VALUE ADDED TAX AND TAX CAPACITY

IN DEVELOPING COUNTRIES

By

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Dedicated to the love of my life:

Dilini, Dehara and Janiru

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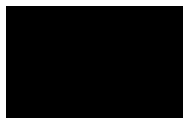I, Konara Mudiyanselage Harsha Kaushalya Dasanayake, certify that:

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ABSTRACT

Developing countries find it challenging to generate enough tax revenue to meet essential government expenditure needs on social welfare and economic development. Weak revenue performance has become a crucial source of instability and a constraint on sustainable growth. However, over the years, taxation technology has developed in leaps and bounds to provide more sophisticated taxation methods that improve both tax capacity and efficiency. This leaves us with an interesting question of why many developing countries have still failed to reap the benefits of new taxation methods to enhance their tax capacity. Concentrating on one such innovation in taxation: Value Added Tax (VAT), this thesis offers three related studies (Chapters 2 to 4) that investigate the effectiveness of VAT on tax capacity of developing countries.

The first study (Chapter 2) focuses on the main channels that constrain the effectiveness of VAT in developing countries. The first section of this study establishes the positive impact of VAT adoption on tax capacity using the difference-in-difference approach with an instrumental variable considering a developing country panel. In the next section, we focus on three different channels: effective tax rate, tax base and informal sector, to decompose the effect of VAT adoption on tax capacity. Our findings re-confirm that the presence of VAT has a positive impact on both total and indirect tax-GDP share in developing countries. Results also reveal that the main channel of increase in tax capacity is through an increase in the effective tax rate. However, the role of VAT as an information source that compels the informal sector to move to the formal sector does not significantly contribute towards the increase in tax capacity in developing countries.

In the second study (Chapter 3), we examine the diffusion and the appropriate-

ness of VAT as an economic institution for each country based on its impact on tax capacity. For this purpose, we develop an appropriateness index based on the assumption that VAT diffusion is jointly determined by the countries' geography and socio-economic condition. In the regression analysis, we use a spatial regression model to disentangle the appropriateness of VAT from geographic factors and use geographic neighbours as an instrumental variable of VAT introduction with interaction terms. Consistent with the literature, our findings confirm that VAT diffusion is primarily driven by countries' geographic distance. More importantly, our results show that the effect of VAT adoption on tax capacity depends on its appropriateness, where countries with a higher appropriateness index have a more significant increase in tax capacity after the introduction of VAT.

The final study (Chapter 4) is based on micro firm survey data in Sri Lanka. We study the variation in the distribution of formal firms below the VAT threshold to investigate the effect of VAT adoption and change in the VAT rate on firms' sales reporting. Using a repeated cross-section survey data from 1994 to 2017 and identification with difference-in-difference, we find that proportion of firms below the threshold has decreased by 11 percentage points immediately after the VAT introduction. However, an increase in the standard VAT rate from 10% to 15% in 2005 has increased the proportion of firms below the threshold by 5.9 percentage points. This suggests 1.2% more firms de-register for every 1% increase in the standard VAT rate. The implications of these results are two-folded. On the one hand, VAT is effective in information revelation through registration. However, on the other hand its informational role is limited, and the de-registration makes it harder to enhance tax capacity by setting up a higher tax rate.

The findings of these studies are expected to contribute towards a better design and implementation of VAT policy in developing countries, which will ensure an enhanced tax capacity and an efficient taxation system providing much-needed funds for development and social welfare.

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This thesis contains work that is prepared for publication. Specifically, content from one chapter of the thesis is submitted to a journal.

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Co-author signature and date:
(Shawn Chen) Date: 20 August,

Student signature:

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I, Anu Rammohan, certify that Konara Mudiyanselage Harsha Kaushalya Dasanayake's statement regarding his contribution to the work is correct.

Coordinating supervisor signature:

Date: 20 August, 2021

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Chapter 1

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INTRODUCTION

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*"In this world nothing can be said to be certain, except **DEATH** and **TAXES**"*

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Benjamin Franklin (1789)

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1.1 Background and Motivation

Government revenue is an integral part of fiscal policy, particularly in developing countries where a significant proportion of government expenditure includes spending on social welfare and infrastructure development. Therefore, tax revenue as the main contributor of government revenue has continued to receive substantial attention from policy makers. Achieving a higher tax revenue with a minimal impact on economic activities has been of paramount importance for any government.

However, a number of previous studies find that developing countries are faced with the problem of lower tax capacity, which results in potential socio-economic issues such as insufficient supply of public goods, higher budget deficits and debt sustainability (Gordon and Li, 2009; Kleven, 2014; Besley and Persson, 2014). The tax share of GDP in developing countries is typically low compared to developed countries but may also be insufficient to meet their public spending.

At the same time, several noteworthy innovations in tax administration have come into limelight in recent history, which were supposed to improve overall tax capacity and efficiency. Value Added Tax (VAT) is one such innovation. The

past few decades have witnessed a surge in developing and transition countries adopting VAT with the primary objective of improving tax capacity. However, not all countries have been able to achieve the expected outcome and importantly a majority of them are developing countries (Keen and Lockwood, 2010; Ahlerup et al., 2015). This raises the important question of why some of these recent innovations in taxation technology are not delivering desired results in developing countries.

Sri Lanka is a classic example of such a situation. The country has faced a continuous decline in tax share in the recent past, and even the adoption of VAT in 2002 has not resulted in overturning the downward trend (Mudiyanselage et al., 2020). This weak tax performance has created several macroeconomic imbalances in the island nation. The average budget deficit and debt level as a share of GDP in Sri Lanka over the last three decades have been about 7% and 88% respectively. The main reason for such a weak fiscal situation is the below-par tax performance where the tax-GDP share has been declining from around 19% in 1990 to around 11% in 2019.

1.2   Contribution and Organisation of the Thesis

Motivated by the weak tax capacity in most of the developing countries and more specifically by the declining tax share observed in Sri Lanka, this thesis combines three distinct yet related essays focusing on the role of VAT and tax capacity in developing countries. In doing so, it tries to answer the striking question of why has VAT not succeeded in improving tax capacity in a number of developing countries as expected.

In the first essay (Chapter 2), we look at general patterns in a cross-country study and analyse the main channels that constrain the effectiveness of VAT in developing countries. We use a novel measure of tax capacity using tax revenue as a share

of "True GDP" which is the sum of reported GDP and the informal economy.[1] This new measurement allows us to identify the changes in tax capacity due to the variations in informal sector after VAT introduction. Next we decompose the effect of the introduction of VAT on tax capacity into three channels: effective tax rate, tax base and the informal sector. In this decomposition exercise, our main emphasis is on the role of VAT in information revelation considering the "last mile problem" as discussed by Pomeranz (2015); Gerard and Naritomi (2018); Naritomi (2019). As highlighted by its proponents, one important feature of VAT compared to other indirect taxes is the self-revelation of information to tax authorities. They argue that the design of the VAT allows better access to financial information via the self-reporting feature of VAT which limits the firms' ability to hide their financial transactions. The use of the informal sector as a separate channel allows us to closely examine the validity of this claim in the case of developing countries.

In the second essay (Chapter 3) we look at whether the effectiveness of VAT can be affected by the appropriateness of VAT in each specific country. As it is well known that 'one size does not fit all', we argue that an institution may be inappropriate if it is introduced to the host country due to geographic factors as it might be incompatible with local economic and political fundamentals. Based on the literature around this and the idea of Keen and Lockwood (2010) on the causes of VAT, we construct a measurement of the appropriateness of VAT to describe the degree of compatibility of VAT adoption to the host country. Our study enriches the understanding of VAT as an institution to mobilize government revenue but also a tax technology that involves new process, equipment and skill to implement it (Gerard and Naritomi, 2018; Ghirmai et al., 2014; Fan et al., 2018; Fjeldstad et al., 2020). In this analysis we consider VAT adoption to be jointly determined by mechanical diffusion force and socio-economic condition. We regard

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[1]For the purpose of this study, We use the general definition of informal economy: which is the part of economy that is not monitored or recorded by any form of government. We use the terms 'underground economy' and 'shadow economy' interchangeably to informal economy.

spatial interdependence as the mechanical diffusion and it allows us to separately identify the influence from neighbouring countries for VAT adoption from the appropriateness of different countries for VAT. We measure spatial interdependence considering geographical neighbourhoods and use the appropriateness index of the socio-economic conditions to study the impact of the appropriateness on the effectiveness of VAT. We find that effectiveness of VAT on tax capacity can be constrained by the appropriateness in that country.

We devote the final essay (Chapter 4) to examining the micro mechanisms of VAT by focusing on Sri Lanka, a typical developing country with weak tax capacity even after VAT introduction. In this essay, we look at an important parameter of VAT policy: VAT threshold for formal firms. VAT threshold is a size-based regulation set by the revenue authorities which determines mandatory registration for VAT. Firms below the VAT threshold are not required to register and pay VAT while for the firms above the threshold, it is mandatory by law to register and pay VAT accordingly. Though its undesirable, size-based regulations create incentive for firms to stay small and avoid the compulsory registration which can significantly distort firm-size distribution (Dharmapala et al., 2011; Gourio and Roys, 2014). Additionally, past studies specifically on VAT threshold find that there could be a significant bunching of firms below the threshold level (Harju et al., 2016; Boonzaaier et al., 2016; Sow and Gebresilasse, 2020). Moving forward from the current literature, in this essay we examine the behavioural response of firms to the changes in the VAT policy after its adoption in Sri Lanka. One innovative finding of this study is that firms actively respond to the increase in standard VAT rate by hiding behind the VAT threshold undermining the tax capacity of Sri Lanka. This is a novel outcome which has not been discussed in the literature before. This shows that the VAT threshold could be a loophole where firms use to stay behind by under-reporting sales in a situation of any other VAT policy changes such as a rate increase.

This thesis is organized into five chapters. Introduction chapter (Chapter 1) provides an overall background with the motivation of the study followed by the contribution of each essay. Three core chapters representing three related essays on VAT and tax capacity in developing countries are included from chapter 2 to chapter 4. Chapter 2 examines the different channels that affects the effectiveness of VAT, giving important emphasis on information revelation. Chapter 3 observes the appropriateness of socio-economic condition for VAT, while chapter 4 includes a micro analysis which looks at firms' response on VAT policy changes. Final chapter (Chapter 5) provides conclusion and policy implications.

REFERENCES

Ahlerup, P., Baskaran, T., and Bigsten, A. (2015). Tax Innovations and Public Revenues in Sub-Saharan Africa. *The Journal of Development Studies*, 51(6):689–706.

Besley, T. and Persson, T. (2014). Why Do Developing Countries Tax So Little? *Journal of Economic Perspectives*, 28(4):99–120.

Boonzaaier, W., Harju, J., Matikka, T., and LastNamePirttilä, J. (2016). How do small firms respond to tax schedule discontinuities? Evidence from South African tax registers. *WIDER Working Paper*, 36.

Dharmapala, D., Slemrod, J., and Wilson, J. D. (2011). Tax policy and the missing middle: Optimal tax remittance with firm-level administrative costs. *Journal of Public Economics*, 95(9-10):1036–1047.

Fan, H., Liu, Y., Qian, N., and Wen, J. (2018). Computerizing VAT Invoices in China. *National Bureau of Economic Research*, Working Paper(24414).

Fjeldstad, O. H., Kagoma, C., Mdee, E., Sjursen, I. H., and Somville, V. (2020). The customer is king: Evidence on VAT compliance in Tanzania. *World Development*, 128:1–12.

Gerard, F. and Naritomi, J. (2018). Value Added Tax in developing countries: Lessons from recent research. *IGC Growth Brief Series 15.*

Ghirmai, E., Logan, S., and Murray, S. (2014). The incidence and impact of Electronic Billing Machines for VAT in Rwanda - IGC. Technical report, International Growth Centre.

Gordon, R. H. and Li, W. (2009). Tax structures in developing countries: Many puzzles and a possible explanation. *Journal of Public Economics*, 93(7-8):855–866.

Gourio, F. and Roys, N. (2014). Size-dependent regulations, firm size distribution, and reallocation. *Quantitative Economics*, 5(2):377–416.

Harju, J., Matikka, T., and Rauhanen, T. (2016). The Effects of Size-Based Regulation on Small Firms: Evidence from Vat Threshold. *VATT Institute for Economic Research Working Paper*, 75.

Keen, M. and Lockwood, B. (2010). The value added tax: Its causes and consequences. *Journal of Development Economics*, 92(2):138–151.

Kleven, H. J. (2014). How Can Scandinavians Tax So Much? *Journal of Economic Perspectives*, 28(4):77–98.

Mudiyanselage, H. K., Rammohan, A., and Chen, S. X. (2020). Tax Effort in Developing Countries: Where is Sri Lanka? *Journal of Tax Administration*, 6(1):162–189.

Naritomi, J. (2019). Consumers as Tax Auditors. *American Economic Review*, 109(9):3031–3072.

Pomeranz, D. (2015). No Taxation without Information: Deterrence and Self-Enforcement in the Value Added Tax. *American Economic Review*, 105(8):2539–2569.

Sow, S. and Gebresilasse, M. (2020). Effect of VAT Adoption on Manufacturing Firms in Ethiopia. *International Journal of Economics and Finance*, 12(10):85.

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Chapter 2

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WHAT IMPAIRS THE "MONEY MACHINE" OF VAT IN DEVELOPING COUNTRIES?

2.1   Introduction

VAT has been regarded as a 'money machine' for government revenue, and its rise is considered as a significant development in tax instruments and tax administration (Keen, 2007; Keen and Lockwood, 2010). Proponents of VAT claim not only that it generates higher tax revenue, but also that it improves the overall tax administration and compliance. Some studies even suggest that VAT improves the aggregate production efficiency of a country (Boadway and Sato, 2009; Adhikari, 2020). Developing countries introduced VAT mainly to increase tax revenue whereas for some developed countries the objective is to improve the tax mix by increasing the indirect tax share.

However, recent evidence shows that the effectiveness of VAT in revenue generation is not as desirable as it had been expected mainly due to the informality and information problem in developing countries. Keen and Lockwood (2010) find that the long run effect of the presence of VAT on the overall revenue-GDP ratio is modest, at about 4.5%. The effect is stronger in rich countries because of their capacity to deal with the administrative and compliance challenges from VAT. For Sub-Saharan countries, they even find negative predicted revenue gain from VAT. Additionally, Ahlerup et al. (2015) examine the effect of tax innovations on tax revenues in sub-Saharan Africa and find that VAT is not a solution

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to the revenue shortages in African countries. Mudiyanselage et al. (2020) show that the tax-GDP ratio in Sri Lanka has been declining since 1990 and that the introduction of VAT in 2002 did not change the downward trend.

Existing studies suggest that informality and information are two crucial factors that weaken the performance of VAT. Some show that broadening the VAT base could increase the informal sector (Piggott and Whalley, 2001); VAT is less effective dealing with the informal sector compared with trade tariffs (Emran and Stiglitz, 2005); and the credit method used to collect VAT creates informality along the supply chain (De Paula and Scheinkman, 2010). In addition to the problems of informality, the VAT can be undermined by the loopholes in the information revelation particularly because of the 'last mile problem' (Pomeranz, 2015; Gerard and Naritomi, 2018; Naritomi, 2019). However, there is a lack of research examining the overall impact of informality and information on the effectiveness of VAT in revenue mobilization from a macro perspective especially in developing countries.

This paper aims to investigate the main channels that constrain the effectiveness of VAT in increasing the tax capacity of developing countries. We measure the tax capacity using the ratio of tax revenue to the 'True' GDP, where the 'True' GDP is the sum of the reported GDP and the un-reported shadow economy. In this aspect, our paper differs from Keen and Lockwood (2010) and Ahlerup et al. (2015) which use the revenue ratio and tax-GDP share as measurements of tax capacity. Our new measurement allows us to identify the changes in tax capacity due to the variations in informal sector after VAT introduction. Then we decompose the effect of VAT on tax-'True' GDP ratio into three channels: effective tax rate, tax base and informal sector.

We use the number of neighbouring countries with VAT as the instrumental variable (IV) to overcome any possible endogeneity in the identification. Other studies in the literature have used a similar strategy: Alavuotunki et al. (2019)

adopt the previous values of neighbouring countries' VAT systems as an instrument of VAT introduction; Ahlerup et al. (2015) employ a two-stage procedure to deal with the self-selection problem of VAT adoption by using the number of neighbours with VAT as a significant predictor for whether a given country has VAT.

The 2SLS regression results using difference-in-difference approach with IV show that the presence of VAT has a significant positive impact on both total tax and indirect tax shares in developing countries. Results also reveal that the main channel of increase in tax capacity is the higher effective tax rate, while the tax base declines in response. However, the role of VAT as an information source does not significantly contribute towards the increase in tax revenue in developing countries.

This paper contributes to the literature by revealing the main constraints that limit the effectiveness of VAT in developing countries. Adhikari (2020) highlights that VAT introduction has a meaningful impact on economic efficiency only in high-income countries while it has no significant effect in low-income countries. We show that the reason for such an insignificant contribution in developing countries are a strong negative response in the tax base and a weak information role. Related papers include Desai and Hines (2005) who show that presence of VAT has a negative impact on trade performance in low income countries and claim that this could be due to problems in the rebate process for exporters. Examining the revenue impact of trade liberalization, Baunsgaard and Keen (2010) find that low-income countries with VAT have not recovered revenue lost from trade liberalization than those without VAT.

The paper proceeds with a section to discuss data, variables and motivation (section 2.2). Section 2.3 explains the empirical strategy, followed by the main results in section 2.4. Section 2.5 discusses the mechanism explicitly and section 2.6 provide additional results. Section 2.7 of this chapter provides the conclusion.

2.2   Data, Main Variables and Motivating Facts

2.2.1   Data Description

Our study considers 127 developing countries for the period 1991-2015. The selection of countries is based on the analytical classification by the World Bank where countries that have per capita Gross National Income (GNI) lower than USD 12,055 are considered as developing countries. The sample includes 105 countries with VAT and 22 countries without VAT. Countries that introduced VAT have both VAT and without VAT years within the sample period. This allows us to use the difference-in-difference approach at the country level as well as the year level.

In this study, we combine data from several different sources. Tax share data are from the International Centre for Tax and Development (ICTD) data base. ICTD provides a comprehensive data set on government revenue shares (Alavuo-tunki et al., 2019). In this study we use the ICTD government revenue data set November 2017 version. VAT introduction data is from Annex 1 of a book titled 'International Tax Dialogue – Key issues and debates in VAT, SME taxation and the tax treatment of the financial sector' edited by Alan Carter (Carter, 2013). We use a set of control variables most commonly identified as determinants of tax share in the tax literature (Ansari, 1982; Eltony, 2002; Gupta, 2007; Keen and Mansour, 2009; Leuthold, 1991; Tanzi, 1992; Zarra-Nezhad et al., 2016). Those determinants include per capita GDP, agriculture share, import share, export share, level of urbanization, external debt exposure and old-age population.

GDP per capita controls for the different levels of economic conditions while agriculture sector as a share of GDP represents the composition of the output structure. Import and export shares of GDP control for the different trade openness levels and external debt as a share of GNI accounts for the level of foreign debt exposure. Urban population as a share of total population represents the level

of urbanization and the old age population is the population aged 65 years and above as a percentage of total population. These variables control for economic and demographic differences of the countries considered. Data on the control variables is from the World Development Indicators (WDI). We use estimates of the size of informal sector from Medina and Schneider (2018). Summary statistics of the main variables used in the regression are reported in Table 2.1 .

Table 2.1: Summary Statistics

	Observations	Mean	St. Dev.	Min.	Max.
Total Tax Share	1,714	0.10	0.04	0.00	0.42
Indirect Tax Share	1,491	0.07	0.03	0.00	0.33
VAT Introduction	1,714	0.76	0.43	0.00	1.00
VAT Neighbours	1,714	3.01	2.08	0.00	12.00
Log(GDP per Capita)	1,714	7.41	1.09	5.09	9.59
Agriculture Share	1,714	0.20	0.14	0.02	0.79
Import Share	1,714	0.40	0.21	0.08	2.36
Export Share	1,714	0.32	0.17	0.05	1.26
Urban Population	1,714	0.45	0.20	0.05	0.90
External Debt	1,714	0.68	0.88	0.01	13.81
Older Population	1,714	0.05	0.03	0.02	0.20

Source: Authors' estimations using data from ICTD, WDI, VAT introduction and Medina and Schneider (2018).

2.2.2   Measurement of Main Variables

We use two different tax shares to represent tax capacity. Tax_{it} includes two tax revenue categories: total tax revenue and indirect tax revenue as a percentage of 'True' GDP in country i in year t. The total tax revenue includes the direct tax revenue and the indirect tax revenue. The direct tax revenue consists of personal and corporate income tax revenue, while the indirect tax revenue includes taxes on goods and services, excise tax and trade taxes. The purpose of using the indirect tax instead of just the VAT revenue is that the former allows us to make comparison between the measurable tax capacity before and after the introduction of VAT in a country.

'True' GDP is the sum of reported GDP and the informal sector as estimated

by Medina and Schneider (2018).[2] This is a new measurement as opposed to the normal tax-to-GDP share used in tax literature (Keen and Lockwood, 2010; Ahlerup et al., 2015). The 'True' GDP allows us to analyze the changes in tax capacity due to variations in informal sector which is important when we study the mechanisms of change in tax capacity at the second stage.

The dummy variable VAT introduction $VatD_{it}$ is the main independent variable of interest. This variable takes on a value of 1 after the introduction of VAT and zero before. If a country introduced VAT within the first six months of a given year we consider that year as the year of VAT introduction. On the other hand, if VAT was introduced in the last six months of a given year we consider next year as the year of introduction for the dummy variable of VAT introduction.

The number of neighbouring countries with VAT, $VatN_{it}$, is the instrument we use for VAT introduction. We constructed $VatN_{it}$ by considering the VAT introduction of bordering nations of a particular country. This variable takes the value of bordering countries that have introduced VAT in any given year.

2.2.3   Motivating Facts

The introduction of a new taxation system may be considered as a significant policy change. Governments as well as private firms have to allocate time and other resources to adopt to the new taxation technology. As in many other technology related spillovers, the motivation to introduce advanced taxation technology could come in as a spillover effect from neighbouring countries.[3] The argument is that if neighbouring countries have already adopted VAT, that is the best

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[2]We acknowledge that there is no perfect estimation for informal sector. However, we used the informal sector estimates to construct the explained variables. These are not subject to the endogeneity concern of measurement error that undermines the explanatory regressors. The measurement error of the informal sector estimates would not lead to bias estimation unless the measurement error itself is affected by the introduction of VAT. It only increases the standard error of the estimates.

[3]Čížek et al. (2017) show that there is a significant spatial correlation between the VAT introductions of neighbouring countries.

source of information and the motivating factor for a government to introduce VAT. Keen and Lockwood (2010) also highlight that having a higher proportion of neighbouring countries with VAT in the region increases the probability of a country to adopt VAT.

In order to check the validity of this argument we developed a series of world maps for each year to see which countries have introduced VAT in a given year. These maps clearly show that there is a higher tendency for a country to adopt VAT if its neighbours have already introduced VAT. Maps of VAT introduction in every decade from 1970 to 2010 are shown in Figures 2.A.1 to 2.A.5 of the Appendix. In these maps, countries that introduced VAT in the same decade are shown in dark Red and countries that introduced VAT in previous decades are in light Red. Non-VAT countries are shown in White. The manner in which VAT introduction has proceeded in these maps show that it is similar to the diffusion of technology through neighbouring countries. This allows us to use number of neighbouring countries as the instrument for the VAT introduction.

2.3 Empirical Strategy

2.3.1 OLS

In order to estimate the effect of VAT introduction on tax capacity we use a standard difference-in-difference regression as specified below:

$$Tax_{it} = \alpha_t + \eta_r + \varphi \times VatD_{it} + \gamma \times X_{it} + \epsilon_{it} \qquad (2.1)$$

$VatD_{it}$ is a dummy variable of VAT introduction in country i in year t. $VatD_{it}$ = 1 after the VAT introduction and $VatD_{it} = 0$ before the introduction. X_{it} is a vector of control variables including per capita GDP, agriculture share, import

and export shares, urbanization, external debt and older population used in all the equations that follow. The parameter of interest is φ which captures the response of the tax share to the introduction of VAT. Year fixed effects α_t capture the time specific characteristics including the effect of technological change such as computerization over time and regional fixed effects η_r capture the region-specific characteristics.

2.3.2 Leading Years

In addition to the baseline regression, we estimate the following regression to check whether there is any impact on revenue share before the VAT introduction.

$$Tax_{it} = \alpha_t + \eta_r + \varphi \times VatD_{it} + \sum_{k=1}^{6} \beta_k \times\ VatBD_{it}^k + \gamma \times X_{it} + \epsilon_{it} \qquad (2.2)$$

In this setting, $VatBD_i$ is a set of dummy variables to identify the leading years to VAT introduction from $t-1$ to $t-6$. This enables us to test whether there is any effect on tax share before the VAT introduction particularly considering the declining trend of tax share prior to the VAT introduction as shown in Figure 2.1.

2.3.3 Event Study

Another way of looking at the VAT introduction is to consider it as an event and analyze the impact of its introduction on tax share before and after the event. Following regression is considered along the lines of the event study by Li et al. (2016).

$$Tax_{it} = \alpha_t + \eta_r + \varphi_k \times \sum_{k=-15}^{15} D_{it}^k + \gamma \times X_{it} + \epsilon_{it} \qquad (2.3)$$

D_{it}^k is a set of dummy variables that identify the period before and after VAT

introduction. For the event study analysis we consider a period of 15 years before and 15 years after the VAT introduction due to the availability of higher level of data.

Figure 2.1: Tax Share Based on Calendar Year and VAT Year

Source: Authors' estimation using ICTD and VAT introduction data.
Note: In this figure, left panel shows the mean tax share of all countries in the sample for calendar years 1980 to 2015. It shows that there is an increasing trend in tax share over a 25 year period. However, the right panel shows the mean tax share based on the VAT introduction year. In this graph we consider 15 years before the VAT introduction and 15 years after the VAT introduction. According to this graph it is clear that countries experienced a decline in tax share prior to the introduction of VAT. The situation has improved significantly after the VAT introduction and provide a more consistent revenue flow compared to the non-VAT period.

2.3.4   IV

The estimated coefficient of φ in Eq. (2.1) could be potentially biased due to endogeneity caused by reverse causality. Specifically, endogeneity is a concern if the decision to introduce VAT is taken as a remedial action to overcome weak revenue performance.[4]   Figure 2.1 shows the change in tax share before and 15 years after the introduction of VAT and it is clear that there is a decline in tax share from around 7 years before the VAT introduction. Therefore, it could be assumed that governments decided to introduce VAT to improve the revenue performance creating a reverse causality problem in our model. In order to overcome this, we use the number of neighbouring countries that introduced

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[4]Ufier (2014) also explains that normal regression techniques will provide biased estimates as countries decided to introduce VAT may be fundamentally different from the ones that decided not to introduce.

VAT as an instrument to the VAT introduction dummy.[5]

The corresponding reduced form regression is given by;

$$Tax_{it} = \alpha_t + \eta_r + \beta \times VatN_{it} + \gamma \times X_{it} + \epsilon_{it} \tag{2.4}$$

where $VatN_{it}$ refers to the number of bordering countries that introduced VAT for each country each year. The first-stage regression with the instrumental variable can be expressed as follows;

$$VatD_{it} = \alpha_t + \eta_r + \varphi \times VatN_{it} + \gamma \times X_{it} + \epsilon_{it} \tag{2.5}$$

The instrument is correlated with the VAT introduction of a particular country. This is because VAT introduction of neighbouring countries has a positive impact on VAT introduction in the host country due to diffusion of technology as discussed in section 2.2.3 and shown in maps of VAT introduction in appendix Figures 2.A.1 to 2.A.5. However, the instrument is exogenous as the tax capacity of the host country is not determined by the number of neighbouring countries with VAT. The IV regression is implemented using the 2SLS combining Eq. (2.5) and Eq. (2.1) respectively as the first and the second stage.

2.4   Empirical Results

2.4.1   OLS Estimation

Table 2.2 reports the baseline OLS regression result of Eq. (2.1). Panel A of Table 2.2 shows the results for total tax share while panel B shows the results

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[5]Ebeke and Ehrhart (2011); Alavuotunki et al. (2019) use share of VAT neighbour as the IV in their studies and Ahlerup et al. (2015) use the number of neighbouring countries with VAT in a two stage procedure to estimate the impact of VAT on tax revenue in Sub-Saharan Africa.

of the indirect tax share. The columns in each panel shows the results with and without control variables. Column (1) shows that VAT introduction has a positive and significant impact on total tax share, but, it is not significant when control variables are included as shown in column (2). When we consider indirect tax share as the dependent variable in columns (3) and (4), VAT introduction is not significant with or without control variables. The coefficients of control variables with total tax share and indirect tax share as shown in columns (2) and (4) are in line with the previous literature. Income levels have a positive and significant relationship with tax share while agriculture share has a significant negative relationship. Tax share has a positive relationship with imports but exports obviously has a negative relationship. In almost every country there are indirect taxes imposed on imports and as a result, higher imports generate higher tax revenue for the government. On the other hand, exports are taxed at zero rate for VAT in many countries where exporters need not to charge output VAT but can claim VAT refund on input VAT paid in the production process. This policy is in place to maintain the competitiveness in the international market and promote exports. In keeping with Zarra-Nezhad et al. (2016) urbanization has a negative relationship with tax share. External debt has a negative relationship while a larger elderly population is positively related to tax shares. Appendix Table 2.A.1 and 2.A.2 show the regression results with the inclusion of the pre-treatment dummies up to six years before the VAT introduction for total and indirect tax shares respectively. None of the pre-treatment dummy variables in any of the models are significant. This suggests that previous policy changes have not affected the decline in tax shares before the VAT introduction or any previous trends. Additionally, the results of the VAT dummy and the control variables are consistent with previous OLS regression results.

The event study considering 15 years before and after the VAT introduction period shows that government tax revenue shares were fluctuating before the VAT introduction but shows improvement post introduction period. However, when

the control variables are included in the event study model the improvement of tax share after the VAT introduction fades away. Figure 2.2 and 2.3 show coefficient plots of the event study with and without control variables for two types of tax shares. Regression results of the event study are available in Table 2.A.3 of the Appendix.

Table 2.2: Effect of VAT on Tax Share - OLS

	Dependent Variable:			
	Total Tax Share		Indirect Tax Share	
	Panel A		Panel B	
	(1)	(2)	(3)	(4)
VAT Introduction	0.007***	0.001	0.003	0.003
	[0.003]	[0.002]	[0.002]	[0.002]
Log(GDP per Capita)		0.015***		0.004***
		[0.002]		[0.001]
Agriculture Share		-0.093***		-0.066***
		[0.011]		[0.009]
Import Share		0.126***		0.086***
		[0.006]		[0.005]
Export Share		-0.080***		-0.048***
		[0.007]		[0.006]
Urban Population		-0.056***		-0.020***
		[0.008]		[0.006]
External Debt		-0.005***		-0.003***
		[0.001]		[0.001]
Older Population		0.622***		0.260***
		[0.050]		[0.047]
Constant	0.079***	-0.013	0.080***	0.035***
	[0.012]	[0.018]	[0.005]	[0.012]
Regional FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1,714	1,714	1,491	1,491
R-squared	0.190	0.489	0.206	0.415

Source: Authors' estimations using data from ICTD, WDI and VAT adoption. Note: Standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. OLS estimation results from regression of Eq. (2.1). The VAT introduction dummy is statistically significant only with total tax share when no control variables are included. This results could be due to the potential endogeneity problem discussed in section 2.3.4.

Figure 2.2: Effect of VAT on Total Tax Share
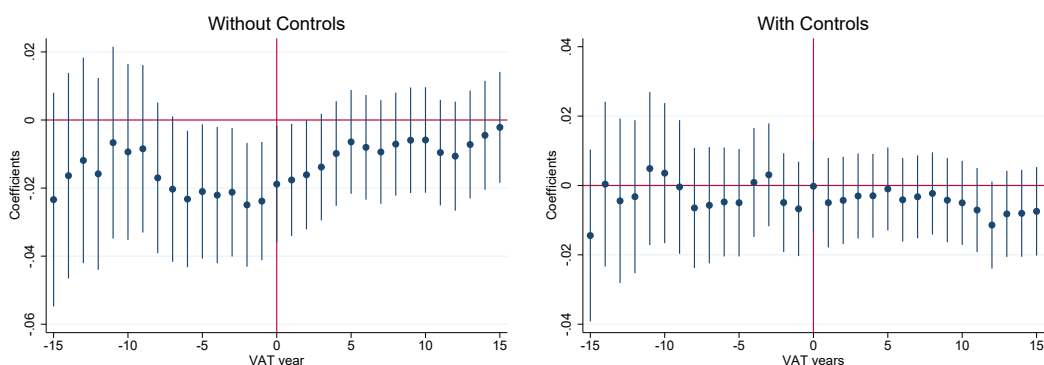
Source: Authors' estimation using ICTD and VAT introduction data.
Note: In this figure, the left panel shows the coefficient values of the year dummies on total tax share (with 95% confidence interval) in the event study based on Eq. (2.3) without including control variables. There are fluctuations of coefficients of year dummies before the VAT introduction but shows a significant improvement after the introduction. This is similar to the graph in Figure 2.1 where post VAT introduction shows significant improvement in tax share. The right panel shows the event study including control variables. After including control variables, VAT introduction is no longer significant in improving tax share. This is similar to the OLS results with control variables. As discussed previously, this could be due to the possible endogeneity. We address the problem in Section 2.3.4 using IV approach.

Figure 2.3: Effect of VAT on Indirect Tax Share
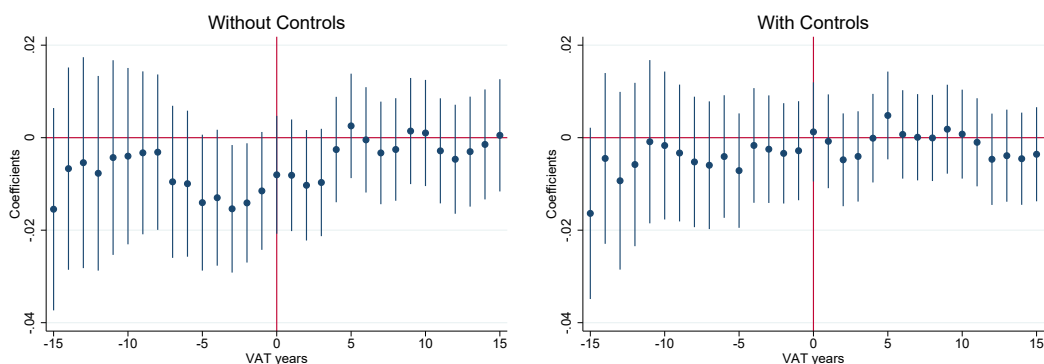
.

Source: Authors' estimation using ICTD and VAT introduction data.
Note: In this figure, the left shows panel the coefficient values of the year dummies on indirect tax share (with 95% confidence interval) in the event study based on Eq. (2.3) without including control variables and the right panel shows the event study including control variables. The fluctuations of coefficients are similar to Figure 2.2

2.4.2   IV Estimation

All the different specifications in Section 2.4.1, including the baseline OLS, leading

years, and the event study, do not show a significant impact of VAT introduction

on tax capacity when the control variables are included in the model. As discussed in the empirical strategy section 2.3.4 these results could be biased due to an endogeneity problem. Therefore, we correct this problem by introducing an IV approach where VAT introduction is instrumented by the number of neighbouring countries with VAT.

Results of the 2SLS based on Eq. (2.5) and Eq. (2.1) are presented in Table 2.3. Panel A shows the reduced form and IV results for the total tax share while panel B shows the same results for indirect tax share. Results of the IV correction show that VAT introduction is positive and significant for both total and indirect tax shares. The coefficient of 0.134 for total tax share shows that introduction of VAT could increase total tax share by 13 percentage points. Compared to the baseline specification which shows a positive but weak relationship between VAT introduction and tax share, the IV results shows a strong positive relationship. The first stage predicting values of the IV are 0.017 and 0.023 respectively and significant at 1% level. Test results of Wu-Hausman and Durbin show that the dummy variable of VAT introduction is endogenous. At the same time, higher eigenvalue F statistics compared to critical values indicate the validity of the IV. Detailed first stage results are available in Table 2.A.4 of the Appendix.

As shown in Table 2.3, per capita GDP, import share and older population have a statistically significant positive relationship with both total and indirect tax share. This is similar to the results shown in Table 2.2 under OLS estimation. Agriculture share and export share show significant negative relationship with tax share again similar to the OLS estimation. As explained in section 2.4.1, these relationships with control variables are in line with previous literature on determinants of tax share. However, urban population and external debt is not significant in the IV estimation.

Table 2.3: Effect of VAT on Tax Share - IV Approach

	Dependent Variable:			
	Total Tax Share		Indirect Tax Share	
	Panel A		Panel B	
	Reduced form	IV	Reduced form	IV
	(1)	(2)	(3)	(4)
VAT Introduction		0.134***		0.044**
		[0.046]		[0.020]
VAT Neighbours	0.002***		0.001**	
	[0.000]		[0.000]	
Log(GDP per Capita)	0.015***	0.012***	0.004***	0.003**
	[0.002]	[0.003]	[0.001]	[0.002]
Agriculture Share	-0.095***	-0.033	-0.066***	-0.049***
	[0.011]	[0.028]	[0.009]	[0.013]
Import Share	0.131***	0.150***	0.088***	0.096***
	[0.006]	[0.013]	[0.005]	[0.007]
Export Share	-0.081***	-0.088***	-0.048***	-0.052***
	[0.007]	[0.013]	[0.006]	[0.007]
Urban Population	-0.057***	-0.009	-0.020***	-0.008
	[0.008]	[0.021]	[0.006]	[0.009]
External Debt	-0.004***	0.006	-0.003***	0.000
	[0.001]	[0.004]	[0.001]	[0.002]
Older Population	0.561***	0.296**	0.255***	0.152**
	[0.051]	[0.143]	[0.047]	[0.075]
Constant	-0.020	-0.099**	0.033***	-0.015
	[0.018]	[0.043]	[0.012]	[0.022]
Regional FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1,714	1,714	1,491	1,491
First stage predicting numbers				
VAT neighbours		0.017***		0.023***
		[0.005]		[0.006]
Econometric Statistics				
Wu-Hausman F		26.227***		5.652**
Durbin (score) chi2(1)		26.423***		5.781**
Minimum eigenvalue F statistic		11.941		15.829

Source: Authors' estimations using data from ICTD, WDI and VAT introduction.
Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Results of the IV approach show that VAT introduction has a significant positive impact on both tax shares. Test results at the bottom confirms the endogeneity problem and the validity of the IV. These results confirm our argument that OLS results provide a bias estimate due to the endogeneity of VAT introduction.

2.4.3   Test of Exclusion Restriction

One key assumption when using an IV is that it should not be correlated with unobserved factors driving the outcome. The only impact on the outcome should be through the endogenous variable. In our study, the number of neighbouring countries with VAT should only have an impact on tax capacity through the VAT introduction of that particular country. We need to test the exclusion restriction by checking whether the IV directly affects either tax revenue or GDP. Although we cannot rule out all cases of violation of exclusion restrictions, we attempt to test the exclusion restriction using two different tests.

Firstly, we use *Personal Income Tax Share in GDP* as the dependent variable in the IV model as a falsification test. *Personal Income Tax Share in GDP* may change if the overall tax capacity of a country is affected by the introduction of VAT in neighbouring countries. Personal income tax is an appropriate tax for this test because it is fairly independent of the VAT. Tax payers of the personal income tax are individual residents, unlike the VAT tax payers. We use the results from section 2.6.1, column 2 of Table 2.5, where VAT introduction has no significant impact on personal income tax share when using number of neighbouring countries with VAT as an instrumental variable. This shows that, VAT introduction in neighbouring countries has no impact on either the income levels of the tax payers in the country of interest or other types of tax revenues that are unrelated to VAT.

Secondly, we do another test by randomly assigning a placebo VAT introduction year for the countries by considering the period before its actual VAT introduction. Then we repeated our IV regression using the number of neighbouring countries as the instrument for the newly assigned placebo VAT introduction dummy. We conduct this random test 10,000 times and draw the Kernel density graph for the coefficients of VAT introduction dummy $\hat{\varphi}$ shown in appendix Fig-

ure 2.A.6. The figure shows that there is a striking spike in the distribution of $\hat{\varphi}$ around zero, suggesting the direct effect of the IV on the dependent variable is very likely small. The solid vertical line shows the coefficient value of the actual VAT introduction. Eighty-one percent of the placebo VAT introduction coefficients are lower than actual VAT introduction coefficient. The mean of $\hat{\varphi}$ is -0.057 and indicated by the dash vertical line which is lower than the actual coefficient. It implies that estimated actual effect from the IV would not over-estimate the true effect due to any potential violation of the exclusion restriction.

2.5 Mechanism

Our analysis in this section is dedicated to understanding the channels through which tax capacity has increased following the VAT introduction. There could be three possible channels: (1) Effective tax rate; (2) Tax base; and (3) Informal sector. The equation below summarizes the channels through which tax share could be affected after the VAT introduction.

$$\frac{Indirect\,Tax}{`True'\,GDP} = \frac{Indirect\,Tax}{Tax\,Base} \times \frac{Tax\,Base}{Reported\,GDP} \times \frac{Reported\,GDP}{`True'\,GDP} \qquad (2.6)$$

Mechanically, introduction of new taxes provides the opportunity for governments to increase tax revenue from existing firms. This could also be the case with VAT as the government would obviously want VAT to generate higher revenue especially due to weak revenue performance in these countries in the period leading up to the VAT introduction. Therefore, increase in tax capacity after the VAT introduction could be due to the increase in tax rate. In order to test the change in tax rate we use effective tax rate: that is tax revenue as a share of tax base to check whether there is a change in the effective tax rate after the VAT introduction. In this analysis we use consumption as the tax base and indirect tax as the tax revenue component.

Another possible channel of change in tax capacity after the VAT introduction could be through the tax base. Firms have a behavioural response to the tax reforms introduced by the government. As discussed in the literature (Pomeranz, 2015; Krever, 2008) this would result in either an increase or decrease in tax base. We use tax base as a share of reported GDP to measure the change in tax base after the VAT introduction.

Annicchiarico and Cesaroni (2018) find that informal sector would lead to severely miscalculating the economic effect of tax reforms. Therefore, another possible channel through which tax capacity could change after the VAT introduction could be due to the existence of the informal sector. Proponents of VAT argue that VAT reforms play a vital role in bringing informal firms to the formal sector. With the VAT introduction, firms in the informal sector are encouraged to register for VAT for of several reasons. Firstly, when larger firms in the formal sector become VAT registered they always seek out VAT registered firms in the supply chain to claim the input tax credit. That would encourage the small firms in the supply chain to register for VAT. De Paula and Scheinkman (2010) show that small firms in Brazil are more likely to register for VAT if their suppliers and/or customers are registered. If small firms do not get the VAT registration they have to either sell at a discount or they will lose business contracts with formal firms. However, if firms in the informal sector supply directly to the unregistered final customers, the rising cost could be shifted downward. In that case, tax incidence depends on the bargaining power of sellers and buyers in the market, and on the elasticity of demand and supply. In most cases, a business has to take a fair share of the rising cost unless it has full bargaining power through which the total costs can be shifted to its customers. Secondly, for unregistered firms, VAT paid on supplies and imports becomes a final tax as they cannot claim input tax and that increase their total cost (Ahlerup et al., 2015). Therefore, there is a valid argument that VAT introduction helps to curtail informal sector by encouraging smaller firms to join the formal stream.

However, VAT introduction could also have a deterrence effect on the informal sector. With the introduction of VAT, government is now equipped with new taxation technology that gives better access to firms' financial information via the self reporting feature of VAT. This could limit the opportunity for small firms to hide their financial transactions and evade taxes. Therefore, they might be discouraged to join the formal sector. Moreover, higher compliance and administration cost could also deter informal sector firms from joining the formal sector (Faridy et al., 2014). Another aspect of this is the VAT registration threshold (Keen and Mintz, 2004). It could create a bunching phenomenon due to the self-selection of registration by the small firms in which many of them would decide to remain unregistered (Harju et al., 2016). Additionally, Zu (2017) also explain that the registration threshold which is a form of technical concession, creates significant legal and economic distortions as well as administrative and compliance burdens. Therefore, to investigate whether the variation in informal sector has helped countries to increase tax capacity, we use reported GDP as a share of 'True' GDP as another channel.

Table 2.4 presents the IV results of the three channels through which indirect tax share could increase after the VAT introduction. The regressions are based on the 2SLS combining Eq. (2.5) and Eq. (2.1). Column (1) shows the contribution of effective tax rate towards the increase in tax share. The introduction of VAT has significantly increased the effective tax rate. This suggests that increase in tax capacity after the VAT introduction has mainly channeled through the increase in effective tax rate. Column (2) which represents the change in tax base shows a significant negative relationship with VAT introduction. This indicates a decrease in tax base after the VAT introduction, which this may be due to the behavioral response by firms to the increase in effective tax rate. This is in line with Alm and El-Ganainy (2013), who find that an increase in VAT rate would lead to a reduction in aggregate consumption. Column (3) suggests that the relationship between informal sector and VAT introduction is not statistically significant, i.e.

there is no change in informal sector after the VAT introduction.

This result emphasises that increase in tax share after the VAT introduction is a result of the increase in effective tax rate on the small tax base. Especially in developing countries VAT is not contributing toward the increase in tax capacity through encouraging informal firms to the formal stream. Conversely, the ultimate objective of introducing VAT is to have a larger tax base with a lower tax rate to generate higher tax capacity. If it is implemented successfully the design of the VAT scheme with enhanced information flow through paper trails will enable achieving that objective. However, governments in developing countries have failed to reap the benefits of these advanced features of the VAT scheme. Instead they are still utilizing the conventional and more convenient method of imposing further tax burden on small tax base to achieve higher tax share.[6]

2.6 Additional Results

2.6.1 Effect on Direct Taxes

Any reform in one type of tax could have spillover effects on other types of taxes in the revenue mix. In this section we use IV approach considering direct tax as a share of 'True' GDP as the dependent variable to check whether VAT introduction has spillover effect on direct taxes. Column (1) of Table 2.5 shows how VAT introduction has affected direct tax as a share of 'True' GDP. According to these results we observe that direct tax share has had a positive significant impact after the VAT introduction. This could be due to an improved information flow to the tax authorities after VAT introduction and the complimentary effect between direct and indirect taxes.

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[6]Nevertheless, the magnitude of these results could vary across countries due to differences in the VAT scheme. One such difference is the registration threshold. However, due to the unavailability of data on the registration threshold across countries and time, we are unable to address the heterogeneous effect across countries.

Table 2.4: Channels of VAT Effect on Indirect Tax Share

	Dependent Variable:		
	Indirect Tax/ Tax base	Tax base/ GDP Reported	GDP Reported / GDP 'True'
	(1)	(2)	(3)
VAT Introduction	0.157***	-0.291***	0.032
	[0.046]	[0.092]	[0.036]
Log(GDP per Capita)	0.008*	-0.041***	0.030***
	[0.004]	[0.008]	[0.003]
Agriculture Share	-0.027	0.009	0.067***
	[0.031]	[0.061]	[0.024]
Import Share	0.063***	0.791***	0.046***
	[0.016]	[0.033]	[0.013]
Export Share	0.030*	-0.871***	-0.076***
	[0.016]	[0.033]	[0.013]
Urban Population	0.006	0.038	-0.002
	[0.021]	[0.042]	[0.016]
External Debt	0.008*	-0.021**	0.002
	[0.004]	[0.009]	[0.003]
Older Population	0.087	1.295***	-0.172
	[0.172]	[0.345]	[0.135]
Constant	-0.129**	1.266***	0.523***
	[0.051]	[0.103]	[0.040]
Regional FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	1,491	1,491	1,491

Source: Authors' estimations using data from ICTD, WDI and VAT introduction.
Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. 2SLS combining Eq. (2.5) and Eq. (2.1). This table shows the mechanism through which indirect tax revenue share increases after the VAT introduction based on Eq. (2.6). The main contributor to the increase in indirect tax share is the effective tax rate (column (1)). There is a negative impact on the tax base (column (2)) and notably, there is only a small contribution from the improvement in information flow (column (3)).

For example, when firms provide sales and cost of sales information for VAT purposes, it also reveals information on profitability on which the firm has to pay corporate tax. Additionally, if a VAT registered firm has VAT registered customers, tax authority will have the access to paper trail of the firms' transactions through its customers. This additional information limits firms' ability to pay lower corporate income tax through under-reporting of profitability. There-

fore, there could be a positive information spillover effect of VAT introduction on corporate tax revenue.[7]

In order to further confirm our results we divided direct tax share into personal income tax and corporate income tax. Columns (2) and (3) of Table 2.5 show the results of personal and corporate tax revenue as a share of 'True' GDP respectively. As expected there is a positive and statistically significant impact on corporate income tax which validates our argument of positive information spillover of VAT introduction to corporate income tax. However, personal income tax has no impact after VAT introduction since VAT is only associated with firms.

Comparing results for the channels of increasing tax share with direct taxes, reveals an important aspect of the information role of VAT. When we investigate the mechanism we find that the information role of VAT is not effective in encouraging informal sector firms to the formal stream. However, we also find that extra information after VAT introduction helps to increase corporate tax revenue. This implies that the information role of VAT in developing countries is only effective in providing information about the firms that are already in the formal stream but are not effective in approaching the informal sector. This is particularly important in designing tax policies since different approaches would be required to address these two different outcomes.

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[7]It is hard to attribute the increase in the total corporate tax revenue after VAT introduction to an increase in the number of corporate tax payers because many new VAT registrations could be unincorporated small businesses which do not pay the corporate income tax.

Table 2.5: Effect of VAT on Direct Taxes

| | Dependent Variable: | | |
| | Direct Tax / GDP 'True' | PI Tax / GDP 'True' | CI Tax / GDP 'True' |
	(1)	(2)	(3)
VAT Introduction	0.075***	0.016	0.047**
	[0.025]	[0.010]	[0.021]
Log(GDP per Capita)	0.011***	0.006***	0.002
	[0.002]	[0.001]	[0.002]
Agriculture Share	0.017	-0.012**	0.011
	[0.016]	[0.005]	[0.010]
Import Share	0.053***	0.014***	0.017***
	[0.008]	[0.003]	[0.006]
Export Share	-0.023***	-0.006*	0.012
	[0.008]	[0.004]	[0.007]
Urban Population	-0.011	-0.015***	-0.001
	[0.011]	[0.004]	[0.007]
External Debt	0.003	0.001	0.003
	[0.002]	[0.001]	[0.002]
Older Population	0.044	0.042	-0.118
	[0.085]	[0.029]	[0.076]
Constant	-0.096***	-0.029***	-0.051***
	[0.027]	[0.009]	[0.016]
Regional FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	1,509	1,150	1,054

Source: Authors' estimations using data from ICTD, WDI and VAT introduction.

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. 2SLS combining Eq. (2.5) and Eq. (2.1). This table further breaks down the increase in tax capacity into different types of direct taxes using IV approach. Direct tax has also contributed positively to the increase in tax revenue after the VAT introduction. Columns (2) and (3) show the breakdown of direct taxes into personal income tax and corporate income tax where only corporate tax share is positive and significant as expected. This result suggests that VAT introduction has a positive impact on direct tax revenue and furthermore, that impact is coming through corporate income tax. VAT introduction has no impact on personnel income tax share.

2.6.2   Heterogeneity

In practice, VAT schemes in various countries differ from each other. Some countries have multiple VAT rates, imposing lower VAT rate on essential goods and service and higher VAT rate on luxury goods. At the same time some countries use a single VAT rate. However, even the single VAT rate can differ from one country to another, as some countries have a lower VAT rate and some countries have a higher VAT rate. Therefore, it is important to study how the heterogeneity can affect the tax capacity and its channels. We use interaction terms in our IV model in order to understand the heterogeneity effect. Accordingly, we change Eq. (2.4) and Eq. (2.5) by interacting $VatD_{it}$ with standard VAT rate of each country as one interaction term and $VatD_{it}$ with number of VAT rates for each country in each year as another interaction term.

Table 2.6 shows the results of total effect and effect on channels. Results of column (1) showing the interaction term between VAT introduction dummy and standard VAT rate again confirm that countries with a higher standard VAT rate after VAT introduction has a significant positive impact on tax capacity. Furthermore, as shown in columns (2) and (3) most of this positive impact is coming from the higher VAT rate and it has a negative impact on tax base as we find in the mechanism results (Table 2.4). Column (4) suggests that the impact of the interaction term on reported GDP as a share of 'True' GDP is positive but not statistically significant. However, the baseline coefficient of the reported GDP share is now negative and significant. This means that the effect of VAT introduction on informal sector will be positive until the standard VAT rate is higher enough. But on average, the effect of VAT introduction on reported GDP share is not significant (Column (3) of Table 2.4). This could be understood as if a country's VAT rate is significantly higher, there is a decrease in informal sector compared to a country with a lower standard VAT rate. It might be because a higher VAT rate leads to higher losses for informal sector firms if they do not

come into the formal stream. For example, in a country with a higher VAT rate, the incentive for formal sector firms to find another formal sector firm in the supply chain is higher than in a country with lower VAT rate.

Therefore, there is a higher probability that informal sector firms lose business if they do not register for VAT. Additionally, informal firms' cost of production will also increase significantly as they are unable to claim input VAT. Of course, more micro-evidence is still needed to test this explanation.

One caveat we need to consider in interpreting these results is that, the effects we identify may include not only that of the VAT introduction, but also other changes that were taking place along with the VAT introduction such as modernization of tax administration. Establishment of 'Large Tax Payer Unit' is one such change happened in most of the countries that adopted the VAT. However, in this paper we try to address this concern to a certain degree by considering the role of information. With our findings we argue that the role of information is quite weak especially in developing countries. Furthermore, tax capacity may depend not only on the tax administration technology, but also on political and fiscal institutions that may affect the incentives of tax enforcement and better utilization of the technology. Many countries, as we know, still lack sufficient incentives (Chen, 2017).

Table 2.6: Effect of VAT Rate and Multiple VAT Rates on Indirect Tax Share

| | Dependent Variable: | | | |
| | Ind. Tax / GDP 'True' | Ind. Tax / Tax Base | Tax Base / GDP Reported | GDP Rep. / GDP 'True' |
	(1)	(2)	(3)	(4)
VAT Introduction	-0.088***	-0.219***	0.285***	-0.138**
	[0.027]	[0.047]	[0.091]	[0.055]
VAT × Std VAT rate	0.552***	1.629***	-3.290***	0.541
	[0.191]	[0.331]	[0.636]	[0.382]
VAT × No. of VAT rates	0.003	0.006	0.025*	-0.010
	[0.005]	[0.008]	[0.015]	[0.009]
Std VAT rate	-0.173	-0.791***	2.498***	0.171
	[0.150]	[0.260]	[0.499]	[0.300]
No. of VAT rates	-0.005	-0.012*	-0.021	0.014*
	[0.004]	[0.007]	[0.014]	[0.008]
Log(GDP per Capita)	0.009***	0.015***	-0.038***	0.036***
	[0.002]	[0.003]	[0.006]	[0.003]
Agriculture Share	-0.074***	-0.096***	0.044	0.009
	[0.012]	[0.020]	[0.039]	[0.023]
Import Share	0.102***	0.023*	0.845***	0.057***
	[0.008]	[0.013]	[0.026]	[0.015]
Export Share	-0.058***	0.058***	-0.907***	-0.077***
	[0.008]	[0.014]	[0.026]	[0.016]
Urban Population	-0.045***	-0.081***	0.117***	-0.081***
	[0.008]	[0.013]	[0.025]	[0.015]
External Debt	-0.006***	-0.010***	-0.019***	-0.007*
	[0.002]	[0.003]	[0.007]	[0.004]
Older Population	0.301***	0.587***	0.108	0.168
	[0.052]	[0.091]	[0.174]	[0.105]
Constant	0.026	0.057	0.886***	0.577***
	[0.021]	[0.037]	[0.070]	[0.042]
Regional FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1,415	1,415	1,415	1,415

Source: Authors' estimations using data from ICTD, WDI and VAT introduction.
Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. 2SLS combining Eq. (2.5) and Eq. (2.1). Both number of VAT rates and standard VAT rate are standardized based on the lowest value. The interaction term between $VatD_{it}$ and standard VAT rate shows that higher the standard VAT rate, higher the tax burden and lower the tax base. The coefficient of reported GDP share is not statistically significant for the interaction term, however, the baseline coefficient is now significantly negative.

2.7   Conclusion

The introduction of VAT is a critical juncture in tax reforms especially in developing countries. It is apparent that governments in developing countries introduced VAT at a time of weak revenue performance. Therefore, it is important to investigate the success of VAT introduction in increasing tax capacity and the underlying mechanisms of such an increase. Abundant studies have been conducted on different aspects of VAT including both theoretical and empirical analysis. However, to the best of our knowledge there is no study that examines the underlying mechanisms of increasing tax capacity after VAT introduction. Using panel data from 1991 to 2015 for 127 developing countries, we first investigate the effect of VAT introduction on total and indirect tax shares and in the next stage we study channels through which VAT introduction could increase indirect tax share.

The results of the IV model show that VAT introduction has significantly helped in increasing tax share in developing countries compared to the OLS estimation. These results emphasise the importance of using the IV approach especially due to the possible endogeneity problem of VAT introduction in the OLS estimation. The results of the next stage reveal that the increase in indirect tax share after the VAT introduction is mainly channeled through the increase in effective tax rate. Governments have used VAT introduction to earn higher tax revenue by increasing the tax burden on the existing tax base and overcome the weak revenue performance prevailed in the pre-VAT period. This is further established by the decline in the tax base after the VAT introduction as firms responded to such extra burden. More importantly, VAT introduction has no positive impact on encouraging informal firms to the formal sector. This highlights that information role of VAT is not effective in increasing tax capacity in developing countries through curtailing the informal sector.

In addition to these findings, we also investigate the change in direct tax share in response to VAT introduction. The results show that VAT introduction has a positive impact also on direct tax revenue. This implies that VAT introduction has a positive information spillover effect more specifically on corporate income tax. Finally, we focus on how the differences in VAT schemes could affect tax capacity differently. The results show that countries with a higher standard VAT rate could record a decline in informal sector as the costs of operating in the underground economy is higher for informal sector firms than in a country with a lower standard VAT rate.

In this study we could only use regional fixed effects instead of country fixed-effects. The reason is that our IV is time invariant for some countries as number of neighbours with VAT have not changed over the sample period. However, in order to minimize the impact of not using country fixed-effects we have used several control variables to account for any country-specific characteristics. Furthermore, our IV; VAT introduction in neighbouring countries does not depend on any country specific characteristic of the given country. Future research could focus on using different IVs that could capture country fixed effects, consider other possible channels and use different other econometric methods.

VAT has been promoted as one of the best tax reforms in history and it has delivered results especially in improving tax capacity and tax efficiency. However, developing countries have not utilized VAT to its full potential but have continued to use conventional methods to overcome the weak revenue performance. Therefore, governments in developing countries should take maximum advantage of superior taxation technologies such as VAT to further enhance tax capacity and tax efficiency by giving more attention to the information role.

REFERENCES

Adhikari, B. (2020). Does A Value-Added Tax Increase Economic Efficiency ? *Economic Inquiry*, 58(1):496–517.

Ahlerup, P., Baskaran, T., and Bigsten, A. (2015). Tax Innovations and Public Revenues in Sub-Saharan Africa. *The Journal of Development Studies*, 51(6):689–706.

Alavuotunki, K., Haapanen, M., and Pirttilä, J. (2019). The Effects of the Value-Added Tax on Revenue and Inequality. *The Journal of Development Studies*, 55(4):490–508.

Alm, J. and El-Ganainy, A. (2013). Value-added taxation and consumption. *International Tax and Public Finance,*, 20:105–128.

Annicchiarico, B. and Cesaroni, C. (2018). Tax reforms and the underground economy: a simulation-based analysis. *International Tax and Public Finance*, 25(2):458–518.

Ansari, M. M. (1982). Determinants of Tax Ratio: A Cross-Country Analysis. *Economic and Political Weekly*, 17(25):1035–1042.

Baunsgaard, T. and Keen, M. (2010). Tax revenue and (or?) trade liberalization. *Journal of Public Economics*, 94(9-10):563–577.

Boadway, R. and Sato, M. (2009). Optimal Tax Design and Enforcement with an Informal Sector. *American Economic Journal*, 1(1):1–27.

Carter, A., editor (2013). *International Tax Dialogue: Key Issues and Debates in VAT, SME Taxation and the Tax Treatment of the Financial sector*. European Commission.

Chen, S. X. (2017). The effect of a fiscal squeeze on tax enforcement: Evidence from a natural experiment in China. *Journal of Public Economics*, 147:62–76.

Čížek, P., Lei, J., and Ligthart, J. E. (2017). Do Neighbours Influence Value-Added-Tax Introduction? A Spatial Duration Analysis. *Oxford Bulletin of Economics and Statistics*, 79(1):25–54.

De Paula, A. and Scheinkman, J. A. (2010). Value-Added Taxes, Chain Effects, and Informality. *American Economic Journal: Macroeconomics*, 2:195–221.

Desai, M. A. and Hines, J. (2005). *Value-Added Taxes and International Trades: The Evidence.* The University of Michigan Law School.

Ebeke, C. and Ehrhart, H. (2011). Does VAT reduce the instability of tax revenues? *CERDI Working Paper No. E 2011.24,*.

Eltony, M. N. (2002). The Determinants of Tax Effort in Arab Countries. *Arab Planning Institute Working Paper.*

Emran, S. M. and Stiglitz, J. E. (2005). On selective indirect tax reform in developing countries. *Journal of Public Economics*, 89:599–623.

Faridy, N., Copp, R., Freudenberg, B., and Sarker, T. (2014). Complexity, Compliance Costs and Non-Compliance with VAT by Small and Medium Enterprises (SMEs) in Bangladesh: Is there a Relationship? *Australian Tax Forum*, 29(2):281–328.

Gerard, F. and Naritomi, J. (2018). Value Added Tax in developing countries: Lessons from recent research. *IGC Growth Brief Series 15.*

Gupta, A. S. (2007). Determinants of Tax Revenue Efforts in Developing Countries. *IMF Working Papers*, 07(184):1.

Harju, J., Matikka, T., and Rauhanen, T. (2016). The Effects of Size-Based Regulation on Small Firms: Evidence from Vat Threshold. *VATT Institute for Economic Research Working Paper*, 75.

Keen, M. (2007). VAT attacks! *International Tax and Public Finance,*, 14:365–381.

Keen, M. and Lockwood, B. (2010). The value added tax: Its causes and consequences. *Journal of Development Economics*, 92(2):138–151.

Keen, M. and Mansour, M. (2009). Revenue Mobilization in Sub-Saharan Africa: Challenges from Globalization. *IMF Working Paper*, WP/09/157.

Keen, M. and Mintz, J. (2004). The optimal threshold for a value-added tax. *Journal of Public Economics*, 88:559–576.

Krever, R. (2008). Designing and Drafting VAT Laws for Africa. In Krever, R., editor, *VAT in Africa*, pages 17–36. Pretoria University Law Press., Pretoria.

Leuthold, J. H. (1991). Tax shares in developing economies A panel study. *Journal of Development Economics*, 35:173–185.

Li, P., Lu, Y., and Wang, J. (2016). Does flattening government improve economic performance? Evidence from China. *Journal of Development Economics*, 123:18–37.

Medina, L. and Schneider, F. (2018). Shadow economies around the world: what did we learn over the last 20 years? *IMF Working Papers*, 18(17):1–76.

Mudiyanselage, H. K., Rammohan, A., and Chen, S. X. (2020). Tax Effort in Developing Countries: Where is Sri Lanka? *Journal of Tax Administration*, 6(1):162–189.

Naritomi, J. (2019). Consumers as Tax Auditors. *American Economic Review*, 109(9):3031–3072.

Piggott, J. and Whalley, J. (2001). VAT Base Broadening, Self Supply, and the Informal Sector. *American Economic Review*, 91(4):1084–1094.

Pomeranz, D. (2015). No Taxation without Information: Deterrence and Self-Enforcement in the Value Added Tax. *American Economic Review*, 105(8):2539–2569.

Tanzi, V. (1992). Structural factors and tax revenue in developing countries: a decade of evidence. In I. Goldin & L. Winters, editor, *Open Economies: Structural Adjustment and Agriculture*, pages 267–285. Cambridge University Press, Cambridge.

Ufier, A. (2014). Quasi-Experimental Analysis on the Effects of Adoption of a Value Added Tax. *Economics Inquiry*, 52(4):1364–1379.

Zarra-Nezhad, M., Sheikh Ansari, M., and Moradi, M. (2016). Determinants of Tax Revenue: Does Liberalization Boost or Decline It? *Journal of Economic Cooperation and Development*, 37(2):103–126.

Zu, Y. (2017). Reforming VAT Concessions: A Tax Expenditure Analysis . *British Tax Review*, 4:418–437.

Appendix

Table 2.A.1: Effect of VAT on Total Tax Share - OLS with Leading Years

	Dependent Variable: *Tax Share in 'True' GDP*					
	(1)	(2)	(3)	(4)	(5)	(6)
VAT	0.004	0.003	0.003	0.002	0.001	0.001
	[0.003]	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]
1 Year before	0.001	0.000	-0.000	-0.001	-0.001	-0.001
	[0.006]	[0.006]	[0.005]	[0.005]	[0.005]	[0.005]
2 Years before	0.002	0.002	0.001	0.001	0.000	
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	
3 Years before	0.009	0.008	0.008	0.007		
	[0.006]	[0.006]	[0.006]	[0.006]		
4 Years before	0.006	0.005	0.005			
	[0.006]	[0.006]	[0.006]			
5 Years before	0.004	0.004				
	[0.007]	[0.007]				
6 Years before	0.005					
	[0.007]					
GDP per Cap	0.015***	0.015***	0.015***	0.015***	0.015***	0.015***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Agri Share	-0.093***	-0.094***	-0.094***	-0.093***	-0.093***	-0.093***
	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]
Import Share	0.126***	0.126***	0.126***	0.126***	0.126***	0.126***
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]
Export Share	-0.080***	-0.080***	-0.080***	-0.080***	-0.080***	-0.080***
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
Urban Pop	-0.056***	-0.056***	-0.056***	-0.056***	-0.056***	-0.056***
	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]
External Debt	-0.004***	-0.005***	-0.005***	-0.005***	-0.005***	-0.005***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Older Pop	0.620***	0.620***	0.620***	0.621***	0.622***	0.622***
	[0.050]	[0.050]	[0.050]	[0.050]	[0.050]	[0.050]
Constant	-0.016	-0.015	-0.014	-0.014	-0.013	-0.013
	[0.018]	[0.018]	[0.018]	[0.018]	[0.018]	[0.018]
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,714	1,714	1,714	1,714	1,714	1,714
R-squared	0.490	0.490	0.490	0.490	0.489	0.489

Source: Authors' estimations using data from ICTD, WDI and VAT introduction.
Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. This table shows the OLS regression results with pre-treatment dummies up to 6 years before the VAT introduction based on Eq. (2.2) using total tax share. The results show that pre-treatment dummies are not significant which suggests that any possible policy changes prior to the VAT introduction had no impact on subsequent changes in total tax share.

Table 2.A.2: Effect of VAT on Indirect Tax Share - OLS with Leading Years

	Dependent Variable: *Indirect Tax Share in 'True' GDP*					
	(1)	(2)	(3)	(4)	(5)	(6)
VAT	0.005**	0.004*	0.004*	0.004*	0.003	0.003
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
1 year before	0.003	0.003	0.003	0.002	0.002	0.002
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
2 years before	0.003	0.003	0.002	0.002	0.002	
	[0.005]	[0.004]	[0.004]	[0.004]	[0.004]	
3 years before	0.004	0.003	0.003	0.003		
	[0.005]	[0.005]	[0.005]	[0.005]		
4 years before	0.004	0.004	0.003			
	[0.005]	[0.005]	[0.005]			
5 years before	0.002	0.002				
	[0.005]	[0.005]				
6 years before	0.004					
	[0.006]					
GDP per Cap	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Agri Share	-0.066***	-0.066***	-0.066***	-0.066***	-0.066***	-0.066***
	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]
Import Share	0.087***	0.087***	0.087***	0.087***	0.087***	0.087***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
Export Share	-0.049***	-0.049***	-0.049***	-0.049***	-0.048***	-0.048***
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]
Urban Pop	-0.020***	-0.020***	-0.019***	-0.019***	-0.019***	-0.019***
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]
External Debt	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Older Pop	0.260***	0.260***	0.260***	0.260***	0.260***	0.260***
	[0.047]	[0.047]	[0.047]	[0.047]	[0.047]	[0.047]
Constant	0.033***	0.034***	0.034***	0.034***	0.034***	0.035***
	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,491	1,491	1,491	1,491	1,491	1,491
R-squared	0.416	0.415	0.415	0.415	0.415	0.415

Source: Authors' estimations using data from ICTD, WDI and VAT introduction.
Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. This table shows the OLS regression results with pre-treatment dummies up to 6 years before the VAT introduction based on Eq. (2.2) using indirect tax share. The results also show that pre-treatment dummies are not significant suggesting that any possible policy changes prior to the VAT introduction had no impact on subsequent changes in indirect tax share.

Table 2.A.3: Results of the Event Study

	Total Tax Share	Total Tax Share	Indirect Tax Share	Indirect Tax Share
	Dependent Variable:			
	(1)	(2)	(3)	(4)
Log(GDP per Capita)		0.015***		0.002
		[0.002]		[0.002]
Agriculture Share		-0.134***		-0.095***
		[0.014]		[0.012]
Import Share		0.165***		0.115***
		[0.007]		[0.006]
Export Share		-0.098***		-0.058***
		[0.009]		[0.008]
Urban Population		-0.073***		-0.026***
		[0.010]		[0.008]
External Debt		-0.007***		-0.005***
		[0.002]		[0.001]
Older Population		0.860***		0.381***
		[0.065]		[0.059]
VAT(-15)	-0.023	-0.014	-0.015	-0.016*
	[0.016]	[0.013]	[0.011]	[0.009]
VAT(-14)	-0.016	0.000	-0.007	-0.004
	[0.015]	[0.012]	[0.011]	[0.009]
VAT(-13)	-0.012	-0.004	-0.005	-0.009
	[0.015]	[0.012]	[0.012]	[0.010]
VAT(-12)	-0.016	-0.003	-0.008	-0.006
	[0.014]	[0.011]	[0.011]	[0.009]
VAT(-11)	-0.007	0.005	-0.004	-0.001
	[0.014]	[0.011]	[0.011]	[0.009]
VAT(-10)	-0.009	0.004	-0.004	-0.002
	[0.013]	[0.010]	[0.010]	[0.008]
VAT(-9)	-0.008	-0.000	-0.003	-0.003
	[0.013]	[0.010]	[0.009]	[0.008]
VAT(-8)	-0.017	-0.006	-0.003	-0.005
	[0.011]	[0.009]	[0.009]	[0.007]
VAT(-7)	-0.020*	-0.006	-0.010	-0.006
	[0.011]	[0.009]	[0.008]	[0.007]
VAT(-6)	-0.023**	-0.005	-0.010	-0.004
	[0.010]	[0.008]	[0.008]	[0.007]
VAT(-5)	-0.021**	-0.005	-0.014*	-0.007
	[0.010]	[0.008]	[0.007]	[0.006]
VAT(-4)	-0.022**	0.001	-0.013*	-0.002
	[0.010]	[0.008]	[0.007]	[0.006]
VAT(-3)	-0.021**	0.003	-0.015**	-0.002
	[0.010]	[0.008]	[0.007]	[0.006]
VAT(-2)	-0.025***	-0.005	-0.014**	-0.003
	[0.009]	[0.007]	[0.007]	[0.006]
VAT(-1)	-0.024***	-0.007	-0.012*	-0.003
	[0.009]	[0.007]	[0.006]	[0.005]
VAT 0	-0.019**	-0.000	-0.008	0.001

	(1)	(2)	(3)	(4)
	[0.009]	[0.007]	[0.006]	[0.005]
VAT 1	-0.018**	-0.005	-0.008	-0.001
	[0.008]	[0.007]	[0.006]	[0.005]
VAT 2	-0.016**	-0.004	-0.010*	-0.005
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 3	-0.014*	-0.003	-0.010	-0.004
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 4	-0.010	-0.003	-0.003	-0.000
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 5	-0.006	-0.001	0.003	0.005
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 6	-0.008	-0.004	-0.000	0.001
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 7	-0.009	-0.003	-0.003	0.000
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 8	-0.007	-0.002	-0.003	-0.000
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 9	-0.006	-0.004	0.001	0.002
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 10	-0.006	-0.005	0.001	0.001
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 11	-0.010	-0.007	-0.003	-0.001
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 12	-0.011	-0.011*	-0.005	-0.005
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 13	-0.007	-0.008	-0.003	-0.004
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 14	-0.004	-0.008	-0.001	-0.005
	[0.008]	[0.006]	[0.006]	[0.005]
VAT 15	-0.002	-0.007	0.001	-0.004
	[0.008]	[0.006]	[0.006]	[0.005]
Constant	0.143***	0.009	0.095***	0.064***
	[0.003]	[0.017]	[0.002]	[0.014]
Regional FE	Yes	Yes	Yes	Yes
Observations	1,714	1,714	1,491	1,491
R-squared	0.141	0.481	0.162	0.419

Source: Authors' estimations using data from ICTD, WDI and VAT.
Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Event study results are from Eq. (2.3). Columns (1)-(2) uses tax share as the dependent variable (Figure 2.2) while columns (3)-(4) results show when indirect tax share is used as dependent variable (Figure 2.3). Results show that VAT introduction has positively impacted tax share, however, after including control variables it does not show a significant impact due to potential endogeneity. This is similar even when indirect tax share is used as the dependent variable.

Table 2.A.4: First Stage Results of the IV Model

	Dependent Variable: VAT Introduction	
	(1)	(2)
VAT Neighbours	0.017***	0.023***
	[0.005]	[0.006]
Log(GDP per Capita)	0.026	0.016
	[0.020]	[0.021]
Agriculture Share	-0.465***	-0.401***
	[0.121]	[0.132]
Import Share	-0.141**	-0.180**
	[0.066]	[0.071]
Export Share	0.057	0.091
	[0.078]	[0.086]
Urban Population	-0.359***	-0.282***
	[0.085]	[0.091]
External Debt	-0.081***	-0.074***
	[0.013]	[0.014]
Old Population	1.980***	2.362***
	[0.565]	[0.678]
Constant	0.604***	0.671***
	[0.199]	[0.211]
Regional fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	1,714	1,491
R-squared	0.315	0.335

Source: Authors' estimations using data from ICTD, WDI and VAT.
Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. As presented in Eq. (2.5), first stage regression, dependent variable is $VatD_{it}$. Number of observations is the only difference between column (1) and column (2) as there are less number of observations under indirect tax share analysis. First stage results show that number of VAT neighbours has a significant positive relationship with VAT introduction in a particular country.
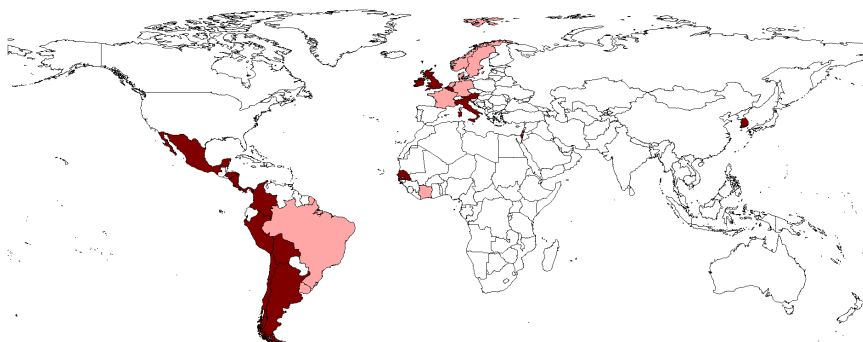
Figure 2.A.1: Countries Introduced VAT by 1970
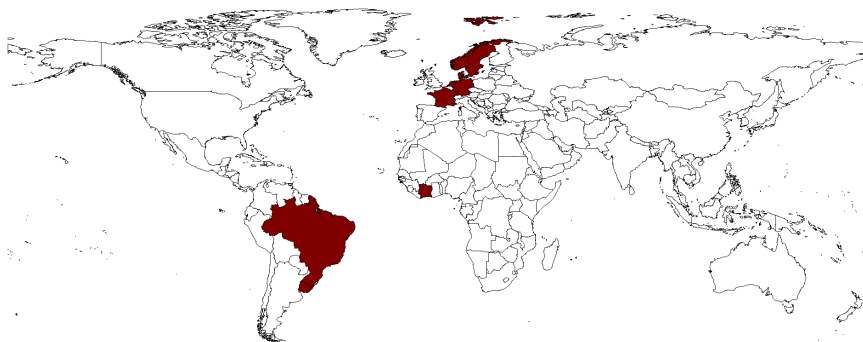
Source: Authors' estimation using VAT introduction data.
Note: In this map, countries shown in dark Red colour are the countries that introduced VAT before 1970.

Figure 2.A.2: Countries Introduced VAT by 1980

Source: Authors' estimation using VAT introduction data.
Note: In this map, countries shown in dark Red colour are the countries that introduced VAT between 1970 and 1980. Countries shown in light Red colour are the countries that introduced VAT before 1970
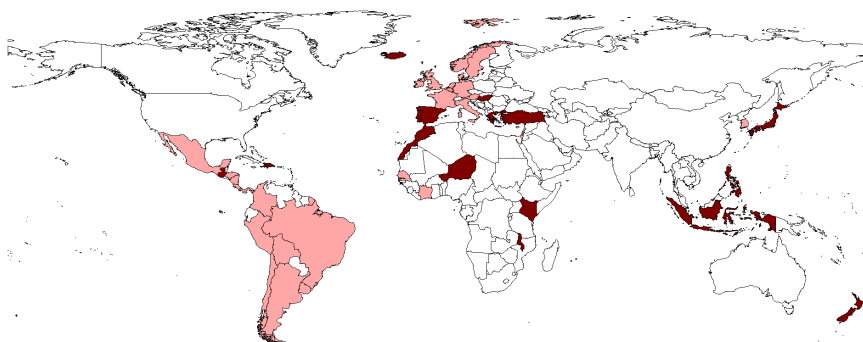
Figure 2.A.3: Countries Introduced VAT by 1990

Source: Authors' estimation using VAT introduction data.
Note: In this map, countries shown in dark Red colour are the countries that introduced VAT between 1980 and 1990. Countries shown in light Red colour are the countries that introduced VAT before 1980
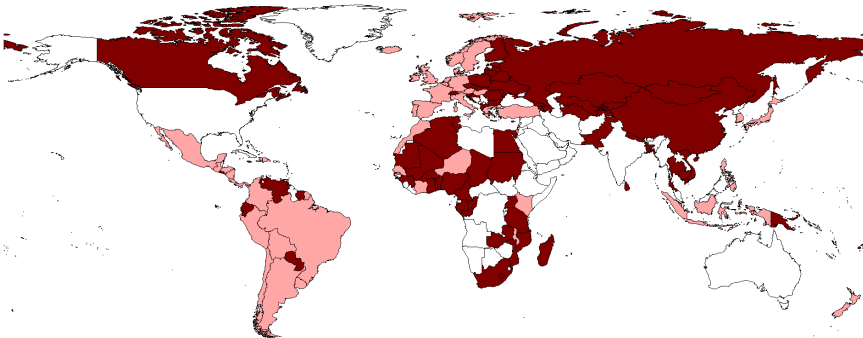
Figure 2.A.4: Countries Introduced VAT by 2000

Source: Authors' estimation using VAT introduction data.
Note: In this map, countries shown in dark Red colour are the countries that introduced VAT between 1990 and 2000. Countries shown in light Red colour are the countries that introduced VAT before 1990

Figure 2.A.5: Countries Introduced VAT by 2010

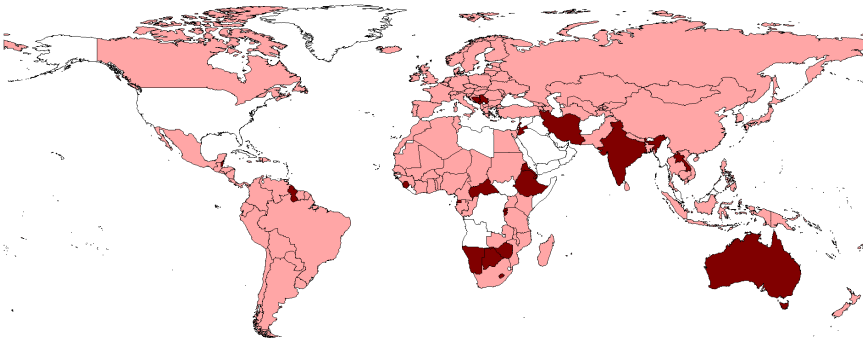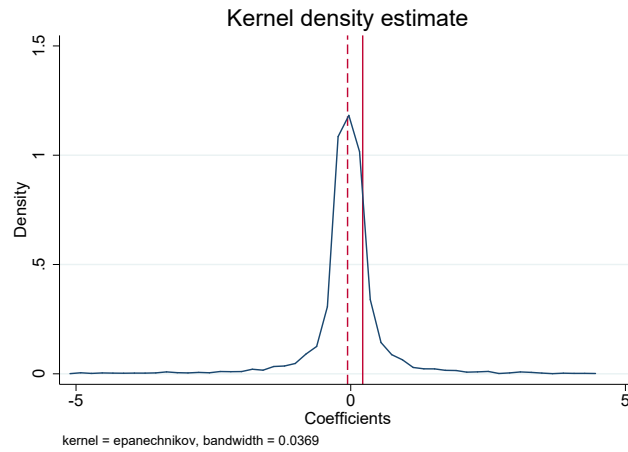Source: Authors' estimation using VAT introduction data.
Note: In this map, countries shown in dark Red colour are the countries that introduced VAT between 2000 and 2010. Countries shown in light Red colour are the countries that introduced VAT before 2000

Figure 2.A.6: Distribution of $\hat{\varphi}$ Estimated with Placebo VAT Introduction Year

Source: Authors' estimation.

Note: This graph shows the density of coefficient values of the placebo VAT introduction dummies in the random tests repeated 10,000 times. The dash vertical line shows the mean of the placebo VAT introduction coefficients. Extreme values are excluded using 1 percentile from each ends. The solid vertical line shows the coefficient of actual VAT introduction dummy. 81% of the placebo VAT introduction coefficients are lower than the actual VAT introduction coefficient.

<div align="right">Chapter 3</div>

APPROPRIATENESS AND EFFECTIVENESS OF VAT: EVIDENCE FROM CROSS-COUNTRY VAT DIFFUSION

"The existence of effectiveness gains from adoption of a VAT is by no means assured, but varies systematically with country circumstances..."

<div align="right">Keen and Lockwood (2010)</div>

3.1 Introduction

Institutions fundamentally affect the economic performance of a state (North, 1981; Acemoglu et al., 2001; Dell and Olken, 2020). New institutions usually originate in one place and diffuse across countries. The diffusion may follow a forceful dynamic process driven by external forces such as military conquests and colonization (Acemoglu et al., 2001; Dell and Olken, 2020), or wishful reform guidance of international institutions such as the World Bank and International Monetary Fund (IMF) (Knoll and Zloczysti, 2012; Ward and Dorussen, 2015). Amid diffusion, institutional and policy choices can also be shaped by exogenous factors such as geography (Gallup et al., 1999; Hall and Jones, 1999), and natural resources (Carmignani and Chowdhury, 2012).

However, one size does not fit all. The institutions that work well in some countries may not produce desirable outcomes in others. An example is the third wave of democratization and its associated problems. Rose and Shin (2001) show that countries have not been successful compared to the first wave of democratization

if they introduced elections before establishing basic institutions such as rule of law, institutions of civil society and accountability. Therefore, it is crucial to investigate the economic and political conditions that may fail a potentially good institution.

In this paper, we argue that institutional dysfunction follows a similar mechanism as the inappropriateness of technology in the study of cross-country technology adoption. Previous studies suggest a technology developed in a rich country which is suitable for a capital-abundant environment may not be appropriate to a labour-abundant less developed country (Acemoglu and Zilibotti, 2001; Caselli and Coleman, 2006). As a result, the technological appropriateness crucially affects the aggregate productivity and income level of a country (Acemoglu and Zilibotti, 2001; Basu and Weil, 1998; Caselli and Coleman, 2006; Diwan and Rodrik, 1991). Enlightened by these literature, we use the term "Institutional Appropriateness" to describe the degree of compatibility of an adopted institution to the host country. An institution may be inappropriate if it is introduced to the host country mainly due to external forces while it might be incompatible with the local economic and political fundamentals.

We focus on a specific economic institution: Value-added Tax (VAT). We investigate how the appropriateness of VAT to each country affects its tax capacity measured by tax-GDP ratio, after the introduction of VAT. In keeping with Keen and Lockwood (2010), we construct a measure of the appropriateness of VAT. We use tax-GDP ratio as the outcome variable to capture the impact of VAT on tax capacity, which is thought to be a pillar of state capacity for economic prosperity (Besley and Persson, 2009, 2011, 2014).

VAT is desirable for investigating institutional and technological diffusion. On the one hand, VAT is not only an institution to mobilize government revenue but also a tax technology that involves new processes, equipment and skills to implement it (Gerard and Naritomi, 2018; Ghirmai et al., 2014; Fan et al., 2018;

Fjeldstad et al., 2020). Therefore, both the general mechanisms of diffusion and appropriateness of institutions (and technologies) can be applied to VAT. On the other hand, VAT has gradually transmitted to more than 166 countries since it was first formally adopted in France in the 1950s. It is now regarded as a key source of tax revenue in many countries. The variation of VAT introduction over time and across countries, along with the available tax revenue data, allow us to implement reliable empirical strategy by combining spatial regressions and an IV.

Many studies have pointed to the role of geography in the diffusion of VAT across countries. These studies exploited the VAT adoption of neighbouring countries as an exogenous variation for various empirical purposes. Keen and Lockwood (2010) use the proportion of countries in the same region that implemented VAT to capture the neighbourhood effect in their study to identify the causes of VAT introduction and argue that the significant positive relationship could be where countries noting the better performance of neighbours adopted VAT.[8] A group of geographically close countries may adopt VAT to replace the more distortionary tariff and turnover tax following policy suggestions from the IMF or World Bank.

Despite the prevalence of VAT, its appropriateness to each country is ambiguous. Many studies show that the effect of VAT on tax capacity and economic efficiency varies tremendously across countries (Baunsgaard and Keen, 2010; Ahlerup et al., 2015; Adhikari, 2020). Studies based on detailed micro data reveal loopholes in the VAT compliance (Pomeranz, 2015; Naritomi, 2019; Waseem, 2020a,b). However, there is limited research on the underlying factors that led to variations in VAT performance across countries. We attempt to fill this gap by proposing a method to measure the appropriateness of VAT and to evaluate the impact of appropriateness on VAT performance.

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[8]Christian and Helene (2011) and Alavuotunki et al. (2019) also use share of neighbouring countries with VAT as the instrumental variable in their studies. Ahlerup et al. (2015) use number of neighbouring countries with VAT while estimating the impact of VAT on tax revenue in Sub-Saharan Africa.

Following the aforementioned studies on VAT diffusion, we measure the appropriateness index of VAT based on the assumption that VAT diffusion is jointly determined by two sets of factors: (1) geography[9]; and (2) country's economic and social conditions. In light of the original idea of Keen and Lockwood (2010), we construct an appropriateness index of VAT based on a country's economic and social conditions such as agriculture share, trade openness, external debt and democracy index. Technically, we disentangle the appropriateness of VAT from geographic factors by using spatial regressions (Spatial Durbin Model). Then we use the geographic neighbours as the IV of VAT introduction and IV's interaction with each country's appropriateness index.

The data we use cover 154 countries over a period from 1980 to 2017 and are drawn from several different sources including International Centre for Tax and Development (ICTD), World Development Indicators, International Tax Dialogue book edited by Alan Carter and Polity IV project. In keeping with the literature, our results show that VAT diffusion across countries is driven by geographic distance between countries (Čížek et al., 2017). As a novel finding, our results additionally suggest that the effect of VAT introduction on tax capacity depends on its appropriateness to the host country. Countries with a greater appropriateness index have a greater increase in tax capacity after the introduction of VAT. These findings may contribute to the literature on institutions, tax capacity, and tax administration.

The rest of the paper is organized as follows. Section 3.2 discusses the data, variable and motivation while section 3.3 focuses on the empirical strategy. Section 3.4 reports the main results including the appropriateness index. Section 3.5 discusses the policy implications and concludes.

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[9]In the robustness analysis, we also extend it to more general factors including legal background and religion.

3.2   Data, Spatial Matrices and Motivating Facts

3.2.1   Data Description

We use a panel data set of 154 countries for the period from 1980 to 2017. As we are considering geographic neighbours as one of the spatial matrices we have not included island nations in our panel. In this panel data set there are 126 countries that introduced VAT and 28 countries that have not introduced VAT. Countries that introduced VAT, have both with VAT and without VAT years in the sample period.

The study combines data from several different sources. VAT-related data is from Annex 1 of the book edited by Alan Carter (Carter, 2013) from International Tax Dialogue. Following Keen and Lockwood (2010), we use a set of control variables that may affect VAT adoption decision including per capita GDP, agriculture share, trade share, urban population, external debt, older population, democracy index and lagged tax to GDP share. Except democracy index and lagged tax to GDP share, data for other control variables is from World Development Indicators (WDI). Democracy index data is from Polity IV Project by Center for Systemic Peace. The Polity IV project provides a democracy index ranging from +10 which is strongly democratic to -10 which is strongly autocratic. We have considered all the negative values as zero which means non democratic countries and positive values without any change to represent the democratic countries at different levels. Tax-GDP ratio is from International Centre for Tax and Development (ICTD) data set. Summary statistics of the main variables used in the regression are reported in Table 3.1.

Table 3.1: Summary Statistics

	Number of Obs.	Mean	St. Dev.	Minimum	Maximum
VAT Introduction	5,852	0.55	0.50	0	1
Log GDP per Capita	5,176	8.24	1.59	4.90	12.17
Agriculture Share	4,635	0.16	0.14	0.00	0.79
Trade Share	4,847	0.78	0.45	0.00	4.43
Urban Population	5,798	0.53	0.24	0.04	1.00
External Debt	3,384	0.68	0.79	0.00	12.33
Older Population	5,646	0.07	0.05	0.01	0.22
Democracy Index	5,031	4.31	4.14	0	10
Lagged Tax Share	4,447	0.17	0.08	0.00	0.57
Number of Rates	4,940	1.99	1.21	1	8
Current Standard Rate	4,940	0.16	0.05	0.04	0.27

Source: Authors' estimations using data from ICTD, WDI, VAT introduction.
Note: All the variables except VAT introduction have been imputed in the regression analysis as it is a requirement to have a strongly balanced panel to run spatial econometric models in STATA. Therefore, all the regressions have 5,852 observations.

3.2.2 Spatial Weight Matrices

In order to check the spatial interdependence of VAT introduction, we use three different spatial weight matrices by defining neighbouring countries in three different ways. Firstly, we consider geographic neighbours where countries share a common geographic boarder. We use GeoDa software (Anselin et al., 2006) to create a queen contiguity matrix which considers all the geographic neighbours irrespective of the length of the boarder. Secondly, we create a weight matrix considering the similarity in the legal origin of the countries using the data from La Porta et al. (1999). In this matrix, element $d_{ij} = 1$ if countries i and j shares the same legal origin and equals zero otherwise. Countries may shape their institutions based on their colonisation history and we classify the legal background into British, French, Socialist, German and Scandinavian. As Ganau (2017) suggests a common legal tradition may lead to institutional similarities among countries and there is empirical evidence that suggests colonial experience has a relationship with the current level of development (Englebert, 2000; Acemoglu et al., 2002; Bertocchi and Canova, 2002).

Thirdly, we use a religion based weight matrix considering cross-country similarity in religious beliefs from CIA World Fact Book. In this exercise, countries are classified under four main religions: Christianity, Islamism, Buddhism and Hinduism. In this matrix, element $d_{ij} = 1$ if countries i and j shares the same dominant religion and equals zero otherwise. Religious beliefs also have the ability to play an important role in influencing the institutions. Therefore, countries with same dominant religion would have spillover effects from one country's institutions to the other. Past literature shows that religion could affect various socio-economic features such as governance and economic policies, legal setup, and political inclinations as well as education, health and capital (Alesina and Giuliano, 2011; Wang and Lin, 2014; Becker and Woessmann, 2009).

3.2.3 Motivating Facts

One of the main objectives of VAT adoption particularly in developing countries is to increase tax capacity. According to advocates of VAT, a broader tax base with less economic distortions and improved efficiency in tax administration are the ways of achieving that objective. However, not all countries have managed to increase tax capacity by adopting VAT. We highlight two African countries in Figure 3.1 to show that VAT performance can differ significantly across countries. Figure 3.1 displays the indirect tax share in Tanzania and Botswana over the sample period along with their VAT introduction years in the vertical lines. In the left panel, Tanzania has a lower indirect tax share before the introduction of VAT in 1999. The introduction of VAT has not made much difference to the level of tax capacity. In the right panel as a contrast, Botswana's indirect tax share before the VAT introduction was volatile and still below the international standards. Botswana introduced VAT in 2003 and has been able to increase the tax capacity significantly after the VAT introduction. This clearly shows that one size does not fit all. Therefore, it is important to identify the appropriate

socio-economic background that allows VAT to thrive in these countries.

Figure 3.1: Appropriateness and Effectiveness of VAT: Two-Country Comparison

Source: Authors' estimation using ICTD and VAT introduction data.
Note: In this figure, the left panel shows the indirect tax share of Tanzania, a Sub-Saharan African country. Tanzania adopted VAT in 1999 (vertical line), however does not show a significant change in indirect tax share after the adoption. In the right panel, indirect tax share of Botswana, another Sub-Saharan African country, shows a significant improvement after the VAT introduction in 2003. Horizontal line shows the average indirect tax-GDP share before and after VAT introduction. This shows that effectiveness of VAT in improving tax capacity differs from country to country. As per our Appropriateness Index discussed in section 3.4.2 Tanzania's AI value is 0.538 while Botswana's AI value is 1.186.

3.3 Empirical Strategy and Regression Specifications

3.3.1 Empirical Strategy

We use difference-in-difference approach together with spatial econometrics to examine the diffusion of VAT to neighbouring countries and the appropriateness of VAT to the host country. In our sample, we identify four different types of countries. Countries that introduced VAT and countries that did not introduced VAT are the two main groups. Apart from that, another difference is appropriate countries and inappropriate countries. In our empirical strategy we first look at VAT adoption using the following approach.

$$\text{VAT} = \alpha \times \text{Socio-economic Conditions} + \beta \times \text{Mechanical Diffusion Force} \quad (3.1)$$

Where VAT is a dummy variable indicating VAT adoption. Under this approach, we regard spatial interdependence as the mechanical diffusion force in VAT adoption. We measure the spatial interdependence using spatial weight matrices under different definitions of neighbourhood: geography, legal background and religious background. The main advantage of this approach is that it allows us to separate the mechanical diffusion force from the appropriateness of VAT in different countries that is determined by socio-economic conditions.

After estimating α and β from spatial regressions, we use '$\beta \times$ Mechanical Diffusion Force' as the IV for the VAT adoption decision and '$\alpha \times$ Socio-economic Conditions' as the measurement of appropriateness in difference-in-difference regression to identify the impact of appropriateness of VAT on the tax-GDP ratio.

3.3.2 Regression Specifications

We use Spatial Durbin (SD) model to capture the role of geography as a mechanical force underlying VAT diffusion based on the study by Lee and Yu (2011). The SD model assumes that, the dependent variable of the home country might be related to both the dependent variable and independent variables in neighbouring countries. Our regression equation using the SD model takes the following specifications:

$$VAT_{it} = \rho \times W_N \times VAT_{it} + \alpha \times X_{it} + \beta \times W_N \times X_{it} + \phi + \epsilon_{it} \qquad (3.2)$$

Where VAT_{it} is the VAT introduction dummy in country i in year t. VAT_{it} = 1 after the VAT introduction and zero before the introduction. W_N is a $N \times N$ row-normalized binary contiguity matrix where N is the total number of countries in the sample. In this matrix, $W_{ij} = 1$ if two countries are neighbours under different neighbourhood specifications (geographic, legal and religion) and

$W_{ij} = 0$ otherwise. X_{it} represents a vector of control variables and ϵ_{it} is the error assumed to be *iid*.

After estimating the spatial interdependence we test the model selection to check whether SD model is the best fix for our analysis compared to other different spatial econometric models. Firstly, we test between Spatial Autoregressive model (SAR) and SD model by testing whether $\beta = 0$ for all the control variables. If the null hypothesis is accepted SAR model is a better fit our analysis than the SD model. If the null hypothesis is rejected then it implies that the SD model is a better fit for our data set. Secondly, we test between the Spatial Error model (SE) and the SD model by testing whether $\beta = -\rho \times \alpha$. In this test as well, if the null hypothesis is accepted then the SE model is a better fit and if the null hypothesis is rejected then the SD model is suitable.

3.4   Empirical Results

3.4.1   Geography as Mechanical Diffusion Force

Table 3.2 reports the spatial regression results of the introduction of VAT based on Eq. (3.2) with spatial fixed effects. Columns (1) to (3) show the results of the three different weight matrices. Our main results show that income level has a significant negative impact on the decision to adopt VAT. This means that countries with higher income levels tend to focus on income tax revenue rather than on indirect taxes such as VAT. Additionally, the effect of agriculture share is also significantly negative. This result is similar to that obtained by Keen and Lockwood (2010) who show that almost all taxes find it hard to reach agriculture sector and VAT is no different. Urban population and democracy index are positively associated with VAT adoption, showing that countries with democratic governing systems as well as higher urban population have higher tendency to adopt VAT. Conversely, external debt has a negative impact on VAT adoption.

This shows that if countries have access to low-cost credit from other countries and multilateral organizations, then they are less motivated to introduce VAT. Older population is a significant determinant of VAT adoption, however, it shows a positive impact under geography and religion based weight matrices while a negative impact under legal origin matrix. According to the results, trade share is not a significant determinant of VAT introduction decision.

The most important result is that all three matrices show that there is a significant spatial interdependence (ρ) at 1% level between the VAT adoption decision of the home country and its neighbours. Effect of geographic neighbourhood has the highest magnitude followed by legal origin and religious background. This shows that geographic neighbours have a higher impact on diffusing taxation technology compared to other types of neighbours.

As discussed in the empirical strategy section, we test the model selection firstly by comparing between the SAR model and the SD model checking whether $\beta = 0$. Accordingly considering the geographic weight matrix, the chi value is 134.58 and Prob > chi2 = 0.0000 shows that we could strongly reject the null hypothesis with p-value lower than 1%. Therefore, SD model fits better than the SAR model. Then we test between SE model and SD model by checking whether $\beta = -\rho \times \alpha$. The test result shows that, chi value is 421.33 and Prob > chi2 = 0.0000 where we could again strongly reject the null hypothesis with p-value lower than 1%. Therefore, out of different spatial econometric models SD model best fits our analysis.

Table 3.2: Cross-Country Diffusion of VAT Introduction

Dependent Variable: VAT Introduction			
	Geo	Legal	Religion
	(1)	(2)	(3)
Spatial			
ρ	0.402***	0.337***	0.177***
	[0.000]	[0.000]	[0.000]
Main			
log GDP per capita	-0.058***	-0.075***	-0.096***
	[0.000]	[0.000]	[0.000]
Agriculture share	-0.522***	-0.479***	-0.663***
	[0.000]	[0.000]	[0.000]
Trade share	0.026	0.009	0.013
	[0.135]	[0.582]	[0.486]
Urban population	0.725***	0.599***	0.191*
	[0.000]	[0.000]	[0.082]
External debt	-0.019***	-0.022***	-0.026***
	[0.003]	[0.001]	[0.000]
Older Population	1.450***	-0.828**	0.832**
	[0.003]	[0.045]	[0.042]
Democracy Index	0.014***	0.013***	0.014***
	[0.000]	[0.000]	[0.000]
Lagged tax share	-0.147	-0.087	-0.170*
	[0.111]	[0.328]	[0.078]
W $\times$ X			
W $\times$ log GDP per capita	-0.115***	-0.197***	-0.207***
	[0.000]	[0.000]	[0.002]
W $\times$ Agriculture share	-0.682***	-0.988**	-1.503***
	[0.000]	[0.041]	[0.005]
W $\times$ Trade share	0.083**	0.376***	0.225**
	[0.017]	[0.000]	[0.019]
W $\times$ Urban population	0.550***	0.045	3.378***
	[0.000]	[0.870]	[0.000]
W $\times$ External debt	-0.054***	-0.051*	-0.054
	[0.000]	[0.057]	[0.171]
W $\times$ Older Population	2.111***	5.760***	-0.248
	[0.000]	[0.000]	[0.859]
W $\times$ Democracy Index	0.006*	0.064***	0.022**
	[0.051]	[0.000]	[0.039]
W $\times$ Lagged tax share	-0.100	-0.920*	-1.532**
	[0.605]	[0.070]	[0.018]
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Number of Observations	5,852	5,852	5,852
Number of Countries	154	154	154

Source: Authors' estimations using data from ICTD, WDI and VAT introduction.
Note: Standard errors are in brackets. *** p<0.01, ** p<0.05, * p<0.1. These results are based on the SD model specified in Eq (3.2). Results shows that there is a significant spatial interdependence between the home country and neighbouring countries when introducing VAT under all three definitions of neighbourhood (ρ value). However, geographic neighbours have more influence compared to others.

3.4.2   Measurement of Appropriateness Index (AI)

Even though countries introduce tax reforms such as VAT based on the influence from neighbouring countries, those reforms may not be successful in the home country due to different socio-economic conditions. That is why we could see there are some countries that have not improved their revenue performances even after VAT introduction (Figure 3.1).

Therefore, as suggested by Keen and Lockwood (2010), the appropriateness as well as the effectiveness of a country's policy reform is based on its specific socio-economic conditions. In this section, we use results from the spatial econometric model to develop an Appropriateness index and test whether VAT is an appropriate tax in terms of improving a country's tax capacity. We use the regression coefficients of control variables of the spatial econometric model Eq. (3.2) to develop the appropriateness index.[10] The mean value of $\hat{\alpha} \times X_{it}$ after VAT introduction ($VATDummy = 1$) is considered as the country specific time-invariant Appropriateness Index (AI) for socio-economic conditions. Specifically, the AI index is constructed as follows:

3.4.3   Effect of AI on Tax Capacity

In order to test the influence of Appropriateness index of VAT on tax capacity, we used the following difference-in-difference regression equation with heterogeneity in AI:

$$Tax_{it} = \rho \times VAT_{it} + \beta \times VAT_{it} \times AI_i + \epsilon_{it} \tag{3.3}$$

where Tax_{it} is the indirect tax-GDP ratio of country i at year t. VAT_{it} is the

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[10]We estimate the Appropriateness index by including all control variables as well as considering only those variables with statistically significant coefficients.

dummy variable for VAT introduction as in previous regressions and AI_i is the time invariant Appropriateness index for country i measured by Eq. (3.4). We use an interaction term to examine the appropriateness of VAT in improving tax capacity. Due to the possible endogeneity between tax-GDP ratio Tax_{it} and VAT introduction VAT_{it}, we use an instrumental variable (IV) for VAT_{it} in this regression.

$$AI_i = \frac{1}{T - s_i} \sum_{t=s_i+1}^{T} \hat{\alpha} \times X_{it} \tag{3.4}$$

where s_i is the year of VAT introduction in country i, and $\hat{\alpha}$ is the estimator of α in Eq. (3.2). T is the current year, so AI_i is the simple time average of $\hat{\alpha} \times X_{it}$ in each year t for country i.

To facilitate cross-country comparison, we additionally normalize AI by dividing its original value by its norm.[11] For this exercise, due to data availability we restricted our analysis to 87 countries that have already introduced VAT.

Figure 3.2 presents the Appropriateness index where we observe that with the exception of Botswana and South Africa, most of the Sub-Saharan African countries have a low appropriateness index value. This result is keeping with the empirical findings of Ahlerup et al. (2015) who show that there no improvement in government revenue after VAT adoption.

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[11]This implies that we test the Appropriateness index in four different ways; all control variables un-scaled, selected control variables un-scaled, all control variables scaled and selected control variables scaled.

Figure 3.2: Appropriateness Index Across Countries
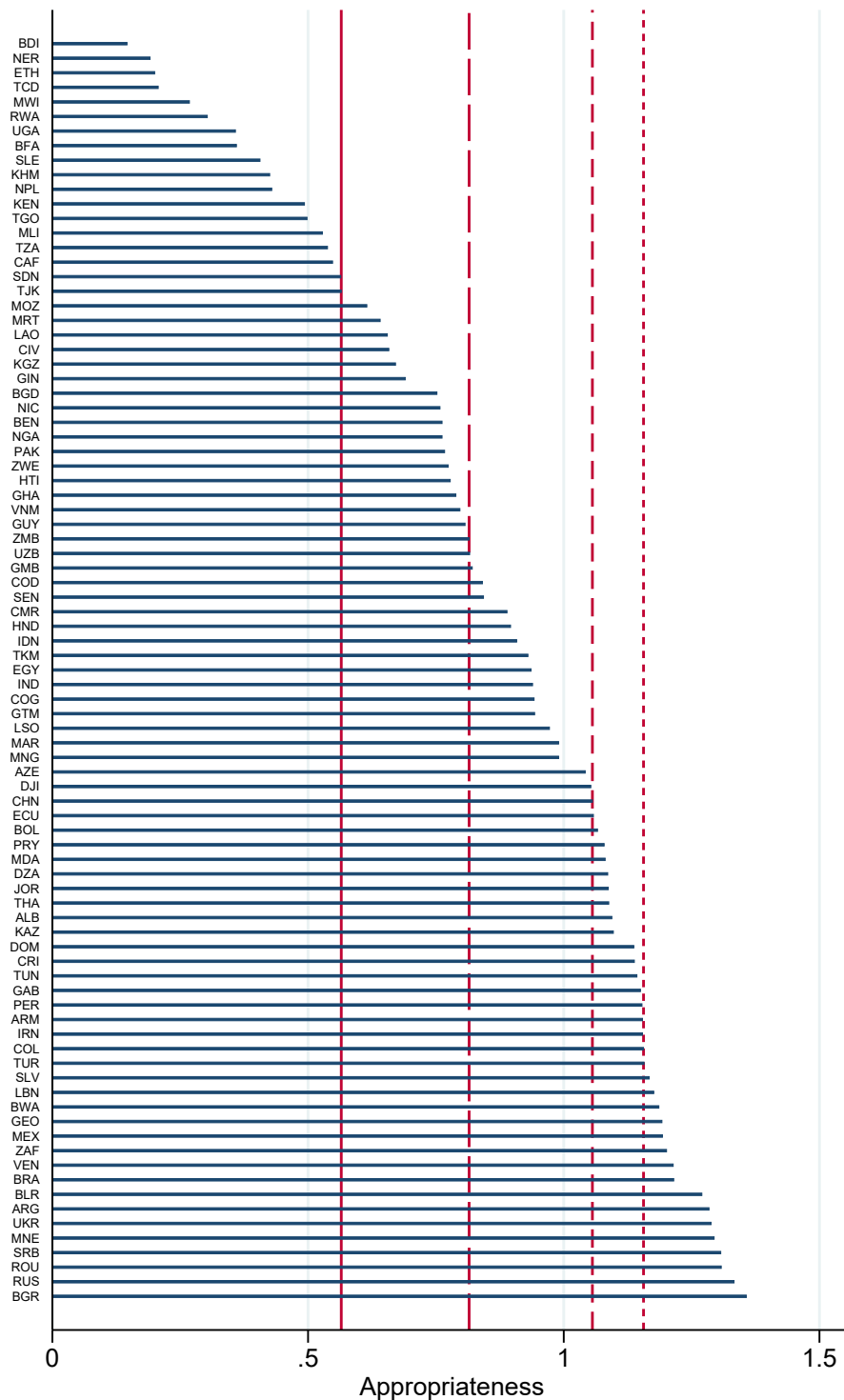
Source: Authors' estimation using spatial regression results.

Note: This figure presents the Appropriateness index for each country developed based on spatial regression results from Table 3.2 using Eq.(3.2). We have used the regression coefficients of sptatistically significant control variables from the spatial regression based on geographic neighbourhood. For comparison purposes, we have used the norm values. Vertical lines are the quintiles used in the regression results Table 3.4. The appropriateness index reveals that most of the sub-Saharan African countries such as Burundi, Niger, Ethiopia, Chad and Malawi have a low AI value.

Previous studies in this area have used either the number of neighbouring countries that have introduced VAT or the share of neighbouring countries with VAT as the IV (Christian and Helene, 2011; Ahlerup et al., 2015; Alavuotunki et al., 2019). We use a matrix of spatial interdependence coefficient (ρ - predicted value based on spatial regression) from the previous regression results multiplied by the geographic matrix as the IV. The previous spatial econometric regression results have shown that the VAT introduction of the home country is affected by the VAT introduction decision of geographic neighbours and the ρ value represent the magnitude. However, the tax share of a country is not directly affected by its geographic neighbours and its only possible through VAT introduction. Therefore, our IV which is based on the spatial regression results is a better representation of the interdependence between countries compared to the number or share of neighbouring countries with VAT.

Table 3.3 shows the results of the IV regression using Eq (3.3). We have used four different versions of appropriateness indices interacted with VAT introduction dummy to examine the appropriateness of VAT in improving tax capacity. The AI (key variables) is constructed using only the controls variables that are statistically significant in the spatial regression but without normalizing them. The AI (all variables) include all the control variables in the spatial regression without normalizing them. AI (key variables, normalized) and AI (all variables, normalized) are the normalized versions of the above two variables. In order to overcome potential endogeneity issues we have used a novel IV as discussed above. According to these results, it is clear that higher the appropriateness index, the higher the tax capacity and this result is robust under all different versions of the appropriateness indices.

Table 3.3: Effect of Appropriateness of VAT on Tax Capacity - IV Estimation

Dependent Variable: Indirect Tax Share				
	(1)	(2)	(3)	(4)
VAT	0.018***	0.017***	0.006	0.006
	[0.002]	[0.003]	[0.005]	[0.004]
VAT × AI (key variables)	0.020**			
	[0.010]			
VAT × AI (all variables)		0.018*		
		[0.010]		
VAT × AI (key variables, normalized)			0.012**	
			[0.006]	
VAT × AI (all variables, normalized)				0.011**
				[0.006]
Constant	0.082***	0.082***	0.082***	0.082***
	[0.002]	[0.002]	[0.002]	[0.002]
Country FE	Yes	Yes	Yes	Yes
Number of Observations	2,318	2,318	2,318	2,318
Number of Countries	83	83	83	83

Source: Authors' estimations using data from ICTD, WDI and VAT introduction.
Note: Standard errors are in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. This table presents the IV estimation results based on Eq. (3.3) with country fixed-effects. As VAT is an indirect tax, indirect tax share has been used to represent the tax capacity. We use an interaction term with *AI* to identify the impact of the appropriateness of VAT on tax capacity. Different *AI* indices are measured based upon Eq. (3.4). The regression results show that countries with a higher Appropriateness index have a significant positive impact on tax capacity after the VAT introduction. This result is robust under different measures of appropriateness indices.

Additionally, we group countries in to quintiles based on AI (key variables) and interact each quintile dummy with VAT introduction using the same IV. The results in Table 3.4 confirm that countries with higher appropriateness indices (fourth and fifth quintiles) have the highest magnitude of improvement in tax capacity while countries with a lower Appropriateness indices record a marginal tax share growth.

Table 3.4: Quintiles of AI and Effectiveness of VAT on Tax Capacity

Variables	Indirect Tax Share
VAT $\times$ 1st Quintile of *AI*	0.012***
	[0.003]
VAT $\times$ 2nd Quintile of *AI*	0.011***
	[0.003]
VAT $\times$ 3rd Quintile of *AI*	0.012***
	[0.004]
VAT $\times$ 4th Quintile of *AI*	0.020***
	[0.007]
VAT $\times$ 5th Quintile of *AI*	0.044***
	[0.004]
Constant	0.079***
	[0.001]
Fixed Effects	Yes
Observations	2,118
Number of IDs	77

Source: Authors' estimations.
Note: Standard errors are in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. This table shows the IV estimation results based on the five quintiles of appropriateness index *AI*, which measured by Eq. (3.4). We dropped five countries in the fourth quintile considered as outliers which recorded highest and lowest tax-GDP shares. Results show that countries with higher appropriateness indices (fourth and fifth quintiles) have the highest magnitude improvement in tax capacity after the VAT introduction while countries with lower appropriateness indices (first, second and third quintiles) record a lower tax share growth after VAT introduction.

3.5   Conclusion

The importance of economic institutions towards countries' development has been widely discussed. However, the impact of institutional appropriateness on the spillover effects of institutions across countries has not received similar attention. The economic institutions in one country could affect the quality of institutions of another country and such diffusion could help to improve the economic outcomes of the adopting country. However, the effect of the adopted institution depends on the appropriateness for the host country.

Therefore, it is important to investigate the appropriateness of institutions and whether spillover effects are truly generating the expected outcomes among receiving countries. In this study we use taxation, which is at the core of economic institutions to test the effect of diffusion. More specifically, we study whether the decision to introduce VAT by a particular country is affected by its neighbour's VAT introduction using a spatial econometric model. We define neighbours under three different definitions: geographic neighbours, countries that share similar legal origin and countries that share similar religious backgrounds. Using a panel data set of 154 countries for a period from 1980 to 2017, we find that similar to the findings of Čížek et al. (2017), there is a significant spatial interdependence between neighbouring countries in the VAT introduction decision. Geographic neighbours have the highest magnitude effect while religious neighbours have the lowest magnitude effect. Moreover, spatial regression allows us to separate the socio-economic appropriateness from the neighbouring country effect.

We then ask the question of how appropriate VAT is in improving tax capacity in different countries. It is evident that some countries are successful in improving revenue share after VAT introduction while some countries are struggling to increase revenue share even after VAT introduction. To investigate the performance of VAT under different socio-economic conditions, we develop an appropriateness index based on the coefficients of the spatial regression results for different control variables. Then we use the appropriateness index interacted with VAT introduction to check the effectiveness of VAT in improving indirect tax share of different countries. Using the IV estimation, we find that countries with a higher Appropriateness indices have a higher chance of improving tax capacity and these results are robust with different classifications we used to estimate the Appropriateness index.

Our findings explain why reforms suggested by international institutions such as the World Bank and the IMF have failed in many countries. The results

also emphasize that a country should take appropriateness in social, economic and political conditions into consideration when introducing its own institutions which may be successful in other countries.

REFERENCES

Acemoglu, D., Johnson, S., and Robinson, J. A. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *The American Economic Review*, 91(5):1369–1401.

Acemoglu, D., Johnson, S., and Robinson, J. A. (2002). Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution. *The Quarterly Journal of Economics*, 117(4):1231–1294.

Acemoglu, D. and Zilibotti, F. (2001). Productivity Differences. *The Quarterly Journal of Economics*, 116(2):563–606.

Adhikari, B. (2020). Does A Value-Added Tax Increase Economic Efficiency ? *Economic Inquiry*, 58(1):496–517.

Ahlerup, P., Baskaran, T., and Bigsten, A. (2015). Tax Innovations and Public Revenues in Sub-Saharan Africa. *The Journal of Development Studies*, 51(6):689–706.

Alavuotunki, K., Haapanen, M., and Pirttilä, J. (2019). The Effects of the Value-Added Tax on Revenue and Inequality. *The Journal of Development Studies*, 55(4):490–508.

Alesina, A. and Giuliano, P. (2011). Family Ties and Political Participation . *Journal of the European Economic Association*, 9(5):817–839.

Anselin, L., Ibnu, S., and Youngihn, K. (2006). GeoDa: An Introduction to Spatial Data Analysis. *Geographical Analysis*, 38(1):5–22.

Basu, S. and Weil, D. N. (1998). Appropriate Technology and Growth. *The Quarterly Journal of Economics*, 113(4):1025–1054.

Baunsgaard, T. and Keen, M. (2010). Tax revenue and (or?) trade liberalization. *Journal of Public Economics*, 94(9-10):563–577.

Becker, S. O. and Woessmann, L. (2009). Was Weber Wrong? A Human Capital Theory of Protestant Economic History. *The Quarterly Journal of Economics*, 124(2):531–596.

Bertocchi, G. and Canova, F. (2002). Did colonization matter for growth? An empirical exploration into the historical causes of Africa's underdevelopment. *European Economic Review*, 46(10):1851–1871.

Besley, T. and Persson, T. (2009). The Origins of State Capacity: Property Rights, Taxation, and Politics. *American Economic Review*, 99(4):1244.

Besley, T. and Persson, T. (2011). *Pillars of Prosperity*. Princeton University Press, Princeton.

Besley, T. and Persson, T. (2014). Why Do Developing Countries Tax So Little? *Journal of Economic Perspectives*, 28(4):99–120.

Carmignani, F. and Chowdhury, A. (2012). The Geographical Dimension of the Development Effects of Natural Resources. *Environmental and Resource Economics*, 52(4):479–498.

Carter, A., editor (2013). *International Tax Dialogue: Key Issues and Debates in VAT, SME Taxation and the Tax Treatment of the Financial sector*. European Commission.

Caselli, F. and Coleman, W. J. (2006). The world technology frontier. *American Economic Review*, 96(3):499–522.

Christian, E. and Helene, E. (2011). Does VAT reduce the instability of tax revenues? *CERDI Working Paper*, E2011.24.

Čížek, P., Lei, J., and Ligthart, J. E. (2017). Do Neighbours Influence Value-Added-Tax Introduction? A Spatial Duration Analysis. *Oxford Bulletin of Economics and Statistics*, 79(1):25–54.

Dell, M. and Olken, B. A. (2020). The Development Effects of the Extractive Colonial Economy: The Dutch Cultivation System in Java. *The Review of Economic Studies*, 87(1):164–203.

Diwan, I. and Rodrik, D. (1991). Patents, appropriate technology, and North-South trade. *Journal of International Economics*, 30(1-2):27–47.

Englebert, P. (2000). Pre-Colonial Institutions, Post-Colonial States, and Economic Development in Tropical Africa. *Political Research Quarterly*, 53(1):36.

Fan, H., Liu, Y., Qian, N., and Wen, J. (2018). Computerizing VAT Invoices in China. *National Bureau of Economic Research*, Working Paper(24414).

Fjeldstad, O. H., Kagoma, C., Mdee, E., Sjursen, I. H., and Somville, V. (2020). The customer is king: Evidence on VAT compliance in Tanzania. *World Development*, 128:1–12.

Gallup, J. L., Sachs, J. D., and Mellinger, A. (1999). Geography and Economic Development. *CID Working Paper*, (1).

Ganau, R. (2017). Institutions and economic growth in Africa: a spatial econometric approach. *Economia Politica*, 34.

Gerard, F. and Naritomi, J. (2018). Value Added Tax in developing countries: Lessons from recent research. *IGC Growth Brief Series 15*.

Ghirmai, E., Logan, S., and Murray, S. (2014). The incidence and impact of Electronic Billing Machines for VAT in Rwanda - IGC. Technical report, International Growth Centre.

Hall, R. E. and Jones, C. I. (1999). Why Do Some Countries Produce So Much More Output Per Worker Than Others? *The Quarterly Journal of Economics*, 114(1):83–116.

Keen, M. and Lockwood, B. (2010). The value added tax: Its causes and consequences. *Journal of Development Economics*, 92(2):138–151.

Knoll, M. and Zloczysti, P. (2012). The Good Governance Indicators of the Millennium Challenge Account: How Many Dimensions are Really Being Measured? *World Development*, 40(5):900–915.

La Porta, R., Lopez-de Silanes, F., Shleifer, A., and Vishny, R. (1999). The quality of government. *Journal of Law, Economics and Organization*, 15(1):222–279.

Lee, L. F. and Yu, J. (2011). Estimation of Spatial Panels. *Foundations and Trends in Econometrics*, 4(1-2):1–164.

Naritomi, J. (2019). Consumers as Tax Auditors. *American Economic Review*, 109(9):3031–3072.

North, D. C. (1981). *Structure and Change in Economic History*.

Pomeranz, D. (2015). No Taxation without Information: Deterrence and Self-Enforcement in the Value Added Tax. *American Economic Review*, 105(8):2539–2569.

Rose, R. and Shin, D. C. (2001). Democratization backwards: The problem of third-wave democracies. *British Journal of Political Science*, 31(2):331–354.

Wang, Q. and Lin, X. (2014). Does religious beliefs affect economic growth? Evidence from provincial-level panel data in China. *China Economic Review*, 31:277–287.

Ward, H. and Dorussen, H. (2015). Public Information and Performance: The Role of Spatial Dependence in the Worldwide Governance Indicators among African Countries. *World Development*.

Waseem, M. (2020a). Overclaimed Refunds, Undeclared Sales, and Invoice Mills: Nature and Extent of Noncompliance in a Value-Added Tax . *CEPR Discussion Paper*, (DP14601).

Waseem, M. (2020b). The Role of Withholding in the Self-Enforcement of a Value-Added Tax: Evidence from Pakistan. *The Review of Economics and Statistics*, pages 1–44.

VAT REGISTRATION THRESHOLD AND FIRM SALES REPORTING: EVIDENCE FROM SRI LANKA

4.1 Introduction

Many developing countries are ailed with insufficient public goods due to weak tax capacity. Their share of tax in GDP could be as low as 10%, while in some developed countries it surpasses 50% (Gordon and Li, 2009; Kleven, 2014; Besley and Persson, 2014). Previous research in this area finds that existence of a large informal sector is one of the main causes for such weak tax performance particularly in developing countries (Alm et al., 2004; Boadway and Sato, 2009; Alm and Embaye, 2013; Annicchiarico and Cesaroni, 2018; Waseem, 2018).[12] In the meantime, Value Added Tax (VAT) has become vastly popular among developing and transitional economies in the past few decades, and is seen as a superior taxation technology which helps to increase the tax base and government revenue by moving informal firms to formal sector (De Paula and Scheinkman, 2010). However, it is evident that not all countries have successfully increased tax capacity and economic efficiency by introducing VAT (Ahlerup et al., 2015; Adhikari, 2020).

In this study, we investigate a novel channel that can potentially constrain the effectiveness of VAT on tax capacity: tax threshold on formal firms. We argue that there could be significant under-reporting of sales by formal firms to stay below the VAT threshold which will undermine the tax capacity of a country. The

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[12]Joshi et al. (2014) discuss previous studies on tax and the informal sector.

VAT threshold is a size-based regulation that creates incentives for firms to stay small and avoid the mandatory registration and payment of VAT (Best et al., 2015; Harju et al., 2016). The incentive could be even stronger in response to an increase in the statutory VAT rate. If the tax administration were unable to identify this under-reporting it would erode the tax base and negatively impact the tax revenue.

We particularly focus on Sri Lanka, a country that has been experiencing deterioration in tax capacity even after the VAT introduction in 2002. We use firm-level survey data from Sri Lanka to study the response of firms' reported sales to changes in VAT rate and threshold from 1994 to 2017. Sri Lanka introduced its first form of value added tax in 1998 named Goods and Services Tax (GST). However, a sales tax: National Security Levy (NSL) was also operational along with GST til 2002. VAT was introduced in 2002 replacing both GST and NSL. There were several changes to the standard VAT rate and the threshold since then. We consider two main policy changes: the introduction of VAT in 2002 and an increase in the standard VAT rate in 2005 to examine the response from firms. We use a difference-in-difference regression approach by considering Small and Medium Enterprises (SMEs) and non-SMEs to statistically estimate the firms' response to these policy changes. In addition, we also check whether the parallel trends assumption holds for VAT introduction.

Our results show that changes in VAT policy were associated with significant behavioural response in firms' reported sales. We use the proportion of firms below the VAT threshold to identify firms' response. We find: (1) transition from GST to VAT resulted in a significant drop of the proportion of SMEs below that threshold even though there is no change in threshold value from GST to VAT. This shows that firms welcome the transition to a fully value-added tax system from a hybrid system which had both sales tax (NSL) and value added tax (GST). (2) However, an increase in standard VAT rate from 10% to 15% in 2005 resulted

in a significant increase in the proportion of SMEs below the threshold. This indicates that SMEs responded actively to the increase in VAT rate by staying below the threshold. This is in keeping with previous findings that a higher VAT rate leads to lower compliance. Agha and Haughton (1996) show that a higher VAT rate is associated with lower compliance in OCED countries and the trade-off limits the revenue-maximising VAT rate to under 25%. Matthews (2003) shows that the efficiency of VAT system declines with the increase in VAT rate due to a combination of factors such as a decrease in VAT base, evasion and avoidance.

Compared to several other studies (Sow and Gebresilasse, 2020; Harju et al., 2016; Boonzaaier et al., 2016) on VAT threshold that find bunching, our results are different, as we do not see any shape bunching right at the threshold. Conversely, we find that the overall firm distribution has changed significantly as a result of a policy change. Most firms responded by reporting sales not uniformly right around the threshold but further away from the threshold in a more random pattern. Consequently, VAT introduction has lowered the firm distribution below the VAT threshold and standard rate hike has increased the distribution below threshold. The result may suggest that the under-reporting of sales does not incur significant costs to the Sri Lankan firms, so they do not need to precisely under-report right below the threshold.

Overall, our results strongly indicate that even firms in the formal sector actively use the VAT threshold to avoid paying taxes. This constrains the feasibility of revenue enhancing by raising the statutory tax rate. Although theoretically the design of the VAT encourages small firms to register for VAT in order to stay in the business, empirical results show otherwise. It may be due to the possibility that the cost of compliance overweight the benefits of registration for small firms. Faridy et al. (2014) also finds that higher compliance and administration cost deter small firms from joining the tax system. This would affect smooth functioning of the entire VAT system and finally result in generating insufficient revenue.

This paper contributes to several branches of the literature. Firstly, our study adds to the empirical literature identifying VAT registration as a different channel of weak tax capacity in developing countries. Our results expand the commonly discussed idea of informal sector being the major contributor of poor tax capacity in developing countries. We show that even the firms in the formal sector use VAT threshold as a shield in reaction to VAT policy changes. Harju et al. (2016) find that there is a bunching of firms just below the VAT threshold in Finland. They show evidence that this response by firm is caused by the compliance cost of VAT. Sow and Gebresilasse (2020) and Boonzaaier et al. (2016) also show the same bunching effect below the threshold in Ethiopia and South Africa. Our study extends these findings to show that especially small firms manipulate the reported sales to move behind the VAT threshold in response to an increase in standard VAT rate and avoid paying VAT. To the best of our knowledge this is the first study which identifies this behaviour by firms in response to VAT rate change. Given the inherent weaknesses of the tax administration in developing countries, this behaviour of firms could lead to far serious repercussions in terms of weakening the tax capacity compared to a developed country.

Secondly, our findings provide additional evidence on the firm-size distribution. It is already established that institutional distortions create misallocations of resources in developing counties (Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009). Even though its undesirable, size-based regulations create incentives for firms to stay small and can significantly distort firm-size distribution (Dharmapala et al., 2011; Gourio and Roys, 2014). Our results show that tax policy parameters such as the VAT threshold are also size-based regulations that enormously shape firm-size distribution.

The rest of the paper proceeds as follows. Section 4.2 provides a brief explanation of the weak tax performance in Sri Lanka including a discussion of the changes to the indirect tax system. Section 4.3 describes the data and motivation while

section 4.4 presents the empirical strategy and results. Section 4.5 provides some additional results and section 4.6 contains policy implications and conclusion.

4.2 Tax System and VAT Reforms in Sri Lanka

4.2.1 Background of the Tax System

Tax revenue in Sri Lanka accounts for more than 80% of total government revenue. However, it has not kept pace with the rise in government expenditure and macroeconomic developments. As a result, both total government revenue and tax revenue as a percentage of GDP have declined since the early 1990s. A decline in indirect tax share has been a significant contributor towards this poor tax performance. Figure 4.1 shows the total tax, direct tax and indirect tax as a share of GDP since 1990. According to Figure 4.1, it is clear that total tax and indirect tax as a share of GDP have followed a declining path while direct tax share has remained below the average at a stable level throughout the period. Given the developments in the macroeconomic conditions and the tax policy changes over this period, it is surprising that tax-GDP ratio exhibits a declining trend, as most of the tax revenue determinants have changed positively within the same period. Therefore, the main focus of this paper is to examine the underlying reasons for such a decline by analysing micro level data.

There are several taxes operating in Sri Lanka. These include Income Tax (Personal and Corporate), Value Added Tax (VAT), Nation Building Tax (NBT), Economic Service Charge (ESC), Excise Tax and Import Duties. The Inland Revenue Department (IRD) established in 1932 is vested with the responsibility of tax collection and administration in Sri Lanka. In addition to the IRD, the Department of Customs and Excise Department also administers several duties and levies.

Over the years, indirect taxes (taxes on production and expenditure) have gone through several changes. Business Turnover Tax (BTT) was the first major indirect tax introduced in 1963. It was replaced by Turnover Tax (TT) in 1981. For the purposes of financing the higher defence budget due to the war against terrorism in Northern and Eastern provinces of the country, government was propelled to introduce another sales tax called the Defence Levy (DF) in 1992 which was later called National Security Levy (NSL). The NSL was introduced at the rate of 1% of taxable supply but gradually increased to 6.5% by the time it was withdrawn. New government elected in 1994 with the purpose of moving towards a VAT system, introduced Goods and Services Tax (GST) act in 1996. However, GST came in to effect from 1st April 1998 and only replaced TT whereas NSL continued to operate without change in order to maintain revenue targets in the transition period. The GST was implemented at a flat rate of 12.5% and the threshold for registration was LKR 1.8mn[13] of taxable supply per year.

Figure 4.1 shows the total, direct and indirect taxes as a share of GDP in Sri Lanka from 1990 to 2018. From this figure it is clear that the decline in tax share is mainly driven by the decline in indirect tax share. Direct tax share is also low compared to peer countries, however, it has remained consistent throughout the period. Conversely, indirect tax share has declined continuously and the introduction of GST in 1998 or the introduction of VAT in 2002 were not successful in reversing the downward trend.

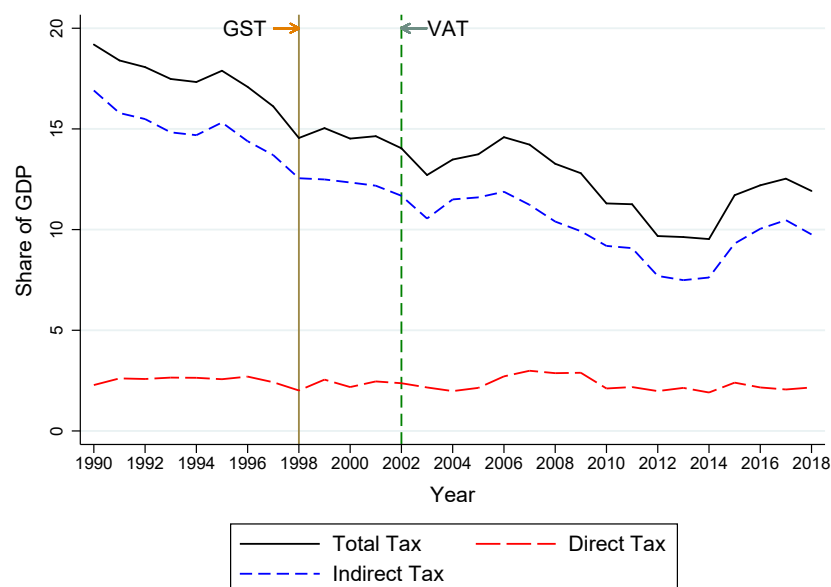### 4.2.2   VAT Introduction and Reforms

Another change in the government in 2001 led to the introduction of VAT in 2002 by abolishing both GST and NSL. VAT threshold remained as LKR 1.8mn of taxable supply per year but the standard VAT rate was changed from 12.5% to 10% and additionally two new rates were introduced. A 0% VAT rate was applied

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[13]Around US$ 9,300 as per the current exchange rate

for exports and deemed exports while a higher VAT rate of 20% was charged for luxury goods.

Figure 4.1: Total, Direct and Indirect Tax Shares

VAT has also subject to several changes in terms of tax rates and tax threshold since its introduction . The first major change was to increase the standard VAT rate from 10% to 15% in November 2004. This increase in standard rate resulted in a slight increase in tax-GDP share as shown in Figure 4.1. However, this was short lived and reverted to a declining trend after 2006. Secondly in 2007, an optional VAT was introduced for firms with taxable supply below LKR 2.5mn per year. This allowed voluntary registration for those firms and pay non-refundable 5% payment on taxable supply. After the end of war in 2009, the government introduced tax reforms in order to promote local and foreign investments. This included an increase in VAT threshold to LKR 2.5mn and a decrease in standard VAT rate from 15% to 12%. In 2013, the VAT threshold was

increased significantly from LKR 2.5mn to LKR 12mn and in 2015 it was further increased to LKR 15mn and the standard rate was reduced to 11%. Conversely, the rate was increased to 15% again in 2017 due to the lackluster tax performance. Sluggish economic growth recorded during the past few years again forced the newly appointed government to decrease the VAT rate to 8% from December 2019. The list of changes to VAT over the period considered for this analysis is included in Table 4.1.

Table 4.1: VAT Reforms in Sri Lanka from 1998 to 2019

Year	Reform	Rate / Threshold
1998	Introduction of GST	Rate - 12.5%, Threshold - taxable supply above LKR 1.8mn per year
2002	Introduction of VAT	Rates - 0%, 10%, 20%, Threshold - taxable supply above LKR 1.8mn per year
2004	Standard VAT rate	10% standard rate increased to 15% and introduced a new rate of 5% for essential food items
2007	Optional VAT	5% non-refundable rate for firms with a taxable supply below LKR 2.5mn (Voluntary registration)
2009	Standard VAT rate and Threshold	15% standard rate decreased to 12% and threshold increased to LKR 2.5mn per year
2013	Threshold	Threshold increased to LKR 12mn per year
2015	Standard VAT rate and Threshold	Standard rate 12% decreased to 11% and threshold increased to LKR 15mn
2017	Standard VAT rate	Standard VAT rate increased from 11% to 15%
2019	Standard VAT rate	Standard VAT rate decreased from 15% to 8%

Source: Inland Revenue Department of Sri Lanka (IRD, 2019).
Note: It is important to note that there were several political regime changes occurred during this period which might have an impact on tax policy change. In 2001, United National Party (UNP) which has right wing economic policies came into power and introduced VAT. In 2005, power shifted back to United National Freedom Alliance (UPFA) which has left wing economic policies. In 2015, again UNP won the election to establish a government however, in 2019 the government shifted back to UPFA.

Government policy decision to decrease VAT rate to 8% at the end of 2019 along with the current economic crisis due to Covid-19 pandemic, government tax share has decreased significantly in 2020. Total tax revenue as a share of GDP has come down to 8.1% in 2020 compared to 11.6% in 2019 (CBSL, 2020). As a result of poor revenue performance central government debt as a share of GDP has increased to 101% in 2020 compared to 86.8% in 2019 (CBSL, 2020). These indicators highlight the magnitude of the economic crisis that Sri Lanka facing in the current context.

4.3   Data and Motivation

4.3.1   Data

We mainly use Annual Survey of Industries (ASI) conducted by the Department of Census and Statistics of Sri Lanka (DCS). DCS has conducted the ASI since 1983 covering the following sectors: Mining and Quarrying, Manufacturing, Generation and Distribution of Electricity, Gas and Water industries. This survey records firm-level data for around 110 industries under the International Standard Industrial Classification (ISIC) revision 4 of the United Nations. All private and public sector establishments with more than 5 persons engaged have been covered in the survey. Firms with 100 or more persons engaged are fully enumerated while firms with persons engaged between 5 and 99 are covered in a sample. Data in digital format is only available since ASI 1995 which contain the firm level data reported for 1994 calendar year. Therefore, this analysis covers data reported for the period from 1994 to 2017 (ASI 1995 to ASI 2018). However, it does not include 2003 and 2013 (ASI 2004 and ASI 2014) as those were census years.

4.3.2   Motivation

VAT has evolved to become a major source of government revenue over the past few decades and is considered to be a significant improvement in terms of improving the revenue capacity as well as overall tax efficiency (Keen and Lockwood, 2010). It is argued that VAT from its design could resolve several problems in the taxation system that weaken the tax capacity. However, empirical studies show mixed results whereby some countries have improved their tax capacity while in some countries VAT is not a success.[14]   When we examine the tax performance

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[14]Keen and Lockwood (2010) find that adoption of VAT is associated with an increase in government revenue in the long run while Ahlerup et al. (2015) find that there is no increase in government revenue in sub-Sahara Africa after VAT introduction.

in Sri Lanka, it is clear that introduction of a VAT system either as GST or complete VAT has not provided the expected impetus to the government revenue. Therefore, it is important to examine the reasons for such a declining trend over the years and why introduction of VAT has not improved the tax capacity. In this paper we use micro data at firm level reported in the ASI survey to investigate this problem.

Some studies on VAT in developing countries find that the existence of a large informal sector is one possible reason for poor tax performance in these countries (Piggott and Whalley, 2001; Emran and Stiglitz, 2005; Sokolovska and Sokolovskyi, 2015; Waseem, 2018). However, there are several problems associated with informal sector analysis including the accuracy of the size of the informal economy. Conversely, in this study, we observe the firms in the formal sector where financial and non-financial information is available and investigate whether the reported data of these firms in the formal sector could be linked to the weak tax performance in Sri Lanka. More specifically, we examine the reported sales of the firms that participated in the ASI at the time of important VAT policy changes such as increase or decrease in standard VAT rate and changes in VAT threshold.

According to Keen and Mintz (2004), one of the important decisions in the VAT policy is the level of threshold above which registration and charge of VAT is mandatory for firms. Setting up a higher threshold limits the ability to earn higher revenue, whereas lower threshold creates excessive pressure on tax administration leading to tax evasion and increases the compliance cost of tax payers.[15] Furthermore, VAT threshold could create a distortion of competition due to different tax treatment for firms above and below the threshold. If firms' cost of compliance is significantly higher after VAT registration, it incentivises firms to

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[15]Kanbur and Keen (2014) find that the key determinants of VAT threshold are the administration cost to the tax authority, compliance cost to the tax payers along with the response of firms. Zee (2005) introduces a formula for the optimal VAT threshold.

stay small. This will result in loss of tax revenue to the government as well as distort efficient firm size distribution.[16] Considering the importance of the threshold as a size-based regulation, we use the proportion of firms below the VAT threshold in a given year to examine how it has affected by major VAT policy changes.

Figure 4.2 shows the proportion of firms below the VAT threshold in each year related to major VAT policy changes. After the introduction of GST in 1998, the registration threshold remained unchanged until 2009. However, during this period GST and NSL were replaced with VAT in 2002, standard VAT rate was increased from 10% to 15% at the end of 2004 and optional VAT scheme was introduced in 2007. It is clear from the Figure 4.2 that proportion of firms below the VAT threshold has changed significantly as a result of both these VAT related policy changes. The abolition of GST along with NSL and introduction of VAT resulted a drop in the proportion of firms below the VAT threshold although the threshold value remained unchanged between GST and VAT.

The increase in standard VAT rate in late 2004 led to a sharp increase in the proportion of firms below the VAT threshold in 2005. This means that as a response to the increase in VAT rate more firms moved below the VAT threshold. Appendix Figure 4.A.1 shows the full set of histograms of log sales for each year. We observe that there are clear 'twin peaks' after the GST legislation was passed in 1996 when more firms moved below the mandatory registration threshold. These twin peaks remained until the introduction of VAT and became a single peak in 2002. After the rate increase in late 2004, the single peak moved back towards the threshold and another set of twin peaks has appeared since 2007 when the optional VAT scheme was introduced. An increase in threshold and a decrease in standard VAT rate in 2009 made the twin peaks to disappear. However, another twin peaks can be observed after the increase in threshold from LKR 2.5mn to 12mn in 2013. This remained until 2017 even after another

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[16]see Dharmapala et al. (2011) and Gourio and Roys (2014).

increase in threshold to LKR 15mn and a decrease in rate in 2015.

The significant changes in the proportion of firms that fall below the VAT threshold due to the changes in VAT policy motivates us to investigate how firms in the formal sector in Sri Lanka react to tax policy changes and the impact of such behaviour towards the tax capacity.

Figure 4.2: Proportion of Firms below the VAT Registration Threshold

1998 - Introduction of GST - Standard rate 12.5%, Threshold LKR 1.8mn per year
2002 - Introduction of VAT - Standard rate 10%, Other rates: 0% for exports and 20% for luxury goods, Threshold LKR 1.8mn per year
2005 - Standard rate increased to 15% and new rate of 5% introduced for essential goods
2007 - Introduction of Optional VAT - Non-refundable 5% rate, Voluntary registration for firms upto LKR 2.5mn sales
2009 - Standard rate decreased to 12%, 5% rate removed and Threshold increased to LKR 2.5mn per year
2011 - Luxury rate of 20% rate decreased to standard rate of 12%
2013 - Threshold increased to LKR 12mn per year, introduced VAT to wholesale and retail trade with a threshold of LKR 500mn
2015 - Threshold increased to LKR 15mn per year and standard rate decreased to 11%
2017 - Standard rate increased to 15%

Source: Authors' estimation using ASI data.
Note: This figure shows how the proportion of firms below the VAT threshold has changed overtime. It is clear that the proportion has changed significantly with the changes to the VAT policy during this period. There is a considerable drop in the proportion of firms below the VAT threshold of LKR 1.8mn with the introduction of VAT in 2002. However, increase in standard VAT rate from 10% to 15% at the end of 2004 has resulted in an increase of the proportion of firms below the threshold level in 2005. This shows that firms under-report sales to stay behind the threshold when the rate was increased.
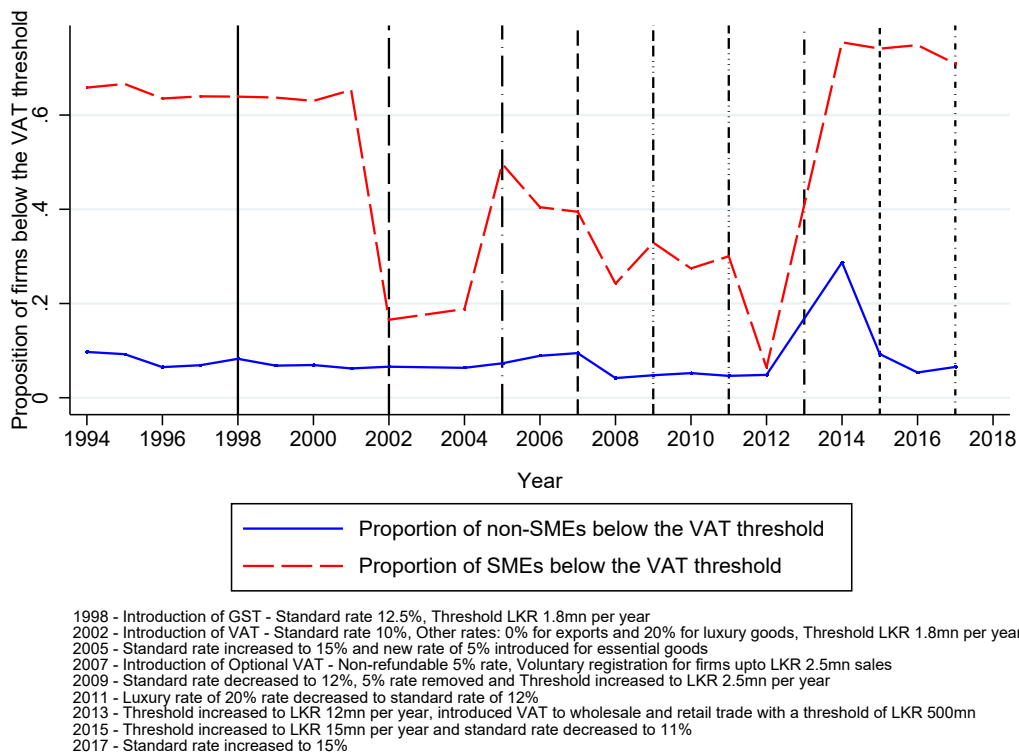
4.4 Empirical Strategy and Results

4.4.1 Empirical Strategy

Although there have been several tax reforms during the sample period, our empirical work only focuses on two policy changes that are relevant to our identification: (1) The introduction of VAT in 2002; (2) The increase in standard VAT rate in 2005. We use difference-in-difference approach to estimate firms' behaviour of under-reporting sales following the VAT policy changes. We consider SMEs as treatment group and non-SMEs as control group in the difference-in-difference analysis. In Sri Lanka, the Department of Small Industries defines Small and Medium Enterprises (SMEs) as establishments with fewer than 50 people. We use non-SMEs as the control group because they are immune to VAT policy changes of interests to us. This is confirmed by Figure 4.3, which shows the proportion of firms below the VAT threshold for SMEs and non-SMEs. Figure 4.3 clearly shows that the changes in the proportion of firms below the VAT threshold has been driven by the SMEs.[17] In contrast, the proportion of non-SMEs below VAT threshold have not changed until the major increase in VAT threshold from LKR 2.5mn to 12mn in 2013. Based on this, it is clear that SMEs and non-SMEs are relatively good treatment and control groups for our analysis for the period before 2013 when the threshold change took place and affected both groups. Therefore, we only use the cleaner quasi-experimental period from 1994 to 2012 for the difference-in-difference regression analysis to identify the effect of VAT policy changes while the threshold remains constant.

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[17]This is in line with the findings of Faridy et al. (2014) who highlight that the complexity of law and higher cost influence the SMEs' compliance to VAT law in Bangladesh.

Figure 4.3: Proportion of Firms below the VAT Threshold - SMEs and non-SMEs

1998 - Introduction of GST - Standard rate 12.5%, Threshold LKR 1.8mn per year
2002 - Introduction of VAT - Standard rate 10%, Other rates: 0% for exports and 20% for luxury goods, Threshold LKR 1.8mn per year
2005 - Standard rate increased to 15% and new rate of 5% introduced for essential goods
2007 - Introduction of Optional VAT - Non-refundable 5% rate, Voluntary registration for firms upto LKR 2.5mn sales
2009 - Standard rate decreased to 12%, 5% rate removed and Threshold increased to LKR 2.5mn per year
2011 - Luxury rate of 20% rate decreased to standard rate of 12%
2013 - Threshold increased to LKR 12mn per year, introduced VAT to wholesale and retail trade with a threshold of LKR 500mn
2015 - Threshold increased to LKR 15mn per year and standard rate decreased to 11%
2017 - Standard rate increased to 15%

Source: Authors' estimation using ASI data.
Note: This figure shows the proportion of SMEs and non-SMEs below the VAT threshold. From this figure it is clear that changes in proportion of firms below the VAT threshold as in Figure 4.2 is driven by SMEs. Proportion of non-SMEs below the VAT threshold has remained low and consistent until the significant increase in VAT threshold in 2013. This allows us to use SMEs and non-SMEs as treatment and control groups in the regression analysis.

The regression specification for the difference-in-difference model with SMEs as the treatment group and non-SMEs as the control group is given by:

$$PT_{rt} = \alpha \times SME_{it} + \beta \times RD_t + \theta \times SME_{it} \times RD_t + \gamma_r + \eta_t + \epsilon_{it} \qquad (4.1)$$

In this equation, the subscripts i, r and t stand for firm, industry and time respectively. PT_{rt} is the proportion of firms below the VAT threshold at industry-year level. SME_{it} is the dummy variable used to identify SMEs where SMEs are defined as firms with employment below 50. The term RD_t includes two dummy variables for the two main policy changes we consider: VAT introduction in 2002

and standard VAT rate increase in 2005.[18] Additionally, we include VAT reforms that occurred in 2007, 2009 and 2011 as controls along with interaction terms with SME. γ_r and η_t represent industry and year fixed effects respectively. ϵ_{it} is the error term assumed to be *iid*.

To test the parallel trends assumption, we use the sum of interaction terms of pre-VAT introduction years with SMEs added to our baseline regression Eq. (4.1). The purpose of this exercise is to test whether the results of VAT introduction has been affected by any prior tax policy change. The regression equation to test the parallel trend assumption is:

$$PT_{rt} = \alpha \times SME_{it} + \beta \times RD_t + \theta \times SME_{it} \times RD_t +$$
$$\sum_{s=1}^{N} \phi^s \times SME_{it} \times PY_t^s + \sum_{s=1}^{N} \rho^s \times PY_t^s + \gamma_r + \eta_t + \epsilon_{it} \tag{4.2}$$

In Eq. (4.2), PY_t^s refers to the years before VAT introduction. The parallel trends assumption requires $\phi^s = 0$ for s=1, 2,....,N.

4.4.2 Baseline Results

Table 4.2 presents the results based on the regression specifications in Eq. (4.1). Columns (1) and (2) present regression results with two main VAT policy changes in consideration and adding other reforms as controls at a time. Column (3) shows results considering two main policy changes and all the control reforms together. The results show that VAT policy changes have a significant impact on the change in proportion of firms below the VAT threshold and both the reforms considered in the regression are statistically significant. As per the results in column (3), SMEs have a positive significant relationship with proportion of firms below VAT

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[18]The increase in standard VAT rate happened by the end of November 2004. Hence we consider this as 2005.

threshold at 1% level (0.072) before the reforms. All the different regression models include industry and year fixed effects and standard errors are clustered at industry level.

The introduction of VAT has resulted in a decrease in the proportion of firms below the VAT threshold by 11 percentage points, and it is statistically significant at the 1% level. This confirms our hypothesis that the introduction of VAT encourages small firms to join the VAT scheme resulting in broader tax base. As claimed by its proponents, the design of the VAT itself makes it an effective taxation technology in information revelation. However, the 2005 VAT reform (where the standard VAT rate increased from 10% to 15%) has led to a rise in the proportion of firms below the threshold by 5.9 percentage points with a 1% level of statistical significance. This shows that small firms have actively responded to the increase in standard VAT rate by under-reporting sales and moving below the threshold level. The regression results suggest that, if the VAT rate increase by 1%, about 1.2% more firms would de-register and would not pay VAT. Accordingly, if the standard VAT rate increased to 20% it would wipe out almost all the increase in tax base established from VAT introduction. This is a novel finding which has not been considered in previous research on the VAT threshold. Furthermore, data on the VAT share of GDP in Sri Lanka for both 2004 and 2005 shows that it has remained unchanged at the level of 5.9% (CBSL, 2005). This also confirms that even the increase in standard VAT rate from 10% to 15% has not increased the VAT share of GDP. The additional revenue expected from an increase of standard VAT rate could have been offset by the under-reporting of firms to remain below the threshold after the increase in standard VAT rate.

Table 4.2: Effect of VAT Policies on Firm Size Distribution

	Proportion of Firms below the VAT Threshold		
	(1)	(2)	(3)
SME × VAT	-0.111***	-0.111***	-0.111***
	[0.023]	[0.023]	[0.023]
SME × 2005	0.059***	0.059***	0.059***
	[0.020]	[0.020]	[0.020]
Controls			
SME	0.072***	0.072***	0.072***
	[0.016]	[0.016]	[0.016]
SME × 2007	-0.063***	-0.064***	-0.064***
	[0.017]	[0.016]	[0.016]
SME × 2009		0.001	0.004
		[0.008]	[0.007]
SME × 2011			-0.007
			[0.006]
Constant	0.292***	0.292***	0.292***
	[0.004]	[0.004]	[0.004]
Observations	46,073	46,073	46,073
R-squared	0.864	0.864	0.864
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Source: Authors' estimations using data from ASI.
Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. This table shows the regression results based on Eq. (4.1). According to column (3) it is evident that VAT introduction has resulted in a significant decrease in proportion of firms below the VAT threshold. However, subsequent increase in standard rate in 2005 overturned that impact to some extent and increased the proportion of firms below the VAT threshold.

4.4.3 Parallel Trends Assumption

In the parallel trends assumption, we check whether any prior reforms driving the results of a particular tax reform. In our analysis we mainly concentrate on VAT introduction and conduct a parallel trends test on whether the regression results of VAT is affected by any tax reform prior to that. We use a series of interaction terms with each year prior to VAT introduction. Table 4.3 provides the results of parallel trends test in which we divide the pre-VAT period into two parts: before GST period (1994 to 1997) and after GST period (1998 to 2001). Column (1) and (2) present the results for two periods separately and column (3) shows the results considering both periods together. The results show that there is no significant tax policy change prior to VAT that has affected the VAT introduction results.

Figure 4.4 presents the coefficient values of the interaction terms of SME dummy with year dummies prior to VAT introduction. For comparison purposes we use 1994 as the base year and the coefficient graph also shows that the parallel trends assumption holds before the VAT introduction. There is no significant change in the proportion of firms below the threshold before introducing VAT.

Figure 4.4: Effect of Tax Reforms on Firm Size Distribution
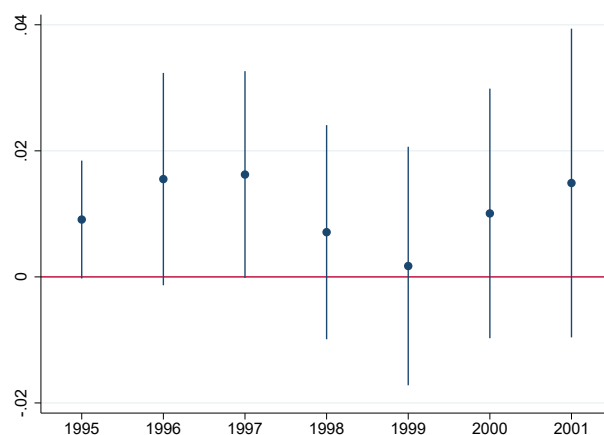
Source: Authors' estimation using ASI data.
Note: This figure shows the coefficient values of the interaction terms of SME dummy with year dummies (with 95% confidence interval) considering 1994 as the base year. It is clear that there is no significant change in the proportion of SMEs before the VAT introduction.

Table 4.3: Effect of VAT Reforms on Firm Size Distribution

	Proportion of Firms below the VAT Threshold		
	(1)	(2)	(3)
Pre-Reform Effects			
SME × 1995	0.003		0.009*
	[0.005]		[0.005]
SME × 1996	0.009		0.016*
	[0.009]		[0.009]
SME × 1997	0.010*		0.016*
	[0.006]		[0.008]
SME × 1998		-0.003	0.007
		[0.007]	[0.009]
SME × 1999		-0.008	0.002
		[0.007]	[0.010]
SME × 2000		0.000	0.010
		[0.008]	[0.010]
SME × 2001		0.005	0.015
		[0.011]	[0.012]
SME	0.069***	0.073***	0.063***
	[0.014]	[0.018]	[0.017]
SME × VAT	-0.108***	-0.112***	-0.102***
	[0.022]	[0.024]	[0.023]
SME × 2005	0.059***	0.059***	0.059***
	[0.020]	[0.020]	[0.020]
SME × 2007	-0.064***	-0.064***	-0.064***
	[0.016]	[0.016]	[0.016]
SME × 2009	0.004	0.004	0.004
	[0.007]	[0.007]	[0.007]
SME × 2011	-0.007	-0.007	-0.007
	[0.006]	[0.006]	[0.006]
Constant	0.292***	0.292***	0.292***
	[0.004]	[0.004]	[0.004]
Observations	46,073	46,073	46,073
R-squared	0.864	0.864	0.864
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Source: Authors' estimations using data from ASI.
Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Regression results for parallel trends assumption also highlight that VAT introduction is the most significant policy change during this period. Before VAT introduction 1995, 1996 and 1997 coefficients are significant but only at 10% level and the coefficient values before VAT introduction are very low in magnitude. However, parallel trends results for all the reforms after VAT introduction shows that VAT introduction is the most significant policy reform with a higher magnitude impact on the proportion of firms below VAT threshold.

4.5   Additional Results

In this section, we use firm distribution to check whether there is a bunching of firms just below the VAT threshold as identified in previous studies on VAT threshold and other size based regulations (Sow and Gebresilasse, 2020; Harju et al., 2016; Boonzaaier et al., 2016). As presented in Figure 4.5, in the Sri Lankan context, we do not find significant bunching just below the VAT threshold.

Conversely, we find that the entire firm distribution below the threshold has decreased after the VAT introduction and increased again after the increase in standard VAT rate in 2005. In Figure 4.5 we show the proportion of firm in each sales bin of LKR 100,000. It shows that the distribution prevailed for the period 1998-2001 before the VAT introduction has changed after introducing VAT. proportion of firms below the threshold of LKR 1.8mn has decreased significantly. However, the increase in standard VAT rate from 10% to 15% in 2005 has again changed the distribution of firms increasing the proportion below the threshold value. This change in distribution is in line with the results of our difference-in-difference regression specifications. The change in distribution below the threshold instead of bunching just below the threshold suggests that for Sri Lankan firms' cost of under-reporting is trivial and negligible. Therefore, firms do not need to precisely under report just below the threshold.

4.6   Conclusion

Similar to many other developing countries, Sri Lanka also has been experiencing weak tax performance over the past few decades. Declining tax-GDP share has raised concerns over the government budget deficit and debt sustainability. Several tax reforms including VAT introduction have been implemented without much success (Figure 4.1) by successive governments. Previous studies based on

developing countries argue that the informal sector could be the main reason for such poor tax performance. Given this background, our paper proposes a different channel and looks at how formal sector firms respond to VAT introduction and standard rate changes which is rarely discussed in the literature.

Figure 4.5: VAT Reforms and Sales Distribution Around VAT Threshold
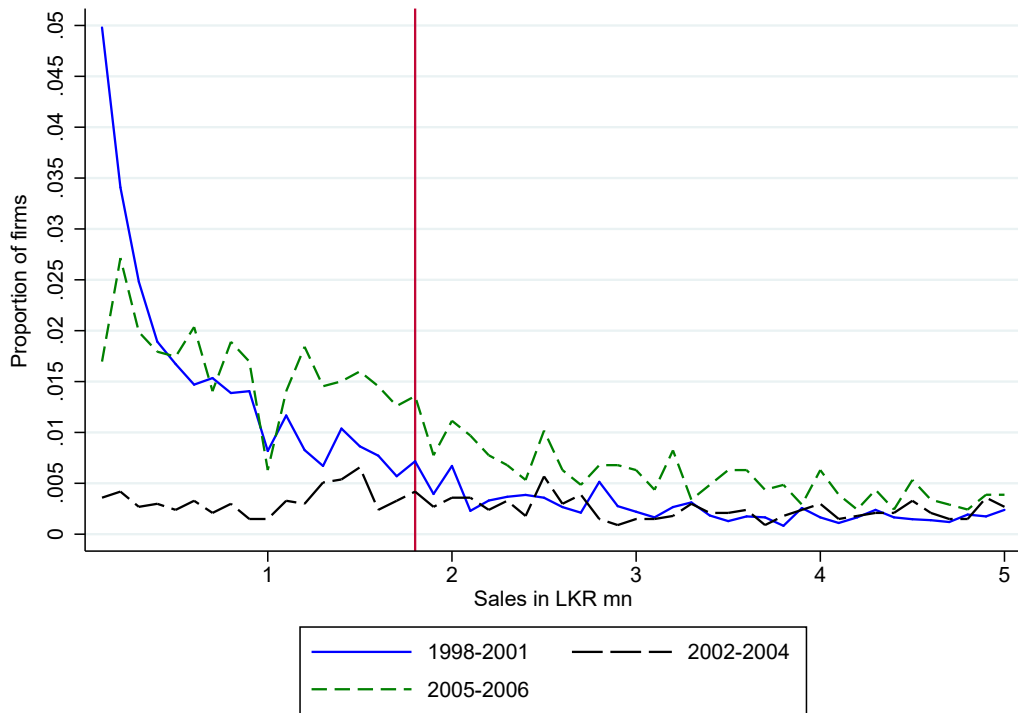
Source: Authors' estimation using ASI data.
Note: This figure shows the proportion of firms in each sales bins of LKR 100,000 for different time periods: before VAT, after VAT and after standard VAT rate increase. Accordingly there is no significant bunching just before the threshold as identified in other related studies. However, we find that distribution of firms below the threshold level has changed significantly with the policy changes. The higher proportion of firms below the threshold which prevailed before 2001 has decreased considerably after the VAT introduction. However, standard rate increase in 2005 has resulted in increase in distribution of firms below the threshold. This distribution change is in line with the regression results discussed above.

Using a firm level survey in Sri Lanka from 1994 to 2017, we first show that proportion of firms below the VAT threshold changes significantly after VAT introduction and rate changes. This shows that firms under-report sales to stay below the threshold where no VAT registration or payment is required. At the next stage we use a difference-in-difference approach to statistically estimate how the proportion of firms below VAT threshold change in response to VAT policy

changes between SMEs and non-SMEs. There we find that VAT introduction has resulted in a significant drop in the proportion of SMEs below the VAT threshold. However, a subsequent increase in the standard VAT rate has resulted in increasing the proportion of SMEs below the threshold. This shows that SMEs have significantly under-reported sales and move below the threshold as a response to an increase in standard VAT rate. This has resulted in lower VAT base and obviously lower tax revenue from VAT. We also check the parallel trends assumption and confirm that the results of VAT introduction has not been affected by any prior tax policy reform.

Our paper also provide additional evidence on firm-size distribution. We show that firm-size distribution in developing countries can be enormously shaped by the tax policy parameters such as tax thresholds and rates. In the Sri Lankan case, as opposed to bunching just below the threshold, the entire firm-size distribution below the threshold changes significantly after VAT introduction and increase in standard VAT rate.

VAT has no doubt delivered successful results in improving tax capacity and efficiency for many countries. However, developing countries have not been able to reap the full benefit of VAT introduction, due to several inherent weaknesses in the tax system and poor design of the VAT policy as identified in the case of Sri Lanka. As emphasised by Keen and Mintz (2004) setting up an appropriate threshold level is one such important parameter in VAT policy. Tax administration should also be capable enough to identify and prevent any deliberate under-reporting by firms to stay below the threshold through their tax audit mechanism. Strong auditing process would increase the cost for the SMEs compared to the benefits of under-reporting and staying under the VAT threshold. This would lead to a larger tax base and much-needed tax revenue for governments in developing countries.

REFERENCES

Adhikari, B. (2020). Does A Value-Added Tax Increase Economic Efficiency ? *Economic Inquiry*, 58(1):496–517.

Agha, A. and Haughton, J. (1996). Designing Vat Systems: Some Efficiency Considerations. *The Review of Economics and Statistics*, 78(2):303–308.

Ahlerup, P., Baskaran, T., and Bigsten, A. (2015). Tax Innovations and Public Revenues in Sub-Saharan Africa. *The Journal of Development Studies*, 51(6):689–706.

Alm, J. and Embaye, A. (2013). Using Dynamic Panel Methods to Estimate Shadow Economies Around the World, 1984–2006. *Public Finance Review*, 41(5):510–543.

Alm, J., Martinez-Vazquez, J., and Schneider, F. (2004). 'Sizing' the Problem of the Hard-to-Tax. *Contributions to Economic Analysis*, 268:11–75.

Annicchiarico, B. and Cesaroni, C. (2018). Tax reforms and the underground economy: a simulation-based analysis. *International Tax and Public Finance*, 25(2):458–518.

Besley, T. and Persson, T. (2014). Why Do Developing Countries Tax So Little? *Journal of Economic Perspectives*, 28(4):99–120.

Best, M. C., Brockmeyer, A., Kleven, H. J., Spinnewijn, J., and Waseem, M. (2015). Production versus Revenue Efficiency with Limited Tax Capacity: Theory and Evidence from Pakistan. *Journal of Political Economy*, 123(6):1311–1355.

Boadway, R. and Sato, M. (2009). Optimal Tax Design and Enforcement with an Informal Sector. *American Economic Journal*, 1(1):1–27.

Boonzaaier, W., Harju, J., Matikka, T., and LastNamePirttilä, J. (2016). How do small firms respond to tax schedule discontinuities? Evidence from South African tax registers. *WIDER Working Paper*, 36.

CBSL (2005). Central Bank of Sri Lanka Annual Report. Technical report, Central Bank of Sri Lanka.

CBSL (2020). Central Bank of Sri Lanka Annual Report. Technical report, Central Bank of Sri Lanka.

De Paula, A. and Scheinkman, J. A. (2010). Value-Added Taxes, Chain Effects, and Informality. *American Economic Journal: Macroeconomics*, 2:195–221.

Dharmapala, D., Slemrod, J., and Wilson, J. D. (2011). Tax policy and the missing middle: Optimal tax remittance with firm-level administrative costs. *Journal of Public Economics*, 95(9-10):1036–1047.

Emran, S. M. and Stiglitz, J. E. (2005). On selective indirect tax reform in developing countries. *Journal of Public Economics*, 89:599–623.

Faridy, N., Copp, R., Freudenberg, B., and Sarker, T. (2014). Complexity, Compliance Costs and Non-Compliance with VAT by Small and Medium Enterprises (SMEs) in Bangladesh: Is there a Relationship? *Australian Tax Forum*, 29(2):281–328.

Gordon, R. H. and Li, W. (2009). Tax structures in developing countries: Many puzzles and a possible explanation. *Journal of Public Economics*, 93(7-8):855–866.

Gourio, F. and Roys, N. (2014). Size-dependent regulations, firm size distribution, and reallocation. *Quantitative Economics*, 5(2):377–416.

Harju, J., Matikka, T., and Rauhanen, T. (2016). The Effects of Size-Based Regulation on Small Firms: Evidence from Vat Threshold. *VATT Institute for Economic Research Working Paper*, 75.

Hsieh, C.-T. and Klenow, P. J. (2009). Misallocation and Manufacturing TFP in China and India. *Quarterly Journal of Economics*, 124(4):1403–1448.

IRD (2019). Inland Revenue Department Annual Performance Report. Technical report, Inland Revenue Department.

Joshi, A., Prichard, W., and Heady, C. (2014). Taxing the Informal Economy: The Current State of Knowledge and Agendas for Future Research. *The Journal of Development Studies*, 50(10):1325–1347.

Kanbur, R. and Keen, M. (2014). Thresholds, informality, and partitions of compliance. *International Tax and Public Finance*, 21(4):536–559.

Keen, M. and Lockwood, B. (2010). The value added tax: Its causes and consequences. *Journal of Development Economics*, 92(2):138–151.

Keen, M. and Mintz, J. (2004). The optimal threshold for a value-added tax. *Journal of Public Economics*, 88:559–576.

Kleven, H. J. (2014). How Can Scandinavians Tax So Much? *Journal of Economic Perspectives*, 28(4):77–98.

Matthews, K. (2003). VAT Evasion and VAT Avoidance: Is there a European Laffer curve for VAT? *International Review of Applied Economics*, 17(1):105–114.

Piggott, J. and Whalley, J. (2001). VAT Base Broadening, Self Supply, and the Informal Sector. *American Economic Review*, 91(4):1084–1094.

Restuccia, D. and Rogerson, R. (2008). Policy distortions and aggregate productivity with heterogeneous establishments. *Review of Economic Dynamics*, 11(4):707–720.

Sokolovska, O. and Sokolovskyi, D. (2015). VAT efficiency in the countries worldwide. *Munich Personal RePEc Archive*, MPRA 66422.

Sow, S. and Gebresilasse, M. (2020). Effect of VAT Adoption on Manufacturing Firms in Ethiopia. *International Journal of Economics and Finance*, 12(10):85.

Waseem, M. (2018). Taxes, informality and income shifting: Evidence from a recent Pakistani tax reform. *Journal of Public Economics*, 157:41–77.

Zee, H. H. (2005). Simple analytics of setting the optimal vat exemption threshold. *De Economist*, 153(4):461–471.

Appendix

Figure 4.A.1: Histograms for Log Sales

<div align="right">

Chapter 5

</div>
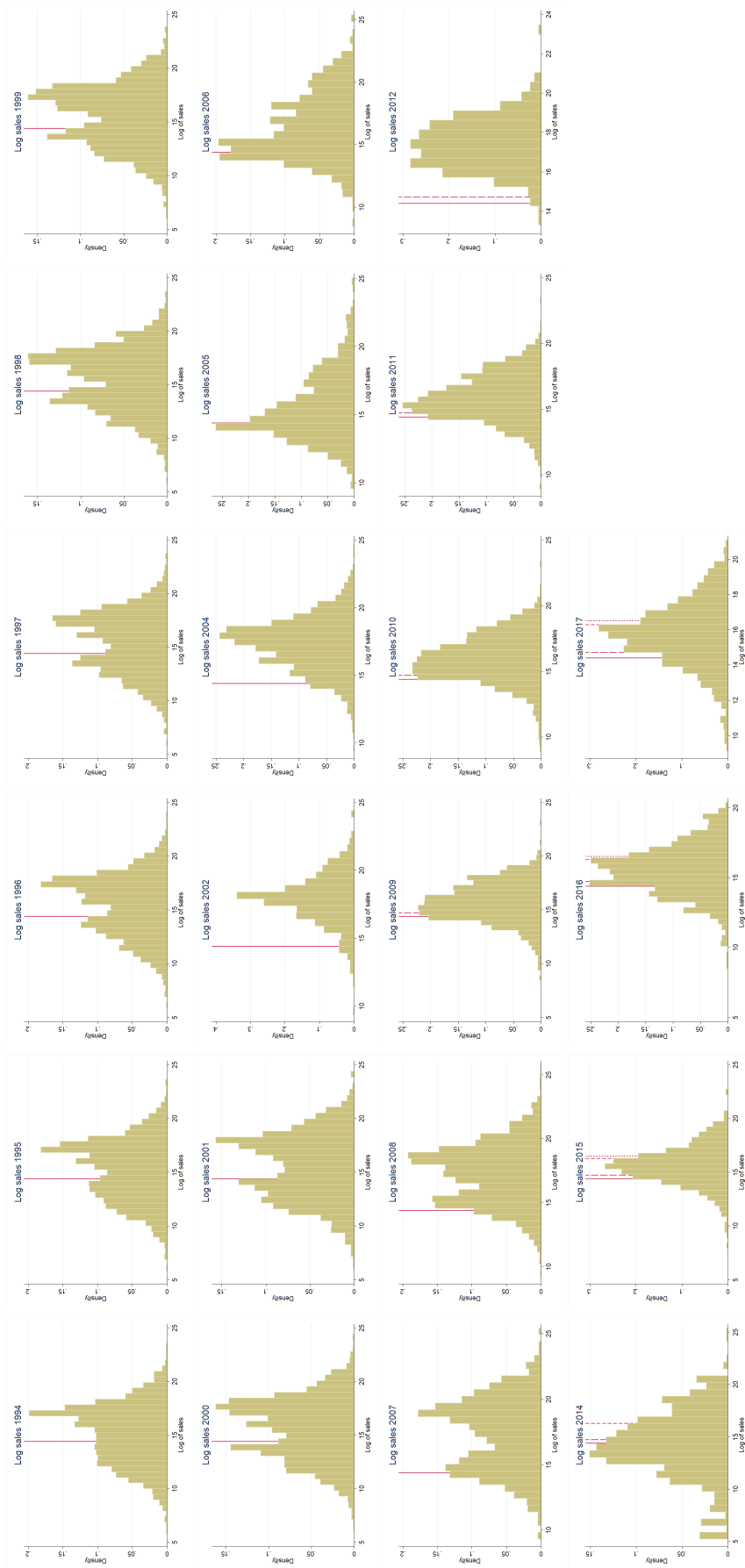
CONISION AND POLICY IMPLICATIONS

The final chapter provides a summary of major findings of the thesis and policy implications that emerge for a better VAT system that improves the overall tax efficiency and generates sufficient revenue with minimal adverse impact on economic activities.

Insufficient tax revenue is an important problem faced by governments in developing countries. This has limited the availability of much needed resources for capital investment as well as welfare programs in these countries. Weak tax performance has led to several macroeconomic problems such as higher budget deficits and debt crisis in many developing countries. During the past few decades most developing and transitional countries have adopted VAT in their search for a solution to the weak tax problem. However, past studies show that especially developing countries have not been able to improve tax capacity even after VAT adoption. Given this background, the central focus of this thesis is to critically analyze VAT system and tax capacity in developing countries.

5.1 Summary of Major Findings

Chapter 2 investigates the main channels that constrain the effectiveness of VAT on tax capacity in developing countries. We use a novel method to measure tax capacity by considering both conventional tax GDP share as well as the informal economy. By employing a difference-in-difference model with an IV in a panel

data set of 127 countries from 1991 to 2015 we find that the presence of VAT has a significant positive impact on both total tax and indirect tax shares in developing counties. The decomposition of the positive effect into three different channels: effective tax rate, tax base and informal sector reveals that the main contribution of VAT introduction on tax capacity is through the increase in effective tax rate while tax base has declined in response. More importantly the role of VAT as an information source does not significantly contribute towards the increase in tax capacity in developing countries. The findings of this study from a macro perspective are in line with the 'last mile problem' discussed by Pomeranz (2015); Naritomi (2019); Gerard and Naritomi (2018) in their analyses of the loopholes of information revelation in the VAT system.

In Chapter 3, we construct a measurement of the appropriateness to explain the degree of compatibility of VAT adoption to the host country. We argue that similar to technological diffusion, VAT adoption might have followed a forceful dynamic process driven by external forces. Building on the idea proposed by Keen and Lockwood (2010), we measure the appropriateness of VAT based on the assumption that diffusion of VAT is jointly determined by geography and countries' socio-economic condition. This allows us to simultaneously identify the influence of geographic neighbours on VAT adoption and measure the appropriateness of VAT in the host country. Our findings are consistent with the literature showing that VAT diffusion is driven by the geographic distance between countries (Čížek et al., 2017). As an addition to the existing literature, we also find that even though VAT adoption is affected by geographic neighbours, the effect of VAT on tax capacity in the host country depends on its appropriateness. Countries with higher appropriateness indices have achieved a greater increase in capacity after VAT introduction.

In chapter 4, we examine tax evasion by misreporting with micro firm level data in a developing country. We focus on one important parameter of VAT policy:

registration threshold. Using firm level survey data from Sri Lanka, we investigate the behavioural response of formal firms to VAT introduction and increase in standard VAT rate. We use SMEs and non-SMEs as treatment and control groups repectively in a difference-in-difference model and find that the proportion of firms below the VAT threshold changes significantly in response to VAT policy changes. We find that share of SMEs below the threshold decreases by around 11 percentage points in the Sri Lankan context immediately after VAT introduction in 2002. However, the increase in the standard VAT rate from 10% to 15% in 2005 leads to an increase in share of SMEs below the threshold by around 5.9 percentage points. That suggests SMEs actively hide below the VAT threshold in response to increase in standard VAT rate. This is a novel finding in this literature whereas previous literature only finds bunching of firms just below the VAT threshold and has not considered firms' response to changes in standard VAT rate. Our results show that even though VAT is effective in information revelation through registration, its role is limited in Sri Lanka. Therefore, it is hard to achieve higher tax capacity by increasing standard rate due to higher de-registration.

5.2 Policy Implications

The findings of this thesis carry several important policy implications. First, we identify the limitation of the information role of VAT in developing countries. Self-information revelation is one important feature of the design of VAT which compels firms to register for VAT leading to a larger tax base. However, our findings show that developing countries have not been able to achieve a larger tax base and instead governments rely on higher VAT rate to earn higher revenue. This has resulted in even smaller tax base as firms try to remain below the threshold by under-reporting. Therefore, tax reforms should target higher tax revenue through a combination of larger tax base and lower rate.

The appropriateness index we developed (Chapter 3) highlights the importance of the socio-economic conditions of the host country to achieving the objectives of VAT adoption. It indicates that countries with higher appropriateness indices achieve higher tax capacity after VAT introduction. VAT as a taxation technology is always interconnected with the general economic environment and the performance of the general economy affects the performance of VAT. Therefore, when governments design fiscal policies and conduct estimations on revenue targets, they need to understand both the impact of tax on economic outcomes and vice-versa. That will enable them to develop more realistic estimations of tax revenue and adjust fiscal policies in a more economically friendly manner.

Finally, our analysis on registration threshold shows the importance of different parameters of the VAT policy. The design of the VAT policy should be conducted with a careful research and should consider the possible response from the related parties. As identified by Keen and Mintz (2004), the registration threshold is one such important parameter of the VAT policy and policy makers should consider the interaction between threshold and standard rate in the tax design. Setting an excessively higher threshold would lower the revenue while a lower threshold would lead to higher collection cost. As observed in the Sri Lankan context, setting up a lower threshold with a weak tax administration capacity would lead to tax evasion at the event of rate increase, leading to lower revenue.

REFERENCES

Čížek, P., Lei, J., and Ligthart, J. E. (2017). Do Neighbours Influence Value-Added-Tax Introduction? A Spatial Duration Analysis. *Oxford Bulletin of Economics and Statistics*, 79(1):25–54.

Gerard, F. and Naritomi, J. (2018). Value Added Tax in developing countries: Lessons from recent research. *IGC Growth Brief Series 15*.

Keen, M. and Lockwood, B. (2010). The value added tax: Its causes and consequences. *Journal of Development Economics*, 92(2):138–151.

Keen, M. and Mintz, J. (2004). The optimal threshold for a value-added tax. *Journal of Public Economics*, 88:559–576.

Naritomi, J. (2019). Consumers as Tax Auditors. *American Economic Review*, 109(9):3031–3072.

Pomeranz, D. (2015). No Taxation without Information: Deterrence and Self-Enforcement in the Value Added Tax. *American Economic Review*, 105(8):2539–2569.