

The Impact of Tax Rate, Compliance Burden and Administrative Governance on Tax Collection: Evidence from Emerging Asian Countries From 2004 To 2015*

BINH TRAN-NAM AND LIEN NGUYEN PHUONG**

Abstract. As low-income countries become more developed, the demands for publicly provided goods and services in these countries tend to increase. This in turn puts pressure on those countries to raise their tax revenue collections both in absolute terms and relative to GDP. The present article seeks to determine the quantitative impacts of tax rate, compliance burden and tax administrative governance on tax collection ratios of 14 emerging Asian countries (Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, and Vietnam) over the period from 2004 to 2015.

Conventional econometric studies of tax collection ratio tend focus on two sets of factors: economic variables (GDP per capita, non-agricultural share in GDP, trade openness, etc) and socio-political factors (corruption or political stability). Unlike those studies, the present article seeks to explain tax collection performance of the chosen countries in terms of tax policy and administration variables (such as tax rate, tax compliance burden and tax administrative governance) and macro and trade indicators (such as inflow foreign direct investment (FDI)). The proxies for those regressors are obtained from a variety of secondary data sources including PwC Paying Taxes, World Bank's World Development Indicators and Worldwide Governance Indicators.

Using the two-step generalised method of moments, the empirical results indicate that tax rate, control of corruption (as a proxy of tax administration governance) and inflow FDI individually have statistically significant beneficial impact on tax collection ratio whereas tax compliance burden significantly and adversely affects tax collection ratio. These findings suggest that, for Asian developing countries at least, tax simplification or governance enhancement can play a positive role in improving their tax revenue performance.

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1. INTRODUCTION AND CONTEXT

Modern governments require resources to provide essential goods and services (such as health and education), to build infrastructure (such as highways or internet network), to make transfer payments (such as aged pension, unemployment benefits, cash subsidies to businesses or foreign aid) and to make interest payments on government's debts. Governments can potentially derive their revenues from many different sources such as tax collection, operating surpluses of government-owned enterprises, revenue from natural resources, investment returns from sovereign wealth funds and foreign aid. Taxation, as a process of transferring resources from the private sector to the public sector, represents by far the most important source of government's revenue in most countries around the world. For example, in the 2016–17 fiscal year, tax revenue constituted almost 94 percent of total revenue of the general government sector in Australia.¹

As a country becomes more developed, the demands for publicly provided goods and services tend to increase at a faster rate than GDP growth. This in turn puts pressure on the country to raise its tax revenue not only in absolute terms but also relative to GDP. This can be best illustrated by the gap in tax collection (tax to GDP) ratio between developed and developing countries. For example, the average tax collection ratio among Organisation for Economic Co-operation and Development (OECD) member countries in 2015 was estimated to be 34.0 per cent² while, for most developing countries, tax collection ratios were less than 20 per cent in 2015.³

Before proceeding further, it may be useful to distinguish between tax collection ratio and tax effort. In this paper, tax collection ratio is defined as the ratio of actual tax revenue to GDP.⁴ Tax effort is defined as the ratio of actual tax/GDP to taxable capacity where taxable capacity refers to the predicted tax collection ratio that can be estimated by regression analysis, taking into account a country's specific, time-varying macroeconomic, demographic and institutional features.⁵ The scope of this paper is confined to tax collection ratio, not tax effort. We also note that tax collection ratios are often used in international comparisons of tax burden although the diverse extent to which tax expenditures are employed by different countries makes such comparisons problematic. How the use of tax expenditures affects tax collection ratio is beyond the scope of the present paper.

Figure 1 illustrates tax collection ratios of 14 emerging Asian countries (Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam) in 2004 and 2015. It reveals a mix of tax collection performance among selected countries. The tax/GDP ratio increases for eight countries, especially Bhutan, Cambodia and Nepal, whereas it decreases for six countries, especially Mongolia. This uneven performance suggests that it is important to pay more attention to tax collection performance of emerging countries and to seek ways to improve it.

¹ Australian Government "Statement 5: Revenue", *Budget Papers No.1, Budget 2018–19* (Commonwealth of Australia, Canberra, 2018) at Table 1.

² OECD (2017), *2017 Revenue Statistics: Tax Revenue Trends in the OECD* (OECD, Paris, 2017) at 3.

³ World Bank Group *World Development Indicators* (World Bank Group, Washington DC, 2017).

⁴ In some studies, tax effort refers to the tax to GDP ratio; see, for example, Richard M. Bird, Jorge Martinez-Vazquez and Benno Torgler "Tax Effort in Developing Countries and High Income Countries: The Impact of Corruption, Voice and Accountability" (2008) 38(1) *Economic Analysis and Policy* 55 at 55.

⁵ See Tuan Minh Le, Blanca Moreno-Dodson and Nihal Bayraktar "Tax Capacity and Tax Effort: Extended Cross-Country Analysis From 1994 To 2009" *Policy Research Working Paper WPS6252* (World Bank International Trade and Investment Unit, Washington, DC, 2012) at 3.

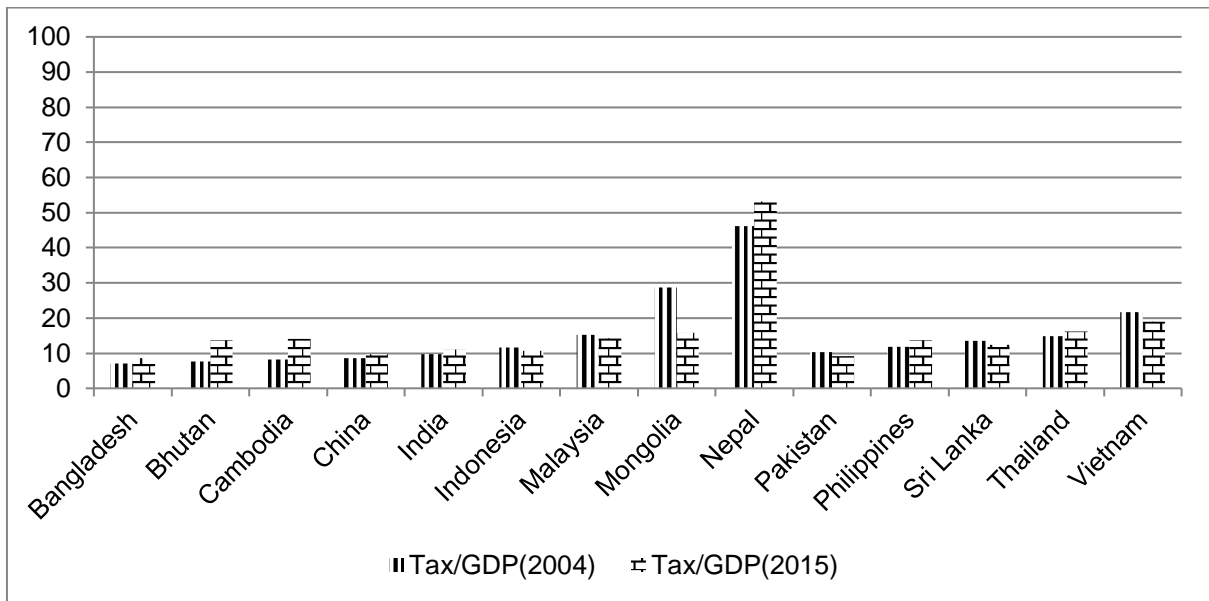


Figure 1: Tax collection ratio in 14 emerging Asian countries, 2004 and 2015

Source: *World Development Indicators*.⁶

Conventional studies on tax collection of developing countries⁷ have tended to focus on economics factors (such as GDP per capita, non-agricultural share in GDP, trade openness and foreign aid) and socio-political factors (such as corruption and political stability). Little attention has been paid to tax policy and administration factors such as tax rate and tax compliance costs, possibly due to the lack of reliable and comparable estimates of tax compliance costs in different countries over time. As a result, while tax compliance burden is expected to exert a negative influence on tax revenue collection, to the best knowledge of the authors, there is not yet any systematic and direct empirical verification.

In recent year, the work of PwC and the World Bank Group⁸ has provided various proxies of tax compliance burden in most countries in the world over time. Despite various limitations in their methodologies (for a critical review of refer to Tran-Nam and Evans⁹), the Paying Taxes project has nonetheless produced panel data on tax compliance burden indicators

⁶ World Bank Group, above n 3.

⁷ See, for example, Bird et al., above n 4; Richard M. Bird, Jorge Martinez-Vazquez. and Benno Torgler “Societal Institutions and Tax Effort in Developing Countries” *CREMA Working Paper No. 2004-21* (Center for Research in Economics, Management and the Arts, Zürich, 2004); “Societal Institutions and Tax Effort in Developing Countries” (2014) 16(1) *Annals of Economics and Finance* 185; Patrick A. Imam. and Davina F. Jacobs. “Effect of Corruption on Tax Revenues in the Middle East” *IMF Working Paper WP/07/270* (IMF, Washington DC, 2007); Tahseen Ajaz and Eatnaz Ahmad “The Effect of Corruption and Governance on Tax Revenues” (2010) 49(4) *The Pakistan Development Review* 405.

⁸ PwC and the World Bank Group *Paying Taxes 2018* (PwC and the World Bank Group, London and Washington DC, 2018).

⁹ Binh Tran-Nam and Chris Evans “Towards the Development of a Tax System Complexity Index”, (2014) 35(3) *Fiscal Studies* 341 at 356–7.

measured in a consistent and comparable basis. This data availability allows us to explore empirically the impact of tax compliance burden in a systematic fashion.

The principal aim of this paper to examine the impact of tax policy and tax administration on tax revenue collection in 14 emerging Asian countries (listed in Figure 1) over the period from 2004 to 2015. More specifically, it seeks to estimate the effects of tax rate, tax compliance burden and quality of tax administrative governance on tax collection ratio for those countries under study. The countries under study are chosen because they form a group of emerging economies in the most dynamical region of the world. Their tax systems have many common features that allow a methodical analysis. Further, the period of study from 2004 to 2015 represents the latest period in which data are available and comparably reliable (i.e., collected by a consistent methodology).

The research framework of the present paper is decisively positivism. More specifically, the method of analysis is econometric (regression analysis) using a variety of secondary, panel data published by PwC and the World Bank Group.¹⁰ The econometric estimation allows us to test tacitly the various hypotheses regarding the impact of tax rate, tax compliance burden and tax administrative governance on tax collection performance.

The remainder of the paper is structured as follows. Section 2 presents a brief review of the literature, which covers both tax revenue estimation/forecast models and empirical studies on tax collection ratios in developing countries. The research methodology, theoretical model, estimating equation and data are then discussed in the next section. Section 4 presents the estimation results and discussions. The research findings confirm that tax rate has a positive impact on tax collection, tax compliance burden adversely affects tax collection whereas quality of government has a beneficial impact on revenue collection. These results suggest that, in Asian developing countries at least, tax simplification or governance enhancement can play a positive role in improving tax revenue collection. Section 5 concludes.

2. REVIEW OF PREVIOUS STUDIES

Empirical studies of tax revenue collection may be classified into two broad groups. The first group is concerned with tax revenue estimation/forecasting. The second group seeks to examine the determinants of tax revenue performance. While the present paper focuses on the second type of studies, it is nevertheless useful to briefly review the literature on tax revenue estimation/forecast.

A distinction may be made between revenue estimation and revenue forecast. Revenue estimation refers to the forecast of future tax revenue under actual tax laws whereas revenue forecast is performed to evaluate tax proposals that may or may not be subsequently adopted. The estimation of future or potential level of tax revenue is of great interest to government treasuries, public officials, politicians, tax academics and consultant economists for obvious reasons. Tax revenue estimation/forecasting is conducted at different jurisdictional levels (national, provincial and local), for different types of taxes (total tax revenue, income tax, GST/VAT, etc) and using different quantitative techniques (naïve method, i.e., time-series or trend analysis, micro method and macro method). For developing countries, time series

¹⁰ PwC and the World Bank Group, above n 9.

analysis is by the far the most commonly adopted method of tax revenue estimation/forecasting.¹¹

Studies of tax revenue determinants typically utilise macroeconomic method of analysis. Such studies can, in principle, be national or international in scope. However a national study would require very long time-series data which may not be available. International studies encompass both developing and developed countries although there is a greater emphasis on developing economies for two main reasons. First, developing countries need to raise their tax collection ratio over time. Secondly, developing countries tend to suffer from various factors (e.g., tax corruption) that prohibit effective and efficient tax collection. International studies of tax revenue determinant normally employ dynamic analysis of panel data. Further, these studies focus on tax collection ratio rather than tax revenue because large countries such as the USA or China would dominate any international econometric analyses that use absolute tax revenue as a regressand.

In the context of developing economies, Bird et al.¹² have identified two broad groups of determinants of tax collection ratio (called tax effort in their studies). The first group consists of economic factors (called structural factors in their papers) such as level of economic development (real income per capita), composition of output (share of non-agriculture in GDP), trade openness (ratio of exports plus imports to GDP) and rate of population. The second group consists of institutional factors (called demand factors in their studies) such as some of the six quality of governance indicators developed by Kaufmann et al.¹³

In the context of the Middle East, Imam and Jacobs¹⁴ refined tax collection ratio into the ratio between non-hydrocarbon tax revenue and non-hydrocarbon GDP. For independent variables they included level of economic development (logarithm of income per capita), level of industrialisation (share of agricultural sector), trade openness, consumer price level and corruption (obtained from the International Country Risk Guide (ICRG)¹⁵). Using the system generalised method of moments (GMM), they found corruption significantly and negatively affects corporate and other enterprise taxes, taxes on payroll and workforce, VAT, excises, trade taxes, customs and import duties and export taxes, but, surprisingly, not total tax revenue.

In a study of Pakistan's tax collection ratio, Ajaz and Ahmad¹⁶ employed the same independent variables as Imam and Jacobs. They however added the one-year lagged dependent variable and governance (obtained from the World Bank's WGI) to the list of independent variables. Using the GMM, they found that output composition, corruption and

¹¹ Annette Kyobe and Stephan Danninger "Revenue Forecasting – How Is It Done? Results from a Survey of Low-income Countries" *IMF Working Paper No WP/05/24* (IMF, Washington DC, 2005) at 14.

¹² Bird et al. above n 8.

¹³ These include Voice and accountability, Political stability and absence of violence, Government effectiveness, Regulatory quality, Rule of law and Control of corruption. They are now known as World Bank's Worldwide Governance Indicators (WGI); see Daniel Kaufmann, Aart Kraay and Massimo Mastruzzi *Governance Matters III: Governance Indicators for 1996–2002* (World Bank, Washington DC, 2003).

¹⁴ Imam and Jacobs. above n 8.

¹⁵ See Stephen Knack "Aid Dependence and the Quality of Governance: Cross-Country Empirical Tests", (2001) 68(2) *Southern Economic Journal* 310.

¹⁶ Ajaz and Ahmad, above n 8.

governance are statistically significant. It is unclear how Ajaz and Ahmad constructed their governance variable from the six WGI.

In our study, we are interested in the effects of institutional factors on tax revenue collection. For practical purposes, we shall omit the large and growing volume of related literature on corruption and tax evasion.¹⁷ As discussed below, the influence of governance on revenue collection is both theoretically and empirically unambiguous, especially for countries belonging to the low end of economic development.

In an early study on governance and tax revenue collection, Chand and Moene¹⁸ examined the issue of how to improve tax administrative governance by providing incentives to tax officers. In a series of papers, Bird et al.¹⁹ established that good governance, measured in terms of control of corruption and voice accountability, can promote tax morale and thus give rise to tax revenue collection in both developing and developed countries. This broad finding has been confirmed in other studies.²⁰ But the empirical effect of governance on tax revenue collection may not be uniform for all countries at different levels of development. Applying the GMM to panel data of 82 developing countries, Nguyen Phuong²¹ found that control of corruption has a positive impact on tax revenue in low and lower-middle income countries, while this effect is negative in upper-middle income economies.

In view of the fact that the tax compliance burden tends to be relatively higher in developing countries,²² a meaningful question to be asked is how tax compliance burden affects tax collection ratio. From a theoretical perspective, it has been argued that an increase in tax compliance burden (as a measure of tax complexity) would have an adverse effect on tax revenue.²³ This is because tax compliance costs act like an additional tax on businesses, which has several adverse consequences on tax revenue. First, it may discourage economic activities or encourage taxpayers to stay outside the formal tax system. Secondly, higher tax complexity may give rise to both unintentional errors and aggressive tax planning, leading to less tax revenue being collected. Thirdly, higher tax complexity may discourage FDI, which is particularly important to developing economies.

¹⁷ See, for example, Fedrick Galtung “Current Strategies for Combating Corruption: A Study of Corruption in the Tax Administration” *Occasional Working Paper 8:95* (Transparency International, Berlin, 1995); John Toye and Mick Moore “Taxation, Corruption and Reform” (1998) 10(1) *European Journal of Development Research* 60; Attila Gbewopo “Corruption, Taxation and Economic Growth: Theory and Evidence” (2009) 75(2) *Recherches Économiques de Louvain* 229; Timothy Besley and Persson Torsten “Taxation and Development” in Alan Auerbach, Raj Chetty, Martin Feldstein and Emmanuel Saez (eds), *Handbook of Public Economics* (Vol. 5, North Holland, Amsterdam, 2013) 51.

¹⁸ Sheetal K. Chand and Karl O. Moène (1999) “Controlling Fiscal Corruption” (1999) 27(7) *World Development* 1129.

¹⁹ Bird et al., above n 8.

²⁰ Imam and Jacobs, above n 8; Max Everst-Phillips and Richard Sandall “Linking Business Tax Reform with Governance – How to Measure Success” *Investment Climate in Practice No. 48314* (World Bank Group, Washington DC, 2008); Ajaz and Ahmad, above n 8.

²¹ Lien Nguyen Phuong “Impact of Institutional Quality on Tax Revenue in Developing Countries” (2015) 5(10) *Asian Journal of Empirical Research*, 181 at 190.

²² PwC and the World Bank Group, above n 9.

²³ Binh Tran-Nam “An Integrated Approach to the Economic Measurement of the Costs of Tax Complexity” in Chris Evans, Richard Krever and Peter Mellor (eds) *Tax Simplification* (Kluwer Law International, Rijn, 2015), 55 at 71–3.

The empirical literature has not been able to verify theoretical point in a systematic manner. As pointed out in the introductory section, this is primarily because a lack of reliable and consistent data on tax compliance burden across countries and over time. It is difficult enough to obtain tax compliance cost estimates for a country in a particular year, let alone for 14 countries over a 12-year period!

In a recent study of firm-level tax evasion in transition economies, Abdixhiku et al.²⁴ demonstrated that tax compliance costs positively influences business taxpayers' evasive behaviour but the effect is small. The data on what the authors termed 'tax compliance costs' is derived from responses to a survey question that seeks to measure the amount of time that senior management spends dealing with various legal requirements.²⁵ This is clearly an unacceptable proxy of tax compliance costs.

In short, there is a gap in the literature concerning the empirical effect (sign and magnitude) of tax compliance burden on tax collection ratio. The present study seeks to fill this tax literature gap.

3. RESEARCH METHODOLOGY, THEORETICAL MODEL, ESTIMATING EQUATIONS AND DATA

3.1 Research methodology

The methodology of any research paper consists of three separate elements: research framework, method of analysis and data collection. The research question of the present paper, implicit in its introductory section, is concerned with the impact of tax policy and administrative variables on tax collection ratio. Given the nature of this research question, the appropriate research framework is positivism which seeks to utilise the scientific method to construct theories that are capable of explaining the causal relationship or interaction of relevant variables under study. The research framework of this paper is thus positivistic in the sense that it seeks to estimate quantitative relationships and test hypotheses in an objective manner through the use of data, evidence and rational arguments.

Consistent with its positivistic research framework, this study adopts a quantitative method of analysis. More specifically, econometric methods will be employed to estimate the underlying relationships between the variables under study. In terms of data, the study utilises a range of panel data at the country level. These quantitative data are derived from internationally published sources. The estimating equation, definition of main variables and sources of data are further elaborated in the remainder of this section.

3.2 Theoretical model

²⁴ Lumir Abdixhiku, Besnik Krasniqi, Geoff Pugh and Iraj Hashi "Firm-level Determinants of Tax Evasion in Transition Economies" (2017) 41(3) *Economic Systems* 354 at 363.

²⁵ Abdixhiku et al., above n 26, at 359.

Unlike most previous studies in tax revenue collection, we begin by posulating that, at the country level, tax collection ratio is a function of tax policy and administrative variables, and some relevant economic factors. In symbolic form, this relationship can be expressed as

$$(1) \quad TCR = F(X, Y, Z)$$

where

TCR = tax collection ratio (\equiv tax/GDP);

X = a vector of tax policy variables;

Y = a vector of tax administration variables; and

Z = a vector of relevant economic variables.

When it comes to empirical analyses, it is necessary to specify the independent variables and obtain their values from primary or secondary sources of data. For simplicity, we choose to proceed with the following independent variables:

- X = tax rate, representing a tax policy variable;
- Y_1 = tax compliance burden, representing a tax administration variable;
- Y_2 = tax administration governance, representing another tax administration variable; and
- Z = FDI/GDP (where FDI is inflow foreign direct investment), representing a relevant economic factor.

While the above list is small, there are sufficient independent variables to capture the variation in tax collection ratios. A few remarks deserve mention.

First, other things being equal, tax rate must necessarily have a positive direct effect on tax revenue. However, tax rate may also have a negative indirect effect on tax revenue as a higher tax rate may discourage efforts and entrepreneurship both at individual and business levels, thus leading to lower level of economic activities and tax revenue. By excluding tax base in the RHS of (1) we allow for changes in the level of economic activities and can thus capture both the direct and indirect effects of tax rate on tax collection ratio.

Secondly, tax compliance burden is a good indicator of tax complexity. As indicated in the literature review section, a negative theoretical relationship between tax complexity and tax revenue collection can be expected. However, this not yet been verified in a systematic way, primarily due to a lack of suitable data on tax compliance burden.

Thirdly, there are clearly many indicators of overall macroeconomic conditions in a country. We note, however, that in the 14 emerging Asian countries under study, inflow FDI represents a highly significant source of technology transfer, export earnings and economic growth. This justifies the use of FDI/GDP as an important variable that controls for the macroeconomic health of the countries under study.

Finally, the theoretical model has so far been presented as a static one. Some of the independent variables may have lagged effects on the tax collection ratio. For example, an improvement in the quality of tax administration may take some time to enhance tax revenue collection. Similarly, a sudden increase in current FDI inflow may take, say, a year to produce

a positive impact on economic activities and tax collection ratio. However, the lagged effects may not be very unduly long so, for convenience, we focus on the static model.

3.3 Estimating equations

In view of the theoretical model (1) and the subsequent discussion, we employ a multivariate regression model as follows:

$$(2) \quad TCR_{it} = \alpha_0 + \alpha_1 X_{it} + \alpha_2 Y_{1it} + \alpha_3 Y_{2it} + \alpha_4 Z_{it} + e_{it}$$

where i refers to country, t refers to year and e is a classical random error. In equation (2) we expect a rise (fall) in tax rates will always increase (decrease) tax collection ratio, i.e., $\alpha_1 > 0$ for all tax rates

Alternatively, we may adopt a more flexible functional that allow the negative, indirect effect of tax rate to outweigh the positive, direct effect of tax rate when tax rates become sufficiently high. This can be achieved by employing the following quadratic functional form:

$$(2') \quad TCR_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 (X_{it})^2 + \beta_3 Y_{1it} + \beta_4 Y_{2it} + \beta_5 Z_{it} + u_{it}$$

where $\beta_1 > 0$ and $\beta_2 < 0$. Under these conditions, TCR is increasing (decreasing) in X when $X < (>) -\beta_1/\beta_2$. Thus, the tax rate $X^* = -\beta_1/\beta_2$ can be thought of as the tax-collection-ratio maximising tax rate.

In these regression analyses, we note that tax rate (representing tax policy) is much more under the direct control of the government than the other independent variables. Tax compliance burden and tax administrative governance depend not only on tax policy and tax administrative practices, but also on taxpayer behavioural responses (e.g., tax planning). While governments may offer tax incentives to promote FDI, the actual FDI inflows depend largely on external factors such as world macroeconomic conditions.

We also note that the values of some of the variables under study, such as TCR and Z , can be derived from published sources in a straightforward manner. However, for tax rate, tax compliance burden and tax administrative governance, it is necessary to find their suitable proxies. Using the best data currently available, the proxies for these variables are chosen as follows.

First, for the theoretical variable tax rate, we are not using the statutory income tax rates (individual and corporate) or VAT rates. Instead, we employ the ‘total tax and contribution rate’ (\equiv all taxes borne/turnover), developed by the PwC (2018),²⁶ as a proxy for the tax rate in the estimating equations (2) and (2'). The PwC’s total tax contribution framework identifies five tax bases, namely, profit taxes, people taxes, product taxes, property taxes and planet taxes. This approach emphasises incorporated business taxation at the expense of unincorporated business taxation. This is acceptable in view of the fact that incorporated businesses contribute a significant share of tax revenue collected by the governments of countries under study.

²⁶ PwC *The Total Tax Contribution Framework – Over a Decade of Development* (PwC, London, 2018).

Secondly and similarly, we employ the ‘time to comply and payments,’²⁷ also developed by PwC, as a proxy of tax compliance burden. This variable is defined as number of hours spent per year by a mid-size company to comply with its tax requirements. This measure suffers from a number of obvious drawbacks, for example,

- it excludes tax compliance costs of individual and unincorporated business taxpayers;
- it ignores fees paid to external tax advisers as an important component of tax compliance costs; and
- it disregards the scale of business operation in different countries.

Nonetheless this variable has been measured across countries and over time in a comparable and consistent manner. In this sense the PwC data presents the best available proxy for (business) tax compliance burden.

Thirdly and finally, we note that there is no readily available, reliable indicator of country-level tax administrative governance that is consistently defined and measured across different countries. However, it seems plausible to assume that a country’s tax administrative governance is strongly and negatively correlated to its level of corruption. Under this assumption, tax administrative governance can be proxied by alternative indicators of corruption:

- Corruption Perceptions Index (CPI) developed by Transparency International (TI, 2017);²⁸ or
- WGI developed by the World Bank;²⁹ or
- ICRG;³⁰ or
- the TRACE Business Bribery Risk Matrix jointly developed by TRACE International and the RAND Corporation.³¹

The above alternative indicators are similarly constructed and highly correlated. For consistency with other data employed in the study, we choose to the WGIs. Among the six components of WGIs, it is perceived that the Control of Corruption Indicator is perhaps the best proxy of tax administrative governance. That is, the better the control of corruption, the higher is the quality of tax administrative governance. Note that, in previous studies,³² better control of corruption is interpreted as improving tax morale. In the present paper, better control of corruption is viewed as improving the quality of tax administrative governance.

3.4 List of variables and data sources

Having determined all the control variables, it is now useful to restate the estimating equations, and describe all variables and data sources for the study. The competing, alternative estimating equations, corresponding to (2) and (2’), now become

$$(3) TCR_{it} = \alpha_0 + \alpha_1 TTCR_{it} + \alpha_2 TTCP_{it} + \alpha_3 COCI_{it} + \alpha_4 (FDI/GDP)_{it} + e_{it}$$

²⁷ Defined as number of hours spent per year by a mid-size company to comply with its tax requirements.

²⁸ Transparency International (TI) *Corruption Perceptions Index 2016* (TI, Berlin, 2017).

²⁹ Kaufmann et al., above n 14.

³⁰ Knack, above n 16.

³¹ TRACE International *TRACE Bribery Risk Matrix* (TRACE International, Annapolis, USA, 2017).

³² Bird et al., above n 8.

and

$$(3') TCR_{it} = \beta_0 + \beta_1 TTCR_{it} + \beta_2 TTCSRQ_{it} + \beta_3 TTCP_{it} + \beta_4 COCI_{it} + \beta_5 (FDI/GDP)_{it} + e_{it}$$

respectively, where

$TCR \equiv$ Tax/GDP (%). The values of tax revenue and GDP in domestic currency for the countries under study from 2004 to 2015 are derived from the *World Development Indicators Database*.³³

$TTCR \equiv$ Total tax and contribution rate (%), obtained from the *Paying Taxes Report*.³⁴

$TTCSRQ \equiv$ The square of $TTCR = TTCR \times TTRC / 100$ (we need to divide by 100 because $TTCR$ is expressed as a percentage, not decimal)

$TTCP \equiv$ Time to comply and payments (hours per year), taken from the *Paying Taxes Report*.³⁵

$COCI \equiv$ Control of corruption indicator (ranging from -2.5 to 2.5), extracted from WGI Database.³⁶

$Z = FDI/GDP$ (%). The values of FDI and GDP in domestic currency for the countries under study from 2004 to 2015 are derived from the *World Development Indicators Database*.³⁷

Note that none of the variables is measured in current prices so neither currency conversion using exchange rate nor price adjustment using inflation rate is necessary.

Our null and alternative hypotheses can now be formally stated as follows:

For equation (3):

$H_0: \alpha_i = 0$ ($i = 1, 2, \dots, 4$) vs. $H_a: \alpha_1 > 0, \alpha_2 < 0, \alpha_3 > 0$ and $\alpha_4 > 0$.

For equation (3'):

$H_0: \beta_i = 0$ ($i = 1, 2, \dots, 5$) vs. $H_a: \beta_1 > 0, \beta_2 < 0, \beta_3 < 0, \beta_4 > 0$ and $\beta_5 > 0$.

4. RESULTS AND DISCUSSIONS

4.1 Summary description of data

Figures 2, 3 and 4 illustrate the values of $TTCR$, $TTCP$ and $COCI$ for the 14 countries under study in 2004 and 2015, respectively.

³³ World Bank Group, above n 3.

³⁴ PwC and the World Bank Group above n 9.

³⁵ PwC and the World Bank Group above n 9.

³⁶ World Bank Group, *Worldwide Governance Indicators* (World Bank Group, Washington DC, 2017).

³⁷ World Bank Group, above n 3.

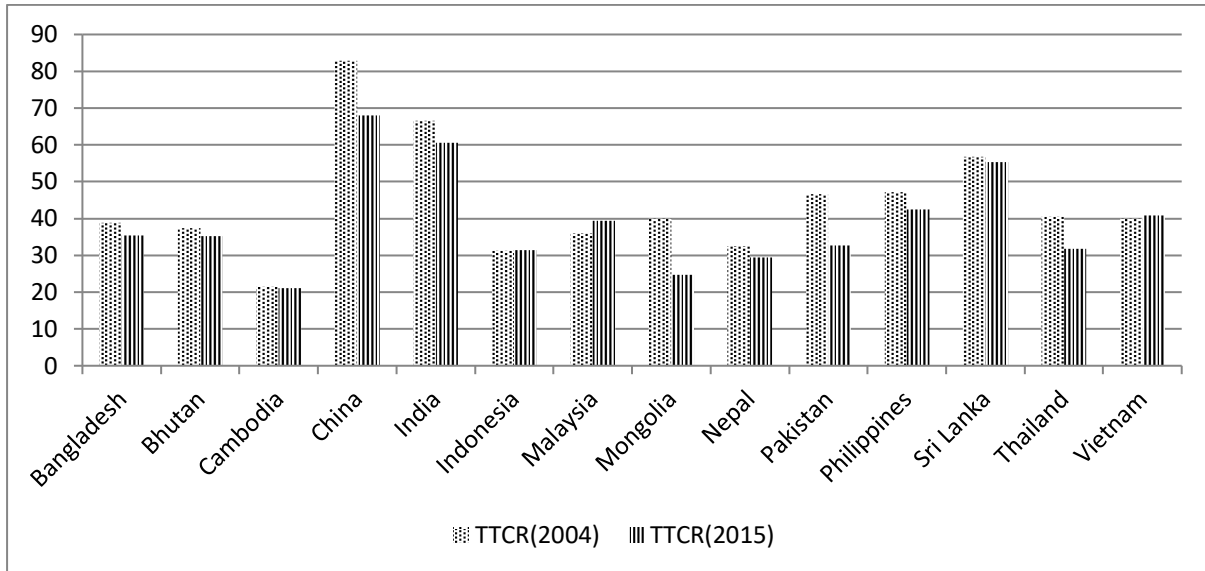


Figure 2: Total tax and contribution rate (%) in 14 emerging Asian countries, 2004 and 2015

Source: *Paying Taxes*.³⁸

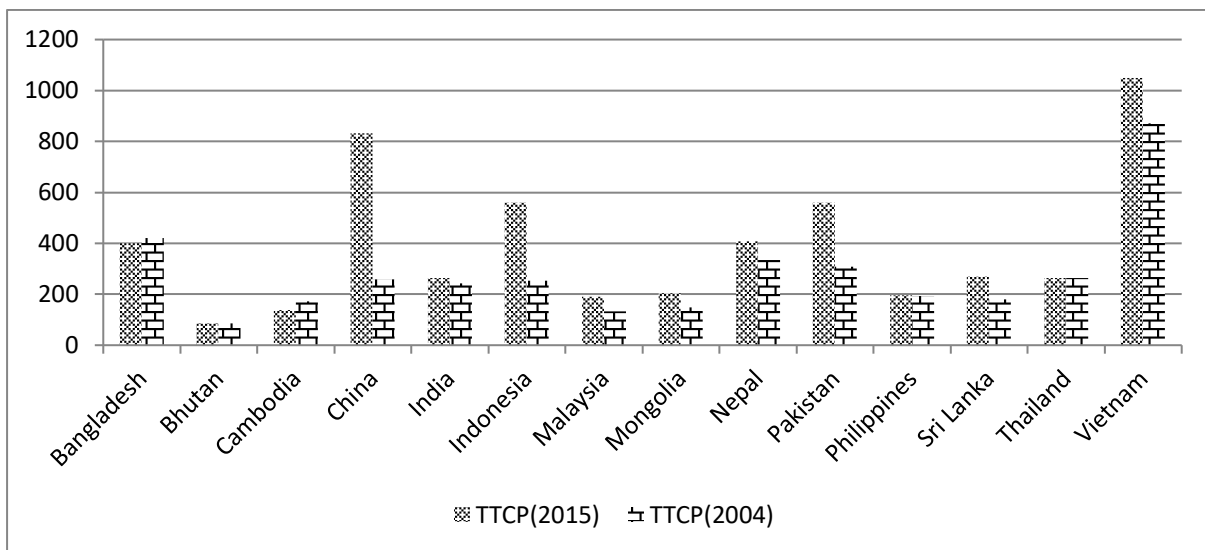


Figure 3: Time to comply and payments (hrs/year) in 14 emerging Asian countries, 2004 and 2015

Source: *Paying Taxes*.³⁹

³⁸ PwC and the World Bank Group, above n 9.

³⁹ PwC and the World Bank Group, above n 9.

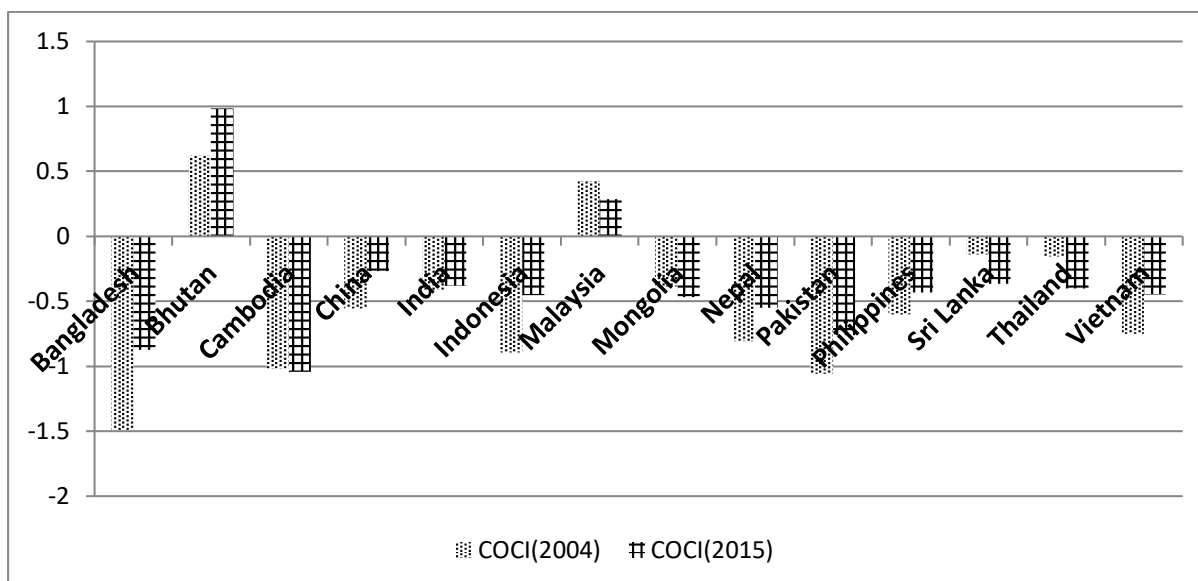


Figure 4: Control of corruption in 14 emerging Asian countries, 2004 and 2015

Source: *Worldwide Governance Indicators*.⁴⁰

Figure 2 suggest that the total tax and contribution rates in the 14 chosen countries are generally high with China being the most tax burdensome country. However, the great majority of them (11 out of 14 countries) have managed to reduce their total tax burden from 2004 to 2015. Similarly Figure 3 indicates that the business tax compliance burden in terms of time spent on business tax affairs is generally high in the countries under study with Vietnam being by far the most tax compliance burdensome country. However, 11 out of 14 have achieved tax simplification that reduces tax compliance burden on business taxpayers. Figure 4 shows that from an international perspective, except Malaysia and Bhutan, the remaining 12 countries in the study perform poorly (below world average) in terms of control of corruption. While nine countries have improved over time, the other five countries have declined in controlling corruption.

Table 1 summarises the basic descriptive statistics of the variables in the estimating equations (3) and (3'). Despite some common features of the countries under study, these variables exhibit considerable variations (in terms of range and standard deviation). The variation in data suggests that the regression analyses of equations (3) and (3') are statistically meaningful exercises.

Table 1: Summary description of variables

Variable	No of obs	Mean	Std dev	Min	Max
<i>TAX/GDP</i> (%)	168	15.320	9.661	6.917 Bagladesh 2017	53.095 Nepal 2015
<i>TTCR</i> (%)	168	42.705	16.194	21.000 Cambodia 2012–15	112.900 Sri Lanka 2012

⁴⁰ World Bank Group, above n 36.

<i>TTCP</i> (hours/year)	168	332.850	234.294	85.000 Bhutan 204–15	1,050.000 Vietnam 2004–10
<i>COCI</i> (ranges from –2.5 to 2.5)	168	–0.486	0.510	–1.488 Bangladesh 2004	1.275 Bhutan 2014
<i>FDI/GDP</i> (%)	168	3.532	5.132	0.006 Nepal 2004	43.912 Mongolia 2011

Sources: *World Development Indicators*⁴¹, *Worldwide Governance Indicators*⁴² and *Paying Taxes*.⁴³

Table 2 presents the correlation matrix of the variables in the estimating equation (3). It is interesting to note that, in terms of simple correlation, *TCR* is uncorrelated with *COCI* and (*FDI/GDP*). Further, *TCR* is significantly and negatively (positively) correlated with *TTCP* (*TTCP*), contradicting to our a priori beliefs.

To ensure the robustness of our regression analysis, we test for multicollinearity among the independent variables. The results (see Table A1 in the Appendix) indicate that all variances are smaller than 10, hence multicollinearity is not a problem in our estimation.

Table 2: Correlation matrix

	<i>TAX/GDP</i>	<i>TCR</i>	<i>TTCP</i>	<i>COCI</i>	<i>FDI/GDP</i>
<i>TAX/GDP</i>	1				
	-0.25				
<i>TCR</i>	(0.00***)	1			
	0.15	0.16			
<i>TTCP</i>	(0.05**)	(0.04**)	1		
	-0.03	0.12	-0.34		
<i>COCI</i>	(0.74)	(0.11)	(0.00***)	1	
	-0.01	-0.22	0.00	-0.09	
<i>FDI/GDP</i>	(0.93)	(0.00**)	(0.97)	(0.23)	1

Sources: Same as Table 2.

Notes: Figures in parentheses denote $\Pr[Z > |z|]$; **, *** significant at 5% and 1% (two-sided test) respectively.

4.2 Empirical findings

⁴¹ World Bank Group, above n 3.

⁴² World Bank Group, above n 36.

⁴³ PwC and the World Bank Group, above n 9.

Because of the choice of control variables, endogeneity is unlikely to be an issue in our estimation. Since our dataset is a strongly balanced dynamic panel data, we apply the two-step GMM of dynamic panel data estimation to the regression equations (3) and (3'). Linear dynamic panel data estimation includes lags of the dependent variable as covariates and contains unobserved panel-level effects, fixed or random. By construction, the unobserved panel-level effects are correlated with the lagged dependent variable, making standard estimators inconsistent. To overcome this problem, we employ the two-step instrumental variable and moment restriction procedures proposed by Arellano and Bond, Arellano and Bover, and Blundell and Bond.⁴⁴

Following good practices in linear dynamic panel data estimation, we use two instrumental variables, namely, the one-period lag of the dependent variable (TCR_{-1}) and (FDI/GDP).⁴⁵ The use of TCR_{-1} as an instrumental variable reduces the total number of observations available for estimation from 168 (= 14 × 12) to 154 (= 168 – 14). Using Stata version 12, the following estimation results are obtained.

Table 3: Estimation results

Variable		Equation (3)		Equation (3')	
		Coefficient (Standard error)	Computed statistic ^a (Pr[Z > z])	Coefficient (Standard error)	Computed statistic ^a (Pr[Z > z])
<i>TTCR</i>		0.217 (0.038)	5.780 (0.000)***	0.719 (0.214)	3.360 (0.001)***
<i>TTCRSQ</i>				-0.004 (0.001)	-2.770 (0.006)***
<i>TTCP</i>		-0.031 (0.004)	-7.650 (0.000)***	-0.033 (0.004)	-9.160 (0.000)***
<i>COCI</i>		9.155 (4.620)	1.980 (0.047)**	11.952 (5.275)	2.220 (0.026)**
<i>FDI/GD</i>		0.006 (0.001)	8.950 (0.000)***	0.007 (0.001)	10.390 (0.000)***
<i>Constant</i>		6.339 (3.781)	1.680 (0.094)**	-9.239 (8.648)	-1.070 (0.285)
No. of observations	154				
No. of groups	14				
No. of instruments for level equation	13				
Wald chi ² test			106.19 (0.000)***		1,230.48 (0.000)***
Sargen–Hansen test ^b			(0.744)		(0.455)

⁴⁴ Manuel Arellano and Stephen Bond “Some Tests of Specification for Panel Data: Monte Carlo Evidence and An Application to Employment Equations” (1991) 58(2) *The Review of Economic Studies* 277; Manuel Arellano and Olympia Bover “Another look at the instrumental variable estimation of error-components models” (1995) 68(1) *Journal of Econometrics* 21; Richard Blundell and Stephen Bond “Initial Conditions and Moment Restrictions in Dynamic Panel Data Models” (1998) 87(1) *Journal of Econometrics* 115.

⁴⁵ Note that in linear dynamic panel estimation an independent variable can also be used as an instrumental variable.

AR(2) test ^c			(0.616)		(0.580)
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Notes:

^a The computed statistics for the estimated coefficients are the z statistic. *, ** and *** significant at 10%, 5% and 1% level of significance for an one-sided test, respectively.

^b Sargen–Hansen test is a test of overidentifying restrictions.

^c AR(2) test is a test for autocorrelation.

4.3 Discussions

The estimation results presented in Table 3 suggest that our parsimonious and innovative specification has been a success. For both estimated equations (3) and (3'), all independent variables, except *COCI*, are statistically significant at 1% level whereas *COCI* are significant at 5% level. This means that each of them individually accounts for the variation in the tax collection ratio in a statistically meaningful way. The two-step dynamic panel data estimation does not report R^2 or adjusted R^2 . However, as indicated by the Wald chi-squared test, the overall goodness of fit of the estimated equations (3) and (3') are both highly satisfactory.

Other diagnostic tests peculiar to linear dynamic panel data estimation are all satisfactory. As a special feature of GMM, we conduct the Sargen–Hansen test for overidentifying restrictions. The result of this test suggests that overidentifying restrictions are valid for both estimated equations (3) and (3'). Similarly, the AR(2) tests also indicate the absence of autocorrelation in both (3) and (3').

More importantly, all estimated coefficients have the expected signs. Thus, all the null hypotheses (that there is no relationship between tax collection ratio and each of the four independent variables) can be convincingly rejected. Indeed, tax rate (as proxied by total tax and contribution rate), tax administrative governance (as proxied by the control of corruption indicator) and FDI/GDP each individually has a positive impact on tax collection ratio. As expected, tax compliance burden (as proxied by time to comply and payments) exerts a negative influence on tax collection ratio.

Four remarks deserve mention. First, under equation (3'), $TTCR^* = 0.719/0.004 = 179.75$, i.e., a rise in *TTCR* continues to raise more revenue so long as $TTCR < 179.75$. We note that in our data sample (i) the maximum value of *TTCR* is 112.90 (Sri Lanka in 2012), and (ii) the trend of *TTCR* is downward over time. Thus, for practical purposes, (3) and (3') are highly similar in that the combined (direct and indirect) effect of *TTCR* is positive for the full range of reasonable values of *TTCR* in both models. The quantitative impact differs, however, between two models. For example, if *TTCR* increases from 40 to 50 per cent, holding other variables constant, the estimated increase in tax collection ratio varies from 1.1 percentage point (using (3)) to 2.6 percentage point (using (3')).

Secondly, the results obtained provides a systematic empirical verification that tax compliance burden negatively influences tax collection performance in developing countries. The impact is strong and quite robust for both estimated equations. For a reduction of 10 hours per year in *TTCP*, holding other factors the same, tax collection ratio can be raised by about 0.3 percentage point.

Thirdly, our results support the sanding-the-wheel hypothesis of the impact of corruption on tax revenue collection, i.e., better control of corruption improves tax collection ratio.⁴⁶ The impact of control of corruption is powerful. For example, a 0.1 improvement in *COCI* can yields a one percentage increase in tax collection ratio, keeping other variables unchanged.

Fourthly and finally, it is a difficult task to discriminate between the two specifications. Both have performed well statistically and economically speaking. They are highl similar in terms of impact of each independent variable on the tax collection ratio. The addition of *TTCRSQ* to (3') reduces the statistical significance of *TTCR* (in terms of the *z* statistic) but improves those of *TTCP*, *COCI* and (FDI/GDP). The positive estimated intercept of (3) has a straightforward interpretation whereas the estimated intercept of (3') is statistically insignificant indicating no omitted variables. Taking the Wald χ^2 test into account, there is a very slight preference for (3') over (3).

5. SUMMARY CONCLUSIONS

We have constructed and esimated a macro model to examine the impact of tax policy, tax administrative and macroeconomic variables on tax collection ratio for 14 emerging Asian countries from 2004 to 2015. The main novelty of our theoretical model is that we explicitly consider the influence of tax rate and tax compliance burden on revenue collection in a systematic fashion. Two alternative estimating equations (one linear and one quadratic in the tax rate) are specified. Our regression analysis utilises a small number of variables whereas our estimating approach is empirically feasible using readily available secondary data (from the World Bank and PwC) as proxies for some of the independent variables.

The choice of countries under study reflects several consideration. First, these countries are emerging economies in perhaps the most dynamical region of the world. Secondly, their tax systems exhibits many common features, including high compliance burden and widespread petty tax aministrative corruption. Thirdly, their tax revenue performance overtime is uneven and, for many of them, appears to be inadequate. Thus, a systematic examination of their tax colleciton ratios is urgently needed.

Applying the two-step GMM of linear dynamic estimation to our strongly balanced panel data, statistically significant and theoretically plausible empirical results have been obtained. Tax rate, tax administrative governance and FDI positively impact on tax collection ratio, while tax compliance burden adversely affects tax to GDP ratio. Our results provide strong empirical support to the theoretical arguments on the impatc of tax complexity on tax revenue collection. Out results also confirm the sanding-the-wheel hypothesis of the impact of corruption on tax revenue collection, i.e., better control of corruption improves tax collection ratio. Our study indicates that, without increasing the tax rate or the tax base by legislation or regulation, the governments of the countries under study can improve their tax revenue collection ratio through tax policy/administrative simplification or more effective control of tax corruption.

⁴⁶ In contrast, it has shown that petty tax administrative bribery has a positive impact on manufacturing innovation in Vietnam; see Binh Tran-Nam, Ngoc Anh Nguyen and Quang Hung Doan "How Petty Tax Corruption Impacts on Product Innovation: Evidence from Vietnam and Implications for Africa" *Tax and Corruption: An African Perspective Symposium*, University of Pretoria and South African Institute of Chartered Accountants, Johannesburg, 3–4 October 2017.

Our study is subject to some obvious limitations with respect to choice of independent variables in the regression analysis. More specifically, we recognise our limitations in having to use readily available secondary data to proxy theoretical variables. This is particularly true in using PwC's time to comply and payments as a proxy for tax compliance burden, despite that fact that such measure is currently the best proxy available for business tax compliance burden.

Our approach can be extended in different directions. First, we could incorporate additional independent variables to improve the explanatory power of our model. A potential, new control variable could be the level of real income per capita in PPP dollar. Secondly, instead of a static specification, we may consider a dynamic specification that involves some lagged independent variables (such as control of corruption or FDI). Thirdly and finally, we note that our approach is totally applicable to developed countries.

Appendix

Table A1: Variance Inflation Factor (VIF) Test

Variable	VIF	1/VIF
<i>TTCP</i> (hours per year)	1.21	0.82696
<i>COCI</i>	1.21	0.82914
<i>TTCR</i> (%)	1.13	0.88279
<i>FDI/GDP</i> (%)	1.05	0.95191
Mean VIF	1.15	