payments of each category rise post reform except non-manufacturers.

## 5.5 Robustness of the Results

The results are robust to alternate specifications which can be of concern here. Most importantly, I check whether the results change materially by changing the time period to months instead of quarters and extending the regressions to full eight years of data instead of using one year pre and post reform. Table A.7 lists the results for unbalanced panels by using monthly tax periods. The results are similar to quarterly specifications in Table A.8 and approximately one third of the quarterly values. Table A.8 lists the robustness test of the results at Table 2 and Tables A.2 to A.6 for the full time period, tax year 2009 to the first quarter of year 2017. These checks show that results are robust to a very long time period and the change to months from quarters would have no meaningful impact on the results.

## 5.6 Tax Policy Implications

The results of this paper can influence tax policy in both developing and developed countries. The self-enforcing advantages of VAT do not hold in absence of effective real time enforcement which can utilize third party reporting. Although, introducing digitization and computerization – and thus increasing enforcement capacity – to cross match available information can reduce evasion at first but the firms can easily switch to other ways for evasion. Building a risk profile for every credit invoice which goes beyond cross matching can substantially reduce tax evasion by curbing sophisticated frauds which rely on invoice mills. Ten percent increase in total revenue is not a trivial outcome for revenue starved developing countries. Best, Shah, and Waseem (2021) estimate that 94 percent of revenue is remitted by top one percent firms in Pakistan and traditional audits found no significant evasion in these top firms. Only 6 percent is remitted by bottom 99 percent firms including audits. In this perspective, revenue impact of reform is that it raises 50 percent more tax than what is remitted by 99 percent of all VAT firms. Conversely, absent a comprehensive real time enforcement mechanism which can utilize these information flows and automatically deny credit up front, the volume of evasion would remain very high. Because many developing countries are still in the process of achieving a complete electronic filing system, a prerequisite for real time enforcement system,

VAT evasion would remain high in these countries.<sup>31</sup>

Compliance costs of implementing a similar system in developing countries may be larger when invoice level data is not captured during digitization. But when such data is already available, genuine taxpayers may not be burdened more except for glitches and errors of the system at first roll out. Gradually these costs would decrease when both firms and tax authorities learn from their experience. Administrative costs, when a computerized system is already available, could in fact decrease because demand for auditors and litigation would decrease. Positive spillovers include increased economic efficiency by discouraging real purchases from informal sector.

In developed countries, EU is prone to carousel fraud which can be curtailed by a similar risk based profiling system. EU and United Kingdom use product specific reverse charge mechanism (Buettner and Tassi 2023). Reverse charge distorts VAT and requires cooperation between different countries. CREST type computerized system eliminates the need for reverse charge to control carousel fraud. Therefore, this research also has significant implications for developed countries.

## 6 Conclusion

This paper contributes to public finance research by determining the effect of going beyond simple cross verification in VAT. With low long term compliance cost and administrative benefits of reduced work force, it can help tax systems to improve revenue efficiency without raising tax rates through computerized risk profiling of taxpayers at transaction level. My results show that CREST reform curbed missing trader fraud which was prevalent across various business categories and types. Real time algorithm based checking greatly enhanced the chances of recovery before any benefit is claimed and evasion declined significantly. If 50 percent of input tax credits in a VAT regime are fake despite simple cross-verification, then it raises serious questions about revenue efficiency of VAT in developing countries despite electronic filing, cross matching and audits. Ten percent of net VAT collection at

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<sup>31</sup>A complete electronic filing system means that all taxes and customs records are integrated so that the computerized enforcement system can run a risk profile on buyers and suppliers.

country level can be increased through adopting tools beyond traditional tax administration. Net revenue impact exceeds total collection from all firms except the top one percent. Tax policy implications of these results are not restricted to developing countries. Developed countries can also curb missing trader fraud through risk profiling instead of product based reverse charge mechanism used in EU.

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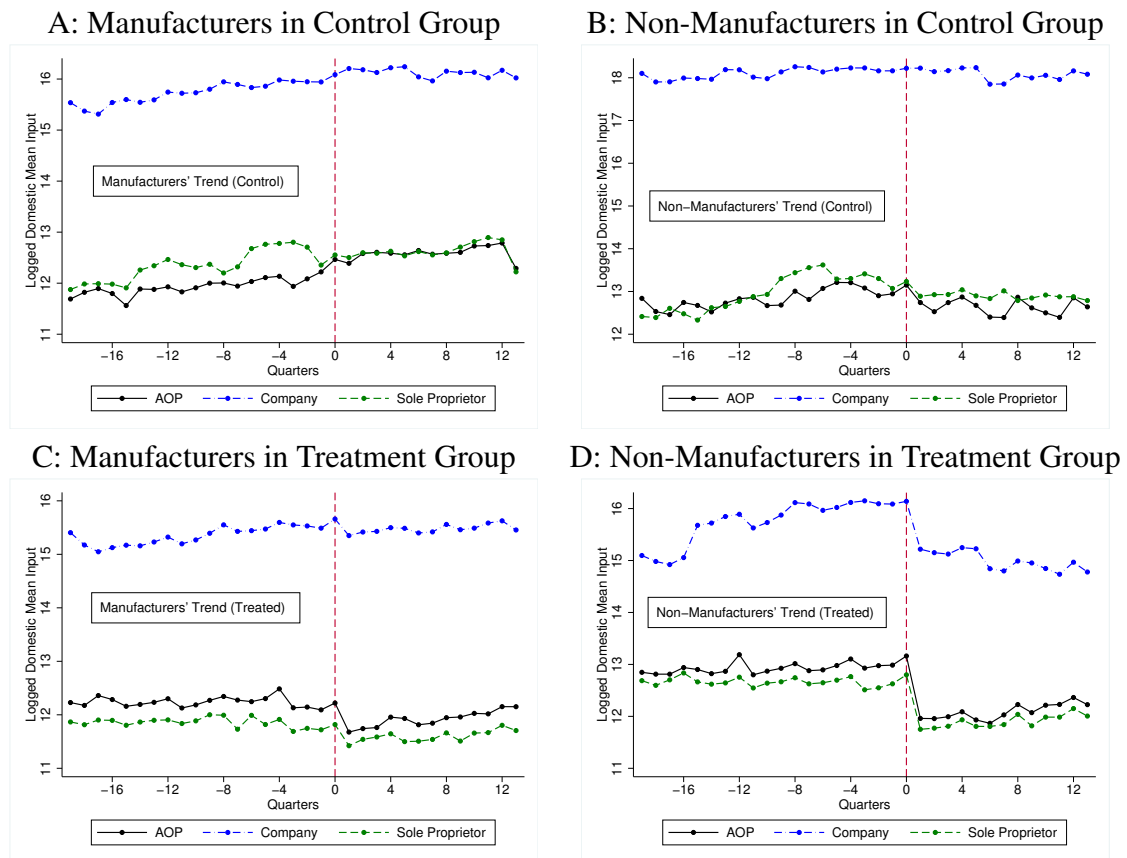
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# A Appendix (For Online Publication)

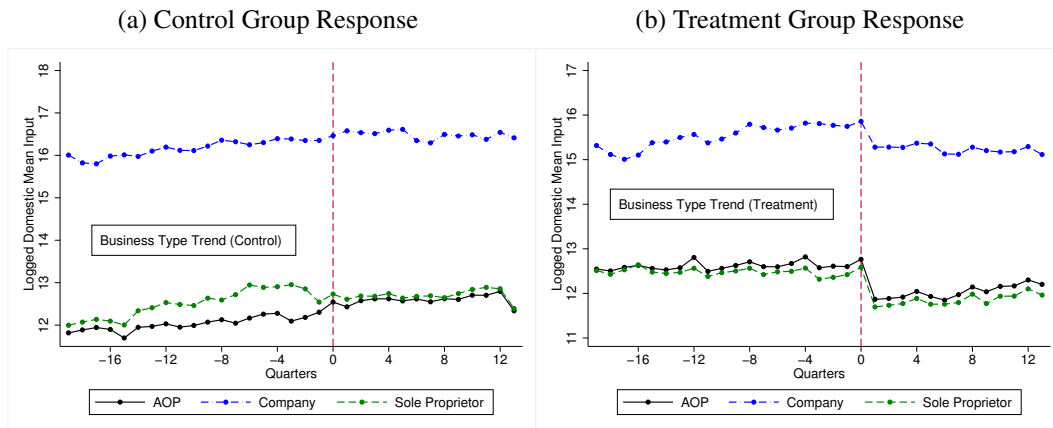
## A.1 Additional Tables and Figures

Figure A.1: Impact on Manufacturers vs. Non-Manufacturers by Business Type



Notes: (Panel A & C) The graph plots the logged mean quarterly domestic input of manufacturers in control and treated groups based on their business type. The reform occurs at dashed vertical line (quarter April-June 2013) which is then used as a reference to show lead and lag quarter time periods. The input tax of each category drops after the reform. Decline in raw numbers is approximately 30 percent for the manufacturers in each category. (Panel B & D) The graph plots the logged mean quarterly domestic input of non-manufacturers in control and treated groups based on their business type. The reform occurs at dashed vertical line (quarter April-June 2013) which is then used as a reference to show lead and lag quarter time periods. The input tax of each category drops after the reform. Decline in raw numbers is approximately 70 log points or 50 percent for the companies and 90 log points or 60 percent for the partnerships and sole proprietorships.

Figure A.2: Heterogeneity by Business Types



Notes: The graph plots the logged mean quarterly domestic input of Companies, Partnerships and Individual Businesses in control and treated groups. The reform occurs at dashed vertical line (quarter April-June 2013) which is then used as a reference to show lead and lag quarter time periods. The input tax of each category drops after the reform. Decline in raw numbers is approximately 30 percent for the companies and 70 percent for individual and partnership businesses.

Table A.1: Descriptive Statistics for Sales, Purchases and Tax Credits

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total Purchase	7.621	7.939	8.68	9.849	10.249	10.557	9.48	8.873	9.336
Taxable Purchase	6.437	7.313	8.015	9.373	9.785	10.067	9.106	8.432	8.797
Domestic Tax Credit	0.585	0.615	0.655	0.732	0.761	0.855	0.782	0.808	0.786
Import Tax Credit	0.226	0.248	0.292	0.374	0.347	0.349	0.371	0.432	0.426
Total Sale	9.304	9.526	10.547	13.13	13.528	13.591	13.402	11.77	12.242
Taxable Sale	8.2	8.591	9.63	10.437	10.644	10.307	9.508	8.631	8.954
Export sale	1.83	1.571	2.674	1.822	1.831	1.808	1.656	1.443	1.347
Observations	855,632	967,549	1,058,021	1,109,744	1,155,709	1,249,873	1,321,672	1,392,310	580,542

Notes: Table provides the financial yearly statistics of average purchase and sales for the eight complete years 2009-2016 and first five months of year 2017 in millions Pak Rupees (100 Pak Rupee = 1 US Dollar). The returns are filed on monthly basis except under very few special cases where the returns are required to be filed quarterly. Total purchase includes the exempt purchases as well as the taxable purchases. Taxable purchase is the total value of purchases including the one taxed at reduced or higher rate than the standard rate. Domestic tax credit is the input tax credit claimed against the purchases made locally and imported tax credit is the credit claimed against imports. Total sales include both exempt and taxable sales (including export sales which are zero rated).

Table A.2: Revenue Impact on Manufacturers

Domestic Input Tax (PKR in Millions)				
	(1)	(2)	(3)	(4)
	Balanced	Balanced	Unbalanced	Unbalanced
DD (Post June 13 × Domestic Input Tax)	-2.15		-2.02	
	(0.67)		(0.65)	
Lead 4		0.13		0.15
		(0.46)		(0.45)
Lead 3		-0.09		-0.08
		(0.45)		(0.43)
Lead 2		0.28		-0.29
		(0.29)		(0.60)
Lead 1		0.11		0.17
		(0.38)		(0.37)
Lag 1		-2.83		-2.52
		(0.84)		(0.81)
Lag 2		-2.00		-1.99
		(0.76)		(0.73)
Lag 3		-1.60		-1.66
		(0.66)		(0.63)
Lag 4		-2.5		-2.58
		(0.82)		(0.79)
Input Tax on Imports	-0.01	0.04	-0.01	0.04
	(0.05)	(0.05)	(0.05)	(0.05)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Clustered Standard Errors	Yes	Yes	Yes	Yes
Number of Groups	21,323	21,323	33,374	33,484
N	191,907	212,937	241,149	263,597

Notes: Table displays the main coefficients as well as coefficients on quarter specific interaction dummies for firm level regressions in case of manufacturers. Leads and lags variables are DD dummies for quarter specific interactions to rule out any pre trend (for plot see figure 4). The regression covers the period from March 2012 to June 2014 such that Lead 4 is the quarter March-June 2012 and Lag 4 is the quarter March-June 2014. Column (1) (2), and (3) (4) show the results for a balanced and unbalanced panel respectively. Standard errors are clustered at firm level and shown in parenthesis. See Table A.8 for robustness checks.

Table A.3: Revenue Impact on Non-Manufacturers

Domestic Input Tax (PKR in Millions)				
	(1)	(2)	(3)	(4)
	Balanced	Balanced	Unbalanced	Unbalanced
DD (Post June 13 × Domestic Input Tax)	-2.47		-2.34	
	(0.66)		(0.64)	
Lead 4		0.02		0.07
		(0.4)		(0.39)
Lead 3		-0.05		-0.05
		(0.44)		(0.42)
Lead 2		0.28		-0.32
		(0.27)		(0.59)
Lead 1		0.31		0.37
		(0.37)		(0.36)
Lag 1		-2.76		-2.58
		(0.88)		(0.82)
Lag 2		-2.45		-2.34
		(0.73)		(0.72)
Lag 3		-2.05		-2.01
		(0.58)		(0.59)
Lag 4		-2.93		-3.07
		(0.91)		(0.84)
Input Tax on Imports	-0.25	-0.21	-0.17	-0.15
	(0.38)	(0.4)	(0.32)	(0.28)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Clustered Standard Errors	Yes	Yes	Yes	Yes
Number of Groups	28,971	28,971	89,700	89,972
N	260,739	289,173	491,079	522,346

Notes: Table displays the main coefficients as well as coefficients on quarter specific interaction dummies for firm level regressions in case of non-manufacturers. Leads and lags variables are DD dummies for quarter specific interactions to rule out any pre trend (for plot see figure 5). The regression covers the period from March 2012 to June 2014 such that Lead 4 is the quarter March-June 2012 and Lag 4 is the quarter March-June 2014. Column (1) (2), and (3) (4) show the results for a balanced and unbalanced panel respectively. Standard errors are clustered at firm level and shown in parenthesis. See Table A.8 for robustness checks.

Table A.4: Revenue Impact on Partnerships

Domestic Input Tax (PKR in Millions)				
	(1)	(2)	(3)	(4)
	Balanced	Balanced	Unbalanced	Unbalanced
DD (Post June 13 × Domestic Input Tax)	-2.94		-2.78	
	(0.61)		(0.59)	
Lead 4		-0.06		-0.01
		(0.37)		(0.37)
Lead 3		-0.13		-0.11
		(0.41)		(0.4)
Lead 2		0.28		-0.28
		(0.28)		(0.59)
Lead 1		0.27		0.32
		(0.36)		(0.35)
Lag 1		-3.32		-3.07
		(0.8)		(0.76)
Lag 2		-2.88		-2.83
		(0.69)		(0.67)
Lag 3		-2.39		-2.41
		(0.55)		(0.54)
Lag 4		-3.77		-3.73
		(0.86)		(0.82)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Clustered Standard Errors	Yes	Yes	Yes	Yes
Number of Groups	13,496	13,496	27,879	27,928
N	121,464	134,775	177,296	191,492

Notes: Table displays the main coefficients as well as coefficients on quarter specific interaction dummies for firm level regressions in case of partnerships. Leads and lags variables are DD dummies for quarter specific interactions to rule out any pre trend (for plot see figure 7 ). The regression covers the period from March 2012 to June 2014 such that Lead 4 is the quarter March-June 2012 and Lag 4 is the quarter March-June 2014. Column (1) (2), and (3) (4) show the results for a balanced and unbalanced panel respectively. Standard errors are clustered at firm level and shown in parenthesis. See Table A.8 for robustness checks.

Table A.5: Revenue Impact on Sole Proprietorships

Domestic Input Tax (PKR in Millions)				
	(1)	(2)	(3)	(4)
	Balanced	Balanced	Unbalanced	Unbalanced
DD (Post June 13 × Domestic Input Tax)	-2.88		-2.72	
	(0.62)		(0.6)	
Lead 4		-0.14		-0.1
		(0.37)		(0.37)
Lead 3		-0.16		-0.15
		(0.41)		(0.4)
Lead 2		0.28		-0.32
		(0.28)		(0.59)
Lead 1		0.31		0.35
		(0.37)		(0.36)
Lag 1		-3.27		-3.03
		(0.8)		(0.76)
Lag 2		-2.85		-2.80
		(0.7)		(0.68)
Lag 3		-2.33		-2.38
		(0.55)		(0.54)
Lag 4		-3.73		-3.69
		(0.86)		(0.82)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Clustered Standard Errors	Yes	Yes	Yes	Yes
Number of Groups	32,106	32,106	84,558	84,867
N	288,954	320,489	489,989	524,581

Notes: Table displays the main coefficients as well as coefficients on quarter specific interaction dummies for firm level regressions in case of sole proprietorships. Leads and lags variables are DD dummies for quarter specific interactions to rule out any pre trend (for plot see figure 6). The regression covers the period from March 2012 to June 2014 such that Lead 4 is the quarter March-June 2012 and Lag 4 is the quarter March-June 2014. Column (1) (2), and (3) (4) show the results for a balanced and unbalanced panel respectively. Standard errors are clustered at firm level and shown in parenthesis. See Table A.8 for robustness checks.



Table A.6: Revenue Impact on Companies

Domestic Input Tax (PKR in Millions)				
	(1)	(2)	(3)	(4)
	Balanced	Balanced	Unbalanced	Unbalanced
DD (Post June 13 × Domestic Input Tax)	-4.59		-4.68	
	(2.4)		(2.35)	
Lead 4		0.54		0.5
		(1.6)		(1.56)
Lead 3		0.20		0.29
		(1.61)		(1.56)
Lead 2		0.83		0.88
		(0.93)		(0.91)
Lead 1		0.27		0.39
		(1.23)		(1.21)
Lag 1		-6.41		-5.95
		(3.15)		(3.00)
Lag 2		-4.42		-4.15
		(2.63)		(2.60)
Lag 3		-3.22		-3.08
		(2.32)		(2.29)
Lag 4		-4.5		-5.55
		(0.86)		(2.95)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Clustered Standard Errors	Yes	Yes	Yes	Yes
Number of Groups	6,670	6,670	12,754	12,780
N	60,030	66,607	83,365	90,274

Notes: Table displays the main coefficients as well as coefficients on quarter specific interaction dummies for firm level regressions in case of companies. Leads and lags variables are DD dummies for quarter specific interactions to rule out any pre trend (for plot see figure 8). The regression covers the period from March 2012 to June 2014 such that Lead 4 is the quarter March-June 2012 and Lag 4 is the quarter March-June 2014. Column (1) (2), and (3) (4) show the results for a balanced and unbalanced panel respectively. Standard errors are clustered at firm level and shown in parenthesis. See Table A.8 for robustness checks.

Table A.7: Robustness to Monthly Time Periods (July 2008- Sept 2016)

	Domestic Input Tax (PKR in Millions)					
	(1)	(2)	(3)	(4)	(5)	(6)
DD (Post June 13 × Domestic Input Tax)	-1.15					
	(0.3)					
DD (Post June 13 × Domestic Input Tax × Manufacturer)		-0.92				
		(0.32)				
DD (Post June 13 × Domestic Input Tax × Non-Manufacturer)			-1.32			
			(0.32)			
DD (Post June 13 × Domestic Input Tax × Partnerships)				-1.44		
				(0.3)		
DD (Post June 13 × Domestic Input Tax × Sole Proprietorships)					-1.38	
					(0.31)	
DD (Post June 13 × Domestic Input Tax × Companies)						-1.89
						(1.01)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Standard Errors	Yes	Yes	Yes	Yes	Yes	Yes
Number of Groups	144,211	36,798	115,050	33,112	105,063	15,841
N	6,840,702	2,417,382	5,049,410	1,782,943	5,002,590	877,528

Notes: The table provides estimation of difference in difference coefficients for the specifications used in Table 2 and Table A.2 to Table A.6 for the complete period of July 2008 to September 2016 using the Monthly return data. The variable DD is defined as an interaction between the dummy for suppliers who were not claiming refund before July 2013 and the dummy which equals one for the period July 2013 onward. The dependent variable is the input tax against domestic purchases and the regression controls for input tax against imports. The coefficient estimates are approximately 1/3 of the coefficients in odd-numbered columns of Table A.8 because the time period is month instead of quarter. Standard Errors are clustered at firm level.

Table A.8: Robustness of the Results in Tables 2-7 to Full Period (July 2008- September 2016)

Domestic Input Tax (PKR in Millions)												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Unbal	Bal	Unbal	Bal	Unbal	Bal	Unbal	Bal	UnBal	Bal	Unbal	Bal
DD (Post June 13 × Domestic Input Tax)	-3.37	-3.44										
	(0.86)	(0.9)										
DD (Post June 13 × Domestic Input Tax × Manufacturer)			-2.81	-2.86								
			(0.99)	(1.0)								
DD (Post June 13 × Domestic Input Tax × Non-Manufacturer)					-3.86	-3.92						
					(0.94)	(1.0)						
DD (Post June 13 × Domestic Input Tax × Partnerships)							-3.98	-4.08				
							(0.89)	(0.91)				
DD (Post June 13 × Domestic Input Tax × Sole Proprietorships)									-3.90	-3.99		
									(0.91)	(0.92)		
DD (Post June 13 × Domestic Input Tax × Companies)											-5.98	-5.88
											(2.98)	(3.01)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Standard Errors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Groups	144,211	43,928	36,798	21,323	115,050	28,971	33,112	13,496	105,063	32,106	15,841	6,670
N	2,348,653	1,331,390	825,108	651,571	1,736,768	877,298	618,385	414,900	1,711,742	968,968	297,478	208,366

Notes: The table provides estimation of difference in difference coefficients for the specifications used in Table 2 and Table A.2 to Table A.6 for the complete period of July 2008 to September 2016. The Monthly return data is used to compute quarterly values, therefore N denotes the quarterly number of observations. The variable DD is defined as an interaction between the dummy for suppliers who were not claiming refund before July 2013 and the dummy which equals one for the period July 2013 onward. The dependent variable is the input tax against domestic purchases and the regression controls for input tax against imports. The odd numbered columns show the results for the unbalanced panel which includes all the firms and the even numbered columns show the results for balanced panel of the firms used for Table 2 to Table A.6. Standard Errors are clustered at firm level.

## **A.2 Legal Definitions & Institutional Background**

### **A.2.1 Definitions**

Many important terms such as distributor, companies etc. used in the paper are clearly defined under the law. All the definitions provided below are directly taken from the text of the Sales Tax Act, 1990. It should be noted here that VAT law was implemented in Pakistan without changing the name of the sales tax law which it replaced because of constitutional restrictions faced by the Federal Government in Pakistan.

1. **Association of Persons (AOP)** includes a firm, a Hindu undivided family, any artificial juridical person and anybody of persons formed under a foreign law, but does not include a company.
2. **Company** means – (a) a company as defined in the Companies Ordinance, 1984 (XL VII of 1984); (b) a body corporate formed by or under any law in force in Pakistan; (c) a modaraba; (d) a body incorporated by or under the law of a country outside Pakistan relating to incorporation of companies; (e) a trust, a co-operative society or a finance society or any other society established or constituted by or under any law for the time being in force; or (f) a foreign association, whether incorporated or not, which the Board has, by general or special order, declared to be a company for the purposes of the Income Tax Ordinance 2001 (XLIX of 2001)
3. **CREST** means the computerized program for analyzing and cross matching of sales tax returns, also referred to as **COMPUTERISED RISK-BASED EVALUATION of SALES TAX**
4. **Distributor** means a person appointed by a manufacturer, importer or any other person for a specified area to purchase goods from him for further supply and includes a person who in addition to being a distributor is also engaged in supply of goods as a wholesaler or a retailer
5. **Supply Chain** means the series of transactions between buyers and sellers from the stage of first purchase or import to the stage of final supply

6. **Wholesaler** includes a dealer and means any person who carries on, whether regularly or otherwise, the business of buying and selling goods by wholesale or of supplying or distributing goods, directly or indirectly, by wholesale for cash or deferred payment or for commission or other valuable consideration or stores such goods belonging to others as an agent for the purpose of sale

### **A.2.2 Invoice Summary Provision**

Pakistan introduced federal VAT in 1990 but with a very limited scope. In 1996, Pakistan expanded it and introduced standard credit invoice system VAT. The government intended to bring down excise and custom duties and expand tax base through a broad based consumption tax. Until 2001, the use of computers and software was minimal. The criminal elements exploited the zero rating against exports to defraud the government of billions of rupees through fake exports and invoices. Federal Board of Revenue (FBR) responded by launching STARR (Sales Tax Automated Refund Repository) in July 2002 which provided limited cross matching ability to the refund processing units. The criminal syndicates, however, continued to misuse, hack or dodge STARR. It also increased compliance cost for genuine firms significantly without curtailing the fraud substantially. A growing perception of inability of tax authorities to plug continued leakage put pressure on the government for more comprehensive measures. Consequently, FBR quickly moved to CREST in 2008. CREST enabled FBR to conduct more comprehensive risk analysis by scrutinizing transaction-level data through invoice summary filed as an annex of monthly VAT return. FBR was able to capture the information that was previously unavailable, within risk analysis software automatically (Federal Board of Revenue 2008; Government of Pakistan 2008).

Pakistan's tax administration uses this transaction-level data to check fake input tax credit. The invoice summary provision in the tax law makes it mandatory for each VAT registered firm to file a monthly summary of purchase and sale invoices. The invoice summary, thus, gives digital synopsis of transactions. It includes registration number of each buyer and seller along with total number of invoices issued and the total tax involved in those invoices. This huge information is designed to

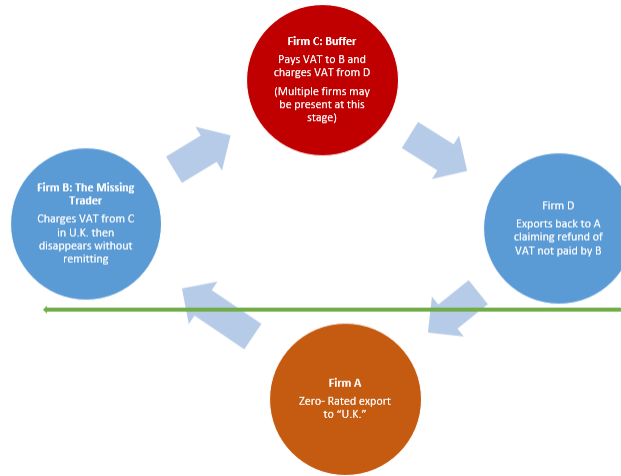
limit different frauds including DMT fraud. The detailed format is in Appendix A.3 where the Annexes A, B, C, and D of the return show all the information captured in invoice summaries. Annexes A and C deal with purchases and sales respectively. Pakistani VAT regime requires compulsory electronic filing of VAT returns and its annexes. It implies that transaction-level data is available in electronic form for processing and counter checking immediately with the filing of the return.

### **A.2.3 Missing Trader Fraud**

The invoice summary provisions exist in most VAT regimes requiring the businesses to submit an electronic summary of sale and purchase invoices to substantiate their VAT return. The backward and forward linkage is designed to enable the tax authorities to comprehensively check the invoice trail in suspicious transactions. The non-deposit of input tax credit claimed on the basis of invoice issued by a non-existent seller can be denied retrospectively or through audit, making both the buyer and seller jointly and severally responsible for the deposit of tax.

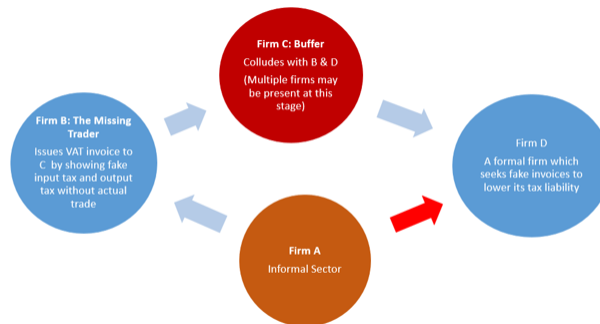
DMT fraud operates in a chain. In Pakistani case, one firm issues invoices to the other and so on. Usually, the first supplier  $S_1$ , issues sales invoices of the desired goods to a buyer without actually supplying them. The buyer in these cases is a well-established business operating in formal sector, generally a manufacturer. The invoice issued by  $S_1$  gives the buyer right to claim input tax credit although she actually purchased those goods from unregistered suppliers in the informal sector. In order to reduce her tax liability, the buyer now has legal claim of input tax against purchases, which never physically occurred. This can reduce tax liability of the buyer significantly. For example, a buyer who made purchases worth ten million PKR from the unregistered or informal sector can reduce her payable VAT by 1.5 million rupees (assuming a 15% tax rate). The self-enforcing mechanism of VAT demands that seller  $S_1$  has a large amount of output tax which must be deposited in the treasury but to this end  $S_1$  is backed by a chain of suppliers say  $S_2, S_3, S_4, S_5$  etc. who can provide the fake input tax credit to reduce the actual tax payment by  $S_1$  to zero or a negligible amount. One such network of suppliers who are criminally colluding with each other can deprive the exchequer to the tunes of billions of rupees each month.

Figure A.3: Missing Trader Fraud



### A- European Carousel Fraud

*Explanation:* This figure is adapted from Keen & Smith (2006). The European carousel fraud operates in a chain and principally relies on one or more suppliers going “missing” after issuing invoices without depositing the tax collected. For example, firm A exports goods to U.K. from an EU member country and gets the VAT refund of tax paid on its purchase. Firm B imports the goods without paying any tax at import and supplies it to firm C (multiple firms can exist at this level). Firm B now goes missing without remitting the tax to government but is invoice issued to firm C is a valid instrument to claim input tax credit. Firm D buys the goods from firm C and exports it back to the same member country and claims refund on strength of the invoice issued by C. U.K. government ends up paying the amount which was never deposited in the exchequer.



### B- Domestic Missing Trader Fraud

*Explanation:* In domestic missing trader fraud, Firm D is actually purchasing goods from A but would not be able to claim input tax because firm A is not registered to issue VAT invoice. Firm D, A or both, now collude with suppliers of fake invoices who have set up fake units that only generate invoices without conducting actual business. These units are registered in different geographical jurisdictions making audit difficult for the revenue authorities. They also provide plausible deniability for firm D which operates in formal sector. In case of Pakistan, the different territorial jurisdictions of the tax offices provide an incentive to operate a missing trader fraud as the audit and enforcement can only be conducted by the office having geographical jurisdiction and the invoices of missing traders can be difficult to verify.

These fake suppliers exploit the difficulty of audit and enforcement faced by the tax administration to get away with this fraud. The EU analogy is applicable here. In Pakistan, audit and enforcement jurisdictions are territorial and the auditors lack the authority and resources to conduct audit and verification beyond their geographical limits. If the suppliers are carefully registered in different jurisdictions then these geographical limits work in a manner similar to the countries in EU but with far more ease of operation for the fraudsters. Clearly, if the suppliers  $S_1, S_2, \dots, S_n$  are registered in different audit and enforcement jurisdictions, then practically there's very little an auditor can do. The investigation can be impeded further by two critical factors. First, the audit normally requires a period of year or more of activity and can take months or even years to complete and still more time is needed to get an enforceable order of recovery from the court. Second, once in the court, the courts are reluctant to buy the argument that based on a presumption some of the suppliers never existed at the time transaction took place. The government ends up giving refund or tax credit for the tax, which was never deposited in the treasury.

I elaborate it with an example. Suppose "M" is a manufacturer who buys recyclable paper and paperboard from large wholesalers operating in informal sector. It costs "M" ten million PKR to purchase this recyclable paper.  $M$  manufactures paper from it and sells it for PKR12.5 million. This firm is required to collect and remit a tax of 1,875,000 PKR (assuming a 15% tax rate) on this sale. If  $M$  can now get an invoice from  $S_1$  for its purchase, then it reduces the tax liability by PKR 1,500,000.  $M$  now collects full PKR 1,875,000 from its buyers but remits only 375,000 PKR.  $S_1$  provides this fake invoice to  $M$  through a chain extending to  $S_2, S_3, S_4, S_5$  and so on. The situation gets worse when  $M$  passes on some of this gain to the market through a reduced price.  $M$  starts capturing the market which leaves no other way for the competitors but to lower their cost by either engaging in similar fraud or changing its operations. Since the capital cost of changing operations is high and benefits are risky, the slippage to fraud is a more realistic and economically rational choice for the firm. This leads to an exponential growth where large segments of the industry get involved in these transactions. Virmani (1989) provides theoretical analysis of these types of problems in sales tax with reference to the evasion through mis-declaration of output but the intuition used by him can be extended to



mis-declaration of inputs.

#### A.2.4 CREST and Reform in July 2013

CREST software analyzes and scrutinizes invoice summaries submitted by the buyers and suppliers. Then it goes back in the supply chain to identify any suspicious activity and points out invoice by invoice discrepancy. CREST is also linked with import and export data and cross verifies imports and export data submitted by the firms in their returns. Exhibit B-I provides a snapshot of the actual interface and output given by the CREST.

Figure A.4: CREST Output showing Supply Chain Discrepancies

<b>Purchase Invoices</b>							
S.No.	Seller Reg. No.	Invoice No.	Invoice Date	Sales tax Amount	Status	Discrepancies	Verification Date
1.		676	02-01-14	4,143.00	Discrepancies	Taxable supply against refund filed not verified in supply chain	12-05-14
2.		5047	02-01-14	2,788.00	Discrepancies	Taxable supply against refund filed not verified in supply chain	12-05-14
3.		353	02-11-13	990.00	Valid		12-05-14
4.		628	04-12-13	30,888.00	Valid		12-05-14
5.		28019	04-01-14	2,141.00	Valid		12-05-14
6.		8	04-11-13	4,608.00	Discrepancies	Taxable supply against refund filed not verified in supply chain	12-05-14
7.		F41-0406	06-11-13	1,058.00	Valid		12-05-14
8.		26447	06-11-13	2,774.00	Valid		12-05-14
9.		F41-0546	07-01-14	1,498.00	Valid		12-05-14
10.		0869/01-14	07-01-14	1,475.00	Valid		12-05-14
11.		1365	07-01-14	28,377.00	Valid		12-05-14
12.		15174	07-01-14	6,720.00	Valid		12-05-14
13.		0100	07-01-14	3,390.00	Valid		12-05-14
14.		1367	07-01-14	31,417.00	Valid		12-05-14
15.		0063	07-11-13	3,865.00	Discrepancies	Taxable supply against refund filed not verified in supply chain	12-05-14
16.		90045341	09-01-14	54,400.00	Valid		12-05-14
17.		25	09-01-14	1,875.00	Valid		12-05-14
18.		699	09-01-14	1,900.00	Discrepancies	Taxable supply against refund filed not verified in supply chain	12-05-14
19.		4651	09-11-13	2,592.00	Valid		12-05-14
20.		28196	11-01-14	2,541.00	Valid		12-05-14
21.		0583/11-13	11-11-13	1,440.00	Valid		12-05-14
22.		9	12-11-13	4,760.00	Discrepancies	Taxable supply against refund filed not verified in supply chain	12-05-14

\* Discrepancy Raised by Processing Officer Page 1 of 4

Notes: The exhibit shows the output after processing of a refund claim through CREST along with invoice specific discrepancies raised against invoices with suspicious supply chain. This system was operational prior to the reform starting as back as 2003 and completely rolled out countrywide by financial year 2008.

If an audit or further inquiry is necessary because either some invoices were not cleared by CREST or for any other reason, the amount cleared by CREST and

approved by the refund processing division is sanctioned and the remaining amount is withheld pending further clarification. In short, refund claimant has to go through a month by month scrutiny which may often result in audit or inquiries. Through CREST system each invoice for the month is under scrutiny for refund claimant. This system is operational since financial year 2008 and the rules provide legal cover for the scrutiny of claims through CREST. Furthermore, the cases in which a firm is supplying goods locally as well as exporting them, CREST scrutinizes each and every invoice whether it pertains to a material used in export of goods or not. If CREST objects to a purchase, refund portion of the claim gets attenuated by the amount of that invoice even if the goods in question were not used in export. For example, a firm has total input for taxable purchases aggregating to PKR 1 million for a month but is only claiming a refund to the tune of PKR 0.5 million against exports. If CREST objects to PKR 0.1 million of input tax credit only, then the refundable amount takes the first hit and gets reduced to PKR 0.4 million.

Figure A.5: CREST Output Showing Other Discrepancies

Sr No	NTN	Particular Of Suppliers Name	Rtn Sts	Declaration Of Suppliers			Declaration Of Buyer			Difference (Buyer Decl - Supplier Decl)			Feed Back
				Inv	Value	Sales Tax	Inv	Value	Sales Tax	Inv	Value	Sales Tax	
1			Non-Filers				4	51,611,620	6,963,822	4	51,611,620	6,963,822	Feed Back
2			Non-Filers				13	17,566,386	2,810,621	13	17,566,386	2,810,621	Feed Back
3			Non-Filers				4	17,169,315	2,747,090	4	17,169,315	2,747,090	Feed Back
4			Filer	3	453,300	72,528	2	5,680,000	908,800	0	5,226,700	836,272	Feed Back
5			Non-Filers				7	3,297,153	527,545	7	3,297,153	527,545	Feed Back
6			Filer	7	6,535,593	1,045,696	13	9,108,664	1,457,387	6	2,573,071	411,691	Feed Back
7			Non-Filers				8	2,513,801	402,208	8	2,513,801	402,208	Feed Back
8			Null-Filers				199	6,511,935	263,730	199	6,511,935	263,730	Feed Back
9			Filer	9	9,071,538	1,451,446	12	11,593,938	1,709,253	3	2,522,400	257,807	Feed Back
10			Non-Filers				12	2,274,559	248,128	12	2,274,559	248,128	Feed Back
11			Filer				22	1,412,295	208,792	22	1,412,295	208,792	Feed Back
12			Null-Filers				11	1,271,200	203,392	11	1,271,200	203,392	Feed Back
13			Non-Filers				7	1,082,891	173,261	7	1,082,891	173,261	Feed Back
14			Non-Filers				10	1,020,708	163,313	10	1,020,708	163,313	Feed Back
15			Non-Filers				4	1,043,709	162,667	4	1,043,709	162,667	Feed Back
16			Non-Filers				1	730,160	116,826	1	730,160	116,826	Feed Back
17			Null-Filers				60	616,226	91,760	60	616,226	91,760	Feed Back
18			Filer				21	494,734	75,663	21	494,734	75,663	Feed Back

ND = Filer Non- Payment

Notes: The exhibit shows auditor's view in CREST for a taxpayer who is not a refund claimant along with invoice specific discrepancies raised against invoices. This system was available to the tax authorities prior to the reform but did not have any legal force in itself to deny input tax claim. Post June 2013, the discrepancy raised by CREST against a domestic supplier as seen in this Exhibit automatically denied input tax claims against the difference amount.

### A.3 Data Description

The data used in the paper is the administrative data of all the returns filed for the tax year 2009-2016 and first five months of the year 2017 constituting a total of 9.69 million returns. The data is anonymized so that it does not reflect actual registration numbers of firms to preserve confidentiality of specific firms. The returns are filed on monthly basis with the exception of a few industries or categories which file return on quarterly basis. Figure A.6 shows the return for the year 2016-17 (tax year 2017) on FBR's website and has several annexes which are also required to be filed with the return electronically. Figure A.6 only contains the annexes relevant for this paper. All returns are filed electronically, however, the period from 2009-2012 may have manual as well as electronic returns because the administration was transitioning towards electronic filing.

The data consists of 100 variables in total and few variables which directly relate to this paper are described in table A.9. Domestic input tax credit is the key variable. The penalty for not filing a return when no tax is due to be paid with the return is nominal throughout this period. The firms have the option to file a revised return to correct any error or misreporting in their return. A total of 3, 134 duplicate returns were filed and therefore dropped. The duplicate returns were also checked to ensure there's no change in the domestic input tax credit but no such case was found. Those who claimed refund in excess of 1 million PKR in total before the year of the reform were tagged as the control and those who obtained no or less than one million in total were tagged as treatment. The variable "Business Activity" includes all that apply, therefore, separate variables were generated to identify manufacturers and other business activities such as importer, wholesaler, and distributor (please refer to the definitions at Appendix A.2). The data for quarter Oct-Dec 2016 was not complete for the month of December and was therefore dropped from this analysis. Outliers in terms of domestic input tax credit were identified by setting a monthly threshold of PKR 2 billion to guard against data entry error. Only one such case was found and dropped. Missing values for the input tax credit for domestic as well as the import purchases were converted to 1 instead of zero for ease of calculations. It should be noted that a missing input tax value implies a zero claim.

Although the errors in data cannot be completely ruled out but the electronic

filing on FBR’s portal implies that the feeding errors that result in figure mismatches are eliminated. As one column of the return is calculated and links forward and backwards through in built software, data entry errors can be ignored. However, the firms can file a revised return, without prior approval voluntarily if that does not interfere with tax credits or payments such that tax liability remains the same or increases. But in case the liability is to be revised downwards then a prior approval is required. The data does not show whether a duplicate return is revised or not but the duplicate returns are substantially less than 1 percent (3134 returns or 0.03%). For analysis purpose, I drop the duplicate returns for the same tax period but it is possible that revised return is dropped instead of the original one.

Table A.9: Data Variables and Description

Variable	Description
TAXPAYER_TYPE	Taxpayer Type (AOP/Company/Sole Proprietorship/FTN or Government Agencies)
BUSINESS_ACTIVITY	Business Activity (Manufacturer, distributor etc.), includes all that apply
ITEM_NAME	Name of the product sold, includes all that apply
CITY	City of registration
TAX_PERIOD	Monthly Tax Period in which return is filed
D_GPURCH	Domestic Purchases from Registered Persons (excluding fixed assets) (Gross Value)
D_TPURCH	Domestic Purchases from Registered Persons (excluding fixed assets) (Taxable Value)
D_INPUT	Domestic input tax credit
DU_GPURCH	Domestic Purchases from Un-registered Persons (Gross Value)
L_GPURCH	Imports excluding fixed assets (includes value addition tax on commercial imports) (Gross Value)
L_TPURCH	Imports excluding fixed assets (includes value addition tax on commercial imports) (Taxable Value)
L_INPUT	Imported Input tax credit
FIX_GPURCH	Capital Goods / Fixed Assets (Domestic Purchases & Imports) (Gross Value)
FIX_TPURCH	Capital Goods / Fixed Assets (Domestic Purchases & Imports) (Taxable Value)
FIX_INPUT	Input Tax on account of Capital Goods / Fixed Assets (Domestic Purchases & Imports)
TOT_PURCH	Total Purchase (Gross Value)
TOT_TPURCH	Total Purchase (Taxable Value)
INPUT	Total Input tax credit for the month
STAX_CREDIT	Credit carried forward from previous tax period(s)
INADMIS_INPUT	Non creditable inputs (relating to exempt, non-taxed supplies of goods or services etc.)
D_GSALE	Total Goods or services supplied locally (Gross Value)
D_TSALE	Total Goods or services supplied locally (Taxable Value)
D_OUTPUT	Total Goods or services supplied locally (Sales Tax)
E_SALE1	Goods or Services exported (Gross Value)
TOT_SALE	Total Sales (Gross Value)
TOT_TSALE	Total Sales (Taxable Value)
G_OUTPUT	Output Tax
TURNOVER_TAX_BY_RETAILERS	Turnover Tax payable by retailers @ 2%
TO_OUTPUT	Retail Turnover - for the Quarter (Taxable Value)
TO_OUTPUT_TAX	Output Tax on Retail Turnover - for the Quarter
REFUND	Refund Claim (Provide Stock Statement as Annex-H)
TAX_PAYABLE	Total Tax Payable
TAX_PAID_NORMAL	Tax paid on normal/previous return (applicable in case of amended return)
BALANCE_TAX	Balance Tax Payable/ (Refundable)

Figure A.6: Sales Tax Return and Annexures

(a)

REGISTRY		NTN		CNIC (in case of Individual)		STRN (Sales Tax Registration No.)	
Name						Normal Revised Monthly Quarterly Tax Period (MMYY)	
SALES TAX CREDITS	Description	Gross Value	Taxable Value	Sales Tax			
	1 Domestic Purchases (excluding fixed assets) Annex-A	-	-	-			
	2 Imports excluding fixed assets (includes 2% on commercial imports) Annex-B	-	-	-			
	3 Capital/fixed assets to be credited at 1/12 <sup>th</sup> of accumulated amount						
	4 (-) Inadmissible input tax relating to exempt supplies/ non-taxed services etc.						
	5 Input Tax for the month (1 + 2 + 3 - 4)						
	6 (+) Previous month credit brought forward						
7 Accumulated Credit (5 + 6)							
SALES TAX DEBITS	8 Supplies Made & Services Rendered Annex-C	-	-	-			
	9 Exports Annex-D	-	-	-			
	10 Extra Tax charged under Chapter XIII of ST Sp. Procedure Rules '07 Annex-C						
	11 Output Tax (8 + 10)						
	12 Retail Turnover - for the Quarter		Turnover				
	13 Electricity supplied to steel sector KWH	-	x Rs. 6.00				
	14 Re-rollable scrap sold by ship breakers M Tons	-	x Rs. 4,848				
	15 Re-meltable scrap sold by ship breakers M Tons	-					
	16 Less: Sales Tax deducted by withholding agent @ 1/5th of tax invoiced						
	17 Debit for the month (11 + 12 + 13 + 14 - 16)						
18 Sales Tax withheld by the return filer as withholding agent (STWH)							
19 Sales Tax Arrears including Principal, Def Surch. & penalty							
PAYABLE/ REFUND	20 Whether excluded from Section 8B(1), under SRO 647(0)2007 (Yes / No)						
	21 Admissible Credit - if 20 = Yes then 7; if 20 = No, then least of 7 or "90% of 11" or 17						
	22 Payable ST - if 17 > 21 then (17 - 21 + 18 + 19); otherwise 18 + 19						
	23 Excess Unadjusted Credit - if 20 = Yes and if 21 > 17 then (21 - 17); otherwise zero; if 20 = No then (7 - 21)						
	24 Refund claim i.e. input consumed in zero-rated or excess of input tax as per rules						
PAYMENTS	25 Balance Credit to be carried forward - if 24 < 23, then (23 - 24); otherwise zero						
	26 Federal Excise Duty (FED) Payable / (FED Drawback) Annex-E						
	27 Goods chargeable to Special Excise Duty (SED) Annex-C						
	28 (-) SED on inputs used in manufacturing of Goods supplied for domestic consumption						
	29 (-) SED paid on goods used in manufacturing of Goods exported (drawback)						
	30 Net SED Payable (27 - 28 - 29)						
	31 SED Arrears						
	32 Net FED Payable If 26 + 30 > 0 then (26 + 30 + 31), else 31						
	33 FED/ SED Drawback if 26 + 30 < 0 then -(26 + 30), else zero						
	34 PDL - Petroleum Development Levy						
	35 Total Taxes Payable (22 + 32+ 34)						
	36 Tax paid on normal/ original return (applicable in case of revised return)						
	37 Balance Tax Payable/ (Refundable) (35 - 36)						
38 Bank Account for payment of refund A/C	Bank	Branch					
DECLARATION	I, _____, holder of CNIC No. _____						
	In my capacity as self/member or partner of association of persons/principal/ officer / trustee/ representative of named above, do solemnly declare that to the best of my knowledge and belief the information given in this return is correct and complete in accordance with the provisions of the Sales Tax Act, 1990, the Federal Excise Act, 2005, and rules as well as notifications issued thereunder.						
HEAD OF ACCOUNTS	Head of Account	Amount	CPR No.		Amount		
	ER02341 - Sales Tax	-			-		
	ER02366 - Sales Tax on services	-			-		
	ER02367 - FED in VAT mode	-			-		
	ER02485 - Federal Excise Duty	-			-		
	CR03901 - PDL	-			-		
TOTAL AMOUNT PAYABLE		-	Total Amount in Figures:		-		
			Amount Received in words: _____				
			Bank Officer's Signatures, Date & Stamp				

## SUMMARY OF DOMESTIC PURCHASES

NTN  STRN  Tax Period Name of Registered Person 

S. Nr.	Particulars of Suppliers				No. of Invoices/ Debit/ Credit Notes	Value of Purchases Excluding S/Tax	Sales Tax	1% SED	Extra tax (paid under Chapter XIII of ST Sp. Procedures Rules, 2007)
	Name	NTN	STRN	CNIC					
Total (Net after incorporating the Debit/ Credit Notes, if any)						-	-	-	-

## CATEGORY WISE SUMMARY:

	Value	Sales Tax
<b>Taxable Goods</b>		
@ 16% (excluding fixed assets)		-
@ 18.5% (excluding fixed assets)		-
@ 21% (excluding fixed assets)		-
Fixed Assets		
Third Schedule Goods		-
<b>Taxable Services purchased (including provincial tax and FED in Sales Tax mode)</b>		
@ 16%		-
@ 21%		-
Others (Pl. specify)		
<b>Zero-rated</b>		
DTR		
Other local zero-rated		
<b>Exempt domestic purchases/services</b>		
Steel Sector: Tax paid at Rs. 6/KWH on electricity bill	KWH	
CNG Dealers: Natural gas purchased	Tax paid at 25%	

- Notes:**
- 1) Supplier-wise summary should be provided for all taxable (excluding zero-rated) purchases made from registered
  - 2) Supplier-wise summary is not required to be submitted by retailers and CNG dealers and in respect of those purchases on
  - 3) 'Others' category also covers purchases made from unregistered persons and should also include purchases for which no separate column is provided.

(b)

**SUMMARY OF IMPORTS**

NTN  STRN  Tax Period   
 Name of Registered Person

S. Nr.	Particulars of GD Imports (Machine No.)				Sales Tax Rate	Import Type	Value for Sales Tax	Sales Tax paid at import stage	2% Sales Tax on commercial imports	1% SED
	Collectorate	GD Type	GD No.	GD Date						
<b>Total</b>							-	-	-	-

GD Types	Collectorates	Import Types	Rate/ Type-wise summary	Value	Sales Tax
EB	KAPR	General	Imports @ 16% (excl. fixed assets)		-
HC	KOIL	Commercial	Imports @ 18.5% (excl. fixed assets)		-
ST Rates	KAFU	Commercial	Imports @ 21% (excl. fixed assets)		-
0%	LDRY	Fixed Assets	Zero Rated		
16%	PDRY	Edible Oil	Imports at other rates		-
18.5%	MDRY	Ship for breaking	Fixed Assets		-
21%	QDRY	Ship for breaking	Exempt Imports		
Exempt	(Also see instructions)	Ship for breaking	Ship for breaking LDT		

**Note:** If there are if items of different rates and types are imported on a single GD, separate line for each type/ rate may be entered in GD-wise summary

(c)



## SUMMARY OF DOMESTIC SALES

NTN  STRN  Tax Period Name of Registered Person 

S. Nr.	Particulars of buyers				No. of Invoices/ Debit/ Credit Notes	Value of Supplies Excluding S/Tax	Sales Tax	1% SED	Extra tax (charged under Chapter XIII of ST Sp. Procedures Rules, 2007)
	Name	NTN	STRN	CNIC					
	<b>All supplies to unregistered persons</b>								
	<b>Total (Net after incorporating the Debit/ Credit Notes, if any)</b>					-	-	-	-

**CATEGORY WISE SUMMARY:**

	Value	Sales Tax
<b>Taxable Goods &amp; services</b>		
@ 16%		-
@ 18.5%		-
@ 21%		-
@ 25% (Natural Gas supplied to CNG dealers)		-
Third Schedule Goods		-
<b>Taxable Services rendered (including provincial tax and FED in Sales Tax mode)</b>		
@ 16%		-
@ 21%		-
<b>Others (Pl. specify)</b>		-
<b>Zero-rated</b>		
DTRE		
Other local zero-rated		
<b>Exempt supplies/services</b>		
<b>Invoices issued under special procedures</b>	<b>Tax invoiced</b>	

- Notes:**
- 1) The buyer-wise summary should be provided for all taxable sales (excluding zero-rated) to registered persons.
  - 2) The buyer-wise summary is not required to be submitted by retailers and CNG dealers.
  - 3) 'Others' category covers supplies for which no separate column is provided.
  - 4) 'Invoices issued under special procedures' reflect sales tax for which sales tax liability is discharged under special procedures and tax on invoice does not form part of output tax.

(d)

SUMMARY OF EXPORTS						Annex-D	
NTN	99999999-9		STRN	xx-xx-xxxx-xxx-xx		Tax Period	MM-YY
Name of Registered Person							
S. Nr.	Particulars of GD Exports (Machine No.)					Value of Exports in Pak Rupees	
	Collectorate	GD Type	GD No.		GD Date		
<b>Total</b>						-	

(e)