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A General Equilibrium Model of Value Added Tax Evasion: An Application to Pakistan

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Abstract

Value added taxes (VAT) constitute a major share of tax revenues in developing countries in which tax evasion is widespread. The literature on VAT evasion, however, is limited. This paper develops a computable general equilibrium framework for analyzing endogenous VAT tax evasion. The analytical framework entails increasing enforcement through greater spending on the enforcement of tax revenue collection. We assume that there is an elasticity that connects the changes in enforcement to actual increases in VAT collection. We apply the model to Pakistan data and show the level of enforcement spending required to achieve certain VAT collection targets. We also examine the short-, medium-, and long-term macroeconomic outlooks, and real consumption distribution across household economic groups associated with higher enforcement spending. We calibrate the model using 2016 as the base year and then run the dynamic model forward for 20 years. We define the implicit VAT rate as that hypothetical statutory rate that, in the absence of evasion, would approximately generate the observed VAT collection. We assume zero additional spending on enforcement in the baseline and estimate two alternative scenarios of VAT revenue target of 8% and 15% of the GDP. The alternative scenarios require increase in enforcement spending by a compounded 46.4% and 322.4%, respectively. We find that the increased enforcement spending enhances the sustainability of the government's budget deficit without causing a decline in real GDP over the long-term. The interest and inflation rates are also lowered. However, there is a small regressive impact on households' real consumption.

Keywords: Value added tax; tax evasion; tax enforcement; computable general equilibrium; macroeconomic outlook

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1. Introduction

Low tax revenue collection is an inherent feature of many developing countries (Besley and Persson, 2014). The size of the informal sector as share of GDP in these countries is also very high (Schneider, 2002). In addition to the lower tax base due to a larger informal sector, tax evasion is a severe problem for developing countries. Higher tax evasion results in lower funds for public sector investment, which limits opportunities for human development and economic growth. Value added taxes (VAT) constitute a major share of tax revenues in many of these countries. The literature on tax evasion, however, mainly focuses on income and corporate taxes and rarely covers VAT evasion. Although a recent paper modeled consumption tax evasion in an optimal tax policy setting under a neoclassical framework (Economides et al., 2020), the literature on sales tax or VAT evasion is generally limited. We intend to address this gap by developing a computable general equilibrium (CGE) model for analyzing the incidence of VAT evasion and applying it to data from a developing country.

The tax performance of a country is closely tied with enforcement. Lack of information and imperfectly observed transactions are the operational bottlenecks of enforcement that lead to VAT evasion. True reporting, verified documents, and strict enforcement rules are, therefore, essential to lessen tax evasion (Kopczuk and Slemrod, 2006; Kleven et al., 2011). Strengthening enforcement to achieve the desired level of tax collection also involves adequate spending. Theoretically, an optimal tax administration should incorporate an enforcement budget such that the social benefit is equal to the social cost. However, in practice, the optimal level of administrative effort has almost always been less than the level that generates maximum revenue (Slemrod and Yitzhaki, 2002).

A long strand of literature examines the social cost of increasing enforcement budgets in an optimization framework (Mayshar, 1991; Kaplow, 1990; Cremer and Gahvari, 1993). Studies

analyzing the impact of investment on enforcement activities in the USA have identified significant revenue potential in the range of USD one trillion over a decade (Sarin and Summers, 2019; Rossotti, 2020). Engel et al. (2006) estimated that each dollar of increase in enforcement spending could increase VAT revenues in Chile by $31. Another strand of studies has focused on the optimal enforcement mechanism (Graetz et al., 1986; Sansing, 1993). Alm and Mckee (2004) showing that in the auditing process, unofficial communication has a more substantial effect on tax compliance than official communication. For emerging and low-income countries, Akitoby et al. (2018) found that multidimensional tax administrative reforms such as risk-based audits, registration, filing, payment, and reporting will work better with indirect taxes. Also, empirical evidence shows that strengthening the auditing and enforcement capacity is the key to significant tax collection in developing countries (Carrillo et al., 2017).

We build on these findings that increasing VAT revenue entails larger enforcement spending. We apply data from Pakistan, a lower-middle-income country that, like many other developing countries, heavily relies on sales taxes (VAT) for fiscal revenues. We contribute to the literature by showing the level of enforcement spending required to achieve certain indirect tax (VAT) collection targets in a developing country setting. Further, we illustrate how the scenarios of higher enforcement spending leading to conclusions about how desired levels of VAT collection are associated with short-, medium-, and long-term macroeconomic outlooks and real consumption distributions across household economic groups. To the best of our knowledge, this is the first study that entails a general equilibrium framework to analyze endogenous VAT evasion and enforcement and generates evidence on the economic consequences of enforcing VAT compliance through higher enforcement spending. In the following sections of the paper we detail the country context, describe the model, lay out numerical simulations, and present the

simulation results from alternative enforcement scenarios.

2. Evidence on VAT Evasion

Several countries, including Pakistan, have adopted the VAT, which is believed to facilitate tax enforcement through a built-in incentive structure (Agha and Haughton, 1996; Kopczuk and Slemrod, 2006). Early research on VAT efficiency was mostly focused on the tax rate and tax base. Bogetic and Hassan (1993) argued that more complexity and narrower bases were responsible for lower tax collection efficiency. Jack (1996) compares several Central and Eastern European nations in terms of VAT adoption, noting that tax administration and evasion must be studied with tax structure to determine tax efficiency. Keen and Smith (2006) explores several avenues of VAT noncompliance, outlining the administrative difficulties associated with VAT fraud and evasion.

Another strand of literature examines the changes in tax policies accommodating VAT and how those changes are related to tax administration quality. Bird and Gendron (2006) considers tax administration quality and changes in tax policy in Ukraine and finds a positive relationship between higher administrative quality and tax collection efficiency. Similarly, Agha and Haughton (1996) find that administrative resources can increase tax collections. Pinhanez (2008) reports administrative reforms having a significant effect on VAT revenue growth in Brazil. Bergman and Nevarez (2006), however, document a mixed effect of audits on VAT compliance in Argentina and Chile. In a more recent study, Das-Gupta et al. (2016) construct tax administration measures of effectiveness from external audits of VAT administrations of India's state governments and find a significantly large effect of tax administration effectiveness on tax revenues.

The efficiency of tax administration has several implications on the tax gap issues. Weak

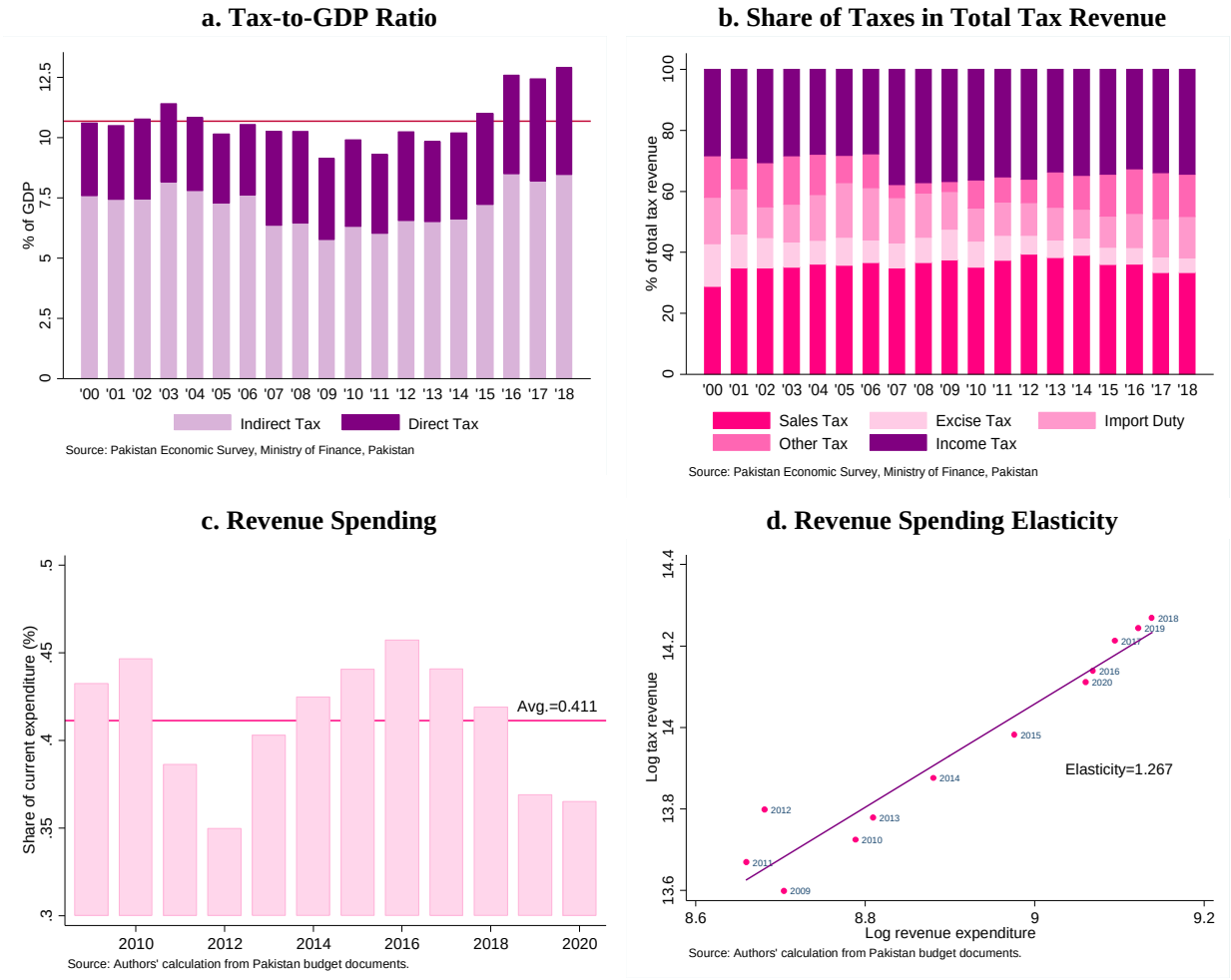
administration increases tax evasion, and a higher level of evasion creates a culture of corruption, especially for developing countries. Previous literature also focuses on the VAT gap in several countries. Aguirre and Shome (1988) estimate the potential VAT revenue before and after the restructuring of the VAT rate structure in Mexico, suggesting a tax gap of 45.1% in 1980 and 48.3% in 1983. Le Minh (2007) estimates a tax gap of 45.6 percent of the revenue potential for Romania. Jenkins and Kuo (2002) estimate the tax gap of 6 percent for alcoholic beverages, 10 percent for tobacco products, and 48 percent for remaining commodities for Nepal.

In summary, there is a sizable body of evidence regarding tax administration methods, tax gap, and low quality of tax administration. The research relies on different periods, different countries, and various measures of effectiveness and methodologies. However, these studies barely address the fiscal spending that is required to enhance enforcement and reduce VAT evasion, particularly in a general equilibrium setting. To this end, our study intends to fill this gap in literature by incorporating a general equilibrium framework where spending on enforcement enhances VAT collection.

3. Pakistan's Context

Pakistan is a lower-middle-income country in South Asia with a historically low tax-to-GDP ratio. Since 2000, the average tax-to-GDP ratio was around 10%, which improved slightly in recent years (Figure 1a). Despite efforts to improve tax collection, Pakistan runs a persistent budget deficit of over 5% of GDP. The tax structure is predominantly inclined toward indirect taxes including sales tax (VAT), excise tax, import duty, and other taxes. Among indirect taxes, the major share of revenue comes from the sales tax (Figure 1b). Because of such reliance, administering VAT, like in many other developing countries, is critical for fiscal operations in Pakistan.

Figure 1: Pakistan's Tax Structure



Tax evasion is an inherent problem of the Pakistan economy. A recent study indicates that Pakistan has the potential to nearly double its tax revenue as share of GDP (Cevik, 2018). However, because of tax evasion and avoidance, Pakistan's tax collection remains lower than in comparator countries. A World Bank project information document states that the tax gap for sales tax (VAT) in Pakistan is around 67% (World Bank, 2019). VAT evasion, thus, is a real concern in the Pakistan context. Previous studies on Pakistan mostly emphasize the efficiency and responsiveness of VAT or sales tax revenue mobilization in response to growth. Examining the elasticity and effectiveness of the tax system in Pakistan for the period of 1974-75 to 2003-

04, Bilqees (2004) reported a better performance of the sales tax in terms of revenue generation despite an overall smaller (less than unity) total tax revenue to total GDP elasticity. With respect to enforcement and tax administration, Illizetzki and Lagakos (2017) argued that improved tax administration in Pakistan could increase tax revenue by almost 8 percent, though the increased tax rate might adversely affect GDP and increase the rate of informality.

Cevik (2018) estimates the short-run and long-run elasticities of tax revenue with respect to GDP over the period 1960-2015 and reports significant variations across various subcategories of tax revenue. The study also finds that the general sales tax revenue is more responsive to GDP, though in comparison to other developing countries, Pakistan's tax revenue elasticity with respect to GDP has been below par. Elasticity estimates with respect to revenue collection expenditure in Pakistan, however, is not available in the literature. Pakistan spends around 0.4% of its total current expenditure for enforcement of tax collection (Figure 1c). We estimated a revenue enforcement spending elasticity (i.e., elasticity of tax revenue with respect to revenue collection spending) of 1.267 for Pakistan during the period 2008-09 to 2019-20 (Figure 1d).

4. Model

We develop the formal structure of a dynamic general equilibrium model that endogenously generates an underground economy. [1] Much of the structure of our model is designed to permit numerical implementation for Pakistan. Our model has *n* discrete time periods. All agents optimize in each period over a 2-period time horizon. That is, in period t they optimize given prices for periods t and $t+1$ and optimize expectations for prices for the future after $t+1$. When period $t+2$ arrives, agents re-optimize for period $t+2$ and $t+3$, based on new information about period $t+2$. The consumers in the model maximize inter-temporal utility

[1] Part of this section, covering the corporate income tax, is based upon Feltenstein et al. (2017), as well as Feltenstein and Datta (2020).

functions. There are 18 consumer groups and we assume Cobb-Douglas utility functions for each category with utility weights derived from the Pakistan social accounting matrix consumption data. The government in the model collects direct and indirect taxes and provides public goods, public infrastructure, and subsidies.

4.1 Production

There are 8 factors of production: five types of capital corresponding to five aggregate nonagricultural productive sectors – light manufacturing, heavy industry, utility (electric, water, sewage), transport, and hotels, housing, health services. There are also 3 additional factors of production. These are urban labor, rural labor, and land. Finally, there are three types of financial assets: domestic currency, bank deposits, and foreign currency. An input-output matrix, A_t, is used to determine intermediate and final production in period *t*. The matrix is 50 x 50, and is taken from *Samwalk* (2010), a 2007 social accounting matrix developed for Pakistan by the International Food Policy Research Institute (see Debowicz et al., 2013 for details). The first 50 rows and columns of the input-output matrix correspond to domestic production. The final row and column represents imports of intermediate and final goods, which are treated as a single aggregate commodity.[2] Corresponding to each sector in the input-output matrix, sector-specific value added figures are produced using capital and urban labor for the nonagricultural sectors, and land and rural labor in agriculture.

The specific formulation of the firm's problem is as follows. Let y_{Ki}^{j}, y_{Li}^{j} be the inputs of capital and urban labor to the *j*th nonagricultural sector in period *i*. Let Y_{Gi} be the outstanding stock of government infrastructure in period *i*. The production of value added in sector *j* in period

[2] Given the available data, that is, the structure of the input-output matrix, we are required to treat imports as an aggregate commodity, rather than having disaggregated imports that compete with domestic production sectors. It is possible that this simplification might have an effect on poverty levels of certain consumer groups, although it would seem unlikely to have significant impacts on aggregate levels of poverty.

i is then given by:

$$va_{ji} = va_{ji}(y^{j}_{Ki}, y^{j}_{Li}, Y_{Gi}) \quad (1)$$

where we suppose that public infrastructure may act as a productivity increment to private production. Sector *j* pays income taxes on inputs of capital and labor, given by t_{Kij}, t_{Lij} respectively, in period *i*. The interpretation of these taxes is that the capital tax is a tax on firm profits, while the labor tax is a personal income tax that is withheld at source. There are no pure profits here, since production functions are constant returns to scale, and hence the corporate income tax is treated as a tax on returns to capital.

We suppose that each type of sectoral capital is produced via a sector-specific investment technology that uses inputs of capital and labor to produce new capital. Investment is carried out by the private sector and is entirely financed by domestic borrowing. Clearly this is a simplification of the investment process, in that we are excluding investment financed by foreign direct investment (FDI) as well as reinvested profits. Since production is constant returns to scale, there are no pure profits to reinvest. In addition, we wish to avoid the complexities of introducing a theory of FDI into the model. Since the model does track the macro outcomes of the historical Pakistan economy, we would claim that we are not losing a significant amount of detail by our simplification. Let us define the following notation:

C_{Hi} = The cost of producing the quantity H of capital of a particular type in period *i*.
r_i = The interest rate in period *i*.
P_{Ki} = The return to capital in period *i*.
P_{Mi} = The price of money in period *i*.
δ_i = The rate of depreciation of capital.

Suppose, then, that the rental price of capital in period 1 is P_1. If C_{H1} is the cost-

minimizing cost of producing the quantity of capital, H_1, then the cost of borrowing must equal the present value of the return on new capital. Hence:

$$C_{H1} = \sum_{i=2}^{n} \left[\frac{P_{Ki}(1-\delta)^{i-2} H_1}{\prod_{j=1}^{i-1}(1+r_j)} \right] \qquad (2)$$

where r_j is the interest rate in period j, given by: $r_j = 1/P_{Bj}$, and P_{Bj} is the price of a bond in period j. The tax on capital is implicitly included in the investment problem, as capital taxes are paid on capital as an input to production.

4.2 Evasion of the Corporate Income Tax

The decision to invest depends not only on the variables in the above equation, but also upon the decision the firm makes as to whether it should pay taxes. This decision determines the firm's entry into the underground economy. We assume that the firm's decision is based upon a comparison of the tax rate on capital with the rate of return on new capital. Formally, suppose that we were in a two-period world. Suppose that:

$$\frac{P_{K2}}{1+r_1} \geq t_{K1}$$

that is, the present value of the return on one unit of new capital is greater than the current tax rate on capital. In this case we assume the investor pays the full tax rate on capital input. Suppose, on the other hand, that:

$$\frac{P_{K2}}{1+r_1} \leq t_{K1}$$

Here the discounted rate of return is less than the tax rate. The extent to which the firm goes into the underground economy is determined by the gap between the tax rate and the rate of return to investment. That is, the firm pays a tax rate of $\bar{t}_{K1}$ where:

$$\overline{t}_{K1} = t_{K1}\left[1 - \left(\frac{t_{K1} - \frac{P_{K2}}{1+r_2}}{t_{K1}}\right)\right]^{\alpha} \qquad (3)$$

Here $0 \leq \alpha$ and higher values of α lead to lower values of taxes actually paid. That is, the ratio $\frac{\overline{t}_{K1}}{t_{K1}}$ reflects the share of the sector that operates in the above ground economy. Hence α represents a firm-specific behavioral variable. An "honest" firm would set $\alpha = 0$, while a firm that is prone to evasion would have a high value for α.

4.3 Banking

We will suppose that there is one bank for each nonagricultural sector of the economy. There are 5 such sectors, and hence 5 banks, corresponding to each of the aggregate capital stocks. Each bank lends primarily to the sector with which it is associated. The banks are, however, not fully specialized in the sector they correspond to. We make the simplifying assumption that each bank holds a fixed share of the outstanding debt of its particular sector. It then holds additional fixed shares of the debt of each of the remaining sectors. We make this assumption of diversification of assets in order to allow for a situation in which a firm that evades taxes, and thereby enters the underground economy, might receive varying degrees of credit rationing from the different banks to which it applies for loans.

Our premise is that banks have no direct way of knowing whether specific firms operate in the underground economy. We assume that banks only care about the amount of capital that they estimate the firm may have. If the firm defaults on its loan, then this represents the best estimate of the amount that the bank could seize. The bank would, presumably, be willing to lend an amount equal to at least the estimated firm capital.

We assume the borrower is required to show the bank his tax returns in order to obtain a

loan. There is a single, flat corporate tax rate that the borrowing firm faces. Hence, suppose that T_{K1} represents taxes actually paid by the borrower in period 1. This is known to the bank, as the potential borrower is required to present his tax returns. Thus if the borrower fully complied with his tax obligation, and hence carried out no underground activity, the value of his capital, $\hat{K}_1$, would be given by:

$$\hat{K}_1 = \frac{T_{K1}}{t_{K1}}$$

In this case the bank lends an amount L_1, where $L_1 < C_{H1}$, as the bank would not be able to seize the full value of the loan in the case of a default. The situation we have described would, in the case of perfect certainty, have credit rationing when the estimated value of the firm's capital is less than its loan request. If the firm's capital is greater than its loan request, there would be no credit rationing.

In a more realistic case of uncertainty about both the true value of the firm, as well as about the bank's own ability to seize the firm, one might expect the lending process to be somewhat different. Accordingly, we will suppose that a simple functional form determines bank lending as a function of the amount requested as well as the estimated value of the firm's capital. We define the amount the bank lends, L_1, as:

$$L_1 = C_{H1}\left[\frac{\frac{\hat{K}_1}{C_{H1}}}{1+\frac{\hat{K}_1}{C_{H1}}}\right]^{\gamma} = C_{H1}\left[\frac{\hat{K}_1}{C_{H1}+\hat{K}_1}\right]^{\gamma} \quad (4)$$

Here γ represents a measure of risk aversion by the bank. If $\gamma = 0$, there are no credit restrictions, and the bank ignores estimates of the borrower's estimated net worth. As γ rises, the bank increasingly restricts lending if the term in brackets is less than 1. Thus, if a firm operates entirely in the underground economy, it will not be able to borrow to finance

investment. If banks are highly risk averse, they will never lend more than a firm's estimated net worth, which is based on its tax return. This tax return therefore represents all the information the bank needs in order to determine its response to a request for a loan.

4.4 Evasion of Value Added Tax – Enforcement Spending Mechanism

Note that in developing our model of corporate income tax evasion, there is no notion of enforcement. Rather, the corporation pays taxes based on its need to access the loans from the banking system. In the case of evasion of the VAT, we take a different approach. Here we suppose that the retail firm pays the VAT based upon the statutory tax rate and the probability of detection if it evades the tax. This approach is based loosely on Allingham and Sandmo (1972). We do not have a direct measure of the probability of detection. Rather, we use the level of expenditure on enforcement as a proxy for the probability of being detected.

The government spends (current spending) on enforcement that enhances collection. It has a target for VAT taxes as a percentage of nominal GNP, $VATARG(i)$ in each period i. The CGE model is continuously calculating VAT tax revenue in each period, $TVR(i)$ as well as $GNP(i)$. There are 20 time periods in the current simulations, so let us designate the number of time periods as $IME = 20$. We specify an adjustment rule for spending on enforcement. We define $QGEV(i)$ as the gap between the target VAT revenue share and the actual collection share, normalized by the target share. More formally:

$$QGEV(i) = \frac{VATARG(i) - TVR(i)/GNP(i)}{VATARG(i)}$$

This functional form of adjustment is arbitrary and we could use almost any continuous function. For now, we will suppose the increase in spending is a linear function of the tax gap, $QGEV(i)$. Let $\gamma\ s.t.\ 0 \leq \gamma$ represent the policy parameter for how much to increase spending on

tax collection enforcement. Thus, for example, if $\gamma = 1$ and if $TVR(i) = 0$ then there will be a 100% increase in enforcement spending. If, on the other hand, VAT tax revenues as a share of GDP are equal or greater than the target, then the enforcement spending increase is 0.

We assume that there is an estimated elasticity that connects the changes in enforcement to actual increases in tax collection. The change in tax collection may be viewed as changing the effective tax rate: the rate the consumer pays. Let the elasticity of tax collection with respect to changes in enforcement spending be denoted by ε. Then the relationship is linear and takes the following form:

$$\widehat{TC(J)} = TC(J) * \left(1.0 + \varepsilon_j * \gamma * QGEV(i)\right)$$

To clarify, $\gamma * QGEV(i)$ represents the percentage change in overall enforcement spending given the tax gap $QGEV(i)$. The term ε_j is the j^{th} sector's elasticity of tax collection with respect to the change in enforcement spending. Thus $\varepsilon_j * \gamma * QGEV(i)$ represents the j^{th} sector's percentage change in tax collection. Hence $\widehat{TC(J)}$ in the above equation is the new VAT collection from sector j .

Intuitively, the implicit VAT rates, what people are actually paying, are changing endogenously in the CGE model solution. The elasticities ε_j needs to be estimated with real data. There could be a single uniform elasticity, or sector by sector estimates based upon compliance behavior across sectors. Some sectors may be more honest, while others may be more risk averse, based upon fears of apprehension.[3]

5. Simulation

We carry out a series of simulations that illustrate how our model can be used to analyze

[3] We do not explicitly, model risk of apprehension, as in, for example, Allingham and Sandmo (1972). Such risk could be incorporated in our model to further enhance the modeling of tax compliance and enforcement spending.

alternative policies. Accordingly, we first calibrate a numerical version of our model to recent Pakistan data, so that the model can be claimed to be useful in analyzing alternative tax policies. Suppose then that we take a particular year as the base for going forward. We then run the dynamic model forward and see how well it replicates a few years of real economic fiscal data. The alternative scenarios we consider are – VAT revenues are targeted to be 8% and 15% of the GDP respectively.

We use 2016 as a base year to begin the model's 20 year forward looking simulation. Here we assume that the government is indifferent to increasing tax collection and thus does not undertake additional spending on enforcement. We define the implicit VAT rate as that hypothetical statutory rate that, in the absence of evasion, would approximately generate the observed VAT collection. In this case, this is 6%. In fact, the statutory VAT rate is 16%, on average. We are also combining VAT with import duties, which are about 14% of indirect tax revenues, and excises to generate a single measure of indirect taxes, so as to correspond to real data.[4]

In the base simulation, indirect taxes in 2016 were 6.21% of GDP, while the sum of sales, excise, and import taxes was 6.63% of GDP in the real data. Over the 3-year period 2016 – 2018 the average indirect tax share of GDP in the base simulation is 6.46%, while the average using real data is 6.55. Thus, we would claim that our model, using estimated parameters and this implicit tax rate, gives a good approximation of the performance of VAT over the first 3 years of the simulation. Over the same time period, the actual Pakistan data shows total taxes were, on average, 12.64% of GDP while in the simulation they were 14.14% of GDP. We slightly overestimate direct tax collections in the simulation. Recall that our methodology for generating

[4] Note that we are excluding excise taxes for technical reasons. Namely, that they violate homogeneity of prices.

evasion of corporate income taxes is based on tax compliance being tied to the need to receive bank loans. We may well underestimate evasion from the corporate income tax. Finally, we assume full compliance with the personal income tax, treating it as a payroll tax withheld at the source. Admittedly, this is a major omission, but we are not attempting to incorporate all possible types of tax evasion.

In the first counterfactual simulation, we suppose that the government is not satisfied with VAT taxes only averaging about 6.5% of GDP (baseline estimate). Accordingly, we will have the government wish to generate a VAT tax rate that will deliver total VAT revenue equaling about 8% of GDP. We consider a single uniform elasticity of 1.3, based upon our estimated elasticity of 1.267 using Pakistan fiscal data. Raising VAT revenues from 6.46% of GDP to about 8% of GDP requires a 22.3% increase in enforcement spending in the first year, and a further 19.7% increase in the 2nd year. Hence there is an almost 50% increase in enforcement spending over 2 years required to improve VAT revenues by about 1.5 percentage points of GDP.

In the second counterfactual simulation, we analyze the scenario to bring VAT revenues up to approximately 15% of GDP. Given the set of statutory VAT rates for all sectors in the economy and the observed real-world level of collection (about 6.5% of GDP), we need to determine how much more needs to be spent on increased enforcement to achieve a higher collection as a share of GDP. It appears that increasing enforcement spending by a compounded 322.4% would lead to the desired outcome in the second counterfactual simulation. This increase in spending takes place over the first 5 years of the simulation, unlike the previous, less ambitious increase which is carried out over the first 2 years. Clearly this is an enormous increase and probably not realistic. It is probably also unrealistic to suppose that the collection

elasticity remains constant as tax enforcement rises so much. Nonetheless, it is interesting to see the macro implications of such a collection measure.

We report and compare the fiscal outlook including indirect taxes, direct taxes, total taxes, expenditure, and budget deficit; macroeconomic outlook including real GDP growth, interest rate, and inflation; and change in real income across different household categories for the base and two alternative simulations over short-, medium-, and long-term. We provide results for the estimated elasticity of 1.3 and a higher elasticity of 1.5, which entails a relatively lower increase in enforcement spending for respective targets.

6. Results

Table 1 shows the fiscal outlooks under alternative scenarios. The share of indirect taxes as percentage of GNP is around 6.5% in the base case, which we intend to change to 8% and 15% respectively in the alternative scenarios. After increasing the enforcement spending that is required to achieve the target level of indirect VAT revenue, we do not observe any significant changes in the direct tax revenue collection. It remains around 7.5% of the GDP across all simulations (base and alternate). Having the share of direct taxes unchanged, and an increase in the share of indirect taxes in the alternate cases the tax to GDP ratio increases from around 14% in the base case to around 16% and 21% respectively in the two alternate cases. As a result, budget deficit decreases by around one to five percentage points in respective cases. However, to achieve the five percentage point reduction, it would require an exorbitantly high enforcement spending which may not be deemed feasible under the status quo. All the fiscal indicators are a little better for the 1.5 enforcement elasticity than those for the 1.3 elasticity.

Table 1. Fiscal Outlook

	Elasticity = 1.3				Elasticity = 1.5			
	5-years	10-years	15-years	20-years	5-years	10-years	15-years	20-years
	(% of GNP)				*(% of GNP)*			
Indirect Tax								
Baseline	6.47	6.51	6.51	6.51	6.47	6.51	6.51	6.51
8%-target	7.46	7.85	7.97	8.01	7.62	8.06	8.19	8.24
15%-target	9.77	12.49	13.33	13.74	10.21	13.05	13.89	14.25
Direct Tax								
Baseline	7.70	7.41	7.60	7.64	7.70	7.41	7.60	7.64
8%-target	7.73	7.39	7.58	7.63	7.73	7.38	7.56	7.63
15%-target	7.81	7.36	7.39	7.54	7.67	7.25	7.27	7.45
Total Tax								
Baseline	14.17	13.93	14.12	14.14	14.17	13.93	14.12	14.14
8%-target	15.20	15.25	15.55	15.64	15.35	15.44	15.76	15.87
15%-target	17.58	19.85	20.72	21.29	17.89	20.30	21.16	21.71
Expenditure								
Baseline	27.59	28.21	28.82	29.55	27.59	28.21	28.82	29.55
8%-target	28.29	28.83	29.36	30.07	28.34	28.88	29.39	30.06
15%	29.93	31.19	31.47	31.86	30.07	31.27	31.45	31.75
Deficit								
Baseline	-13.42	-14.28	-14.70	-15.40	-13.42	-14.28	-14.70	-15.40
8%-target	-13.09	-13.58	-13.81	-14.42	-12.99	-13.44	-13.63	-14.19
15%-target	-12.35	-11.34	-10.75	-10.58	-12.19	-10.97	-10.29	-10.04

The macroeconomic outlooks associated with different scenarios are presented in Table 2. The compound rate of growth of real GDP does not change at all between the base case and 15%-target scenarios over the 20-year period. Nonetheless, we would claim that the fact that real growth remains constant while fiscal tightening is being implemented is a positive sign. There was a slight decrease in the real GDP growth rates in the 8%-target scenario. However, for 1.5 elasticity, the long-term growth rate is a little higher. The interest rate slightly declines in the 8%-target scenario, while a larger decrease is observed in the 15%-target scenario. Finally, the fiscal tightening has led to a significant decline in the rate of inflation in both alternate scenarios.

Table 2. Macroeconomic Outlook

	Elasticity = 1.3				Elasticity = 1.5			
	5-years	10-years	15-years	20-years	5-years	10-years	15-years	20-years
	(%)				*(%)*			
Real GDP Growth								
Baseline	2.19	3.70	4.23	4.67	2.19	3.70	4.23	4.67
8%-target	2.21	3.69	4.23	4.55	2.19	3.66	4.23	4.67
15%-target	3.59	3.62	4.25	4.66	3.32	3.61	4.25	4.74
Interest Rate								
Baseline	10.95	10.34	9.89	10.01	10.95	10.34	9.89	10.01
8%-target	10.87	10.29	9.77	9.91	10.79	9.96	9.47	9.73
15%-target	11.04	9.98	8.99	8.93	10.90	9.65	8.58	8.54
Inflation Rate								
Baseline	20.21	19.18	19.41	19.66	20.21	19.18	19.41	19.66
8%-target	19.15	17.89	17.98	18.46	18.84	17.63	17.67	18.12
15%-target	16.54	14.37	13.45	13.88	15.51	13.46	12.73	13.28

Real consumption can serve as a measure of welfare. Table 3 presents the changes in the distribution of real consumption across different household groups for the 1.3 elasticity. The real consumption for all urban households and rural non-farm poor households (quintile 1 and quintile 2) increase in both alternate simulations. For all other households, real consumption decreases in the alternate scenarios. The medium-farm households suffer the largest loss, followed by non-farm non-poor households, small-farm households, landless farmer households, and waged-landless farmer households. The estimates for the 1.5 elasticity are presented in Table 4. The results are very similar expect a little change in the magnitude.

Table 3. Change in Aggregate Real Consumption Compared to Baseline (Elasticity = 1.3)

	8%-target				15%-target			
	5-years	10-years	15-years	20-years	5-years	10-years	15-years	20-years
	(%)				(%)			
Urban households								
Quintile 1	2.14	1.54	1.10	0.71	7.21	6.50	4.32	2.71
Quintile 2	2.51	1.56	1.04	0.64	8.60	6.80	4.15	2.45
Other	2.34	1.58	1.09	0.70	7.97	6.77	4.34	2.68
Rural households								
Medium Farm								
Sindh	-2.23	-2.44	-2.07	-1.88	-6.87	-9.54	-9.31	-8.96
Punjab	-1.20	-1.80	-1.72	-1.66	-3.75	-7.17	-7.86	-8.05
Other Pakistan	-1.00	-1.64	-1.61	-1.59	-3.12	-6.55	-7.42	-7.75
Small Farm								
Sindh	-0.89	-1.55	-1.54	-1.53	-2.72	-6.14	-7.09	-7.46
Punjab	-0.67	-1.37	-1.39	-1.40	-1.91	-5.32	-6.39	-6.84
Other Pakistan	-0.54	-1.28	-1.32	-1.34	-1.42	-4.90	-6.06	-6.53
Landless Farmer								
Sindh	-0.33	-1.01	-1.17	-1.28	-1.03	-4.12	-5.58	-6.39
Punjab	-0.11	-0.80	-0.99	-1.13	-0.27	-3.23	-4.80	-5.70
Other Pakistan	0.11	-0.59	-0.83	-0.99	0.44	-2.38	-4.07	-5.08
Waged Landless Farmer								
Sindh	1.21	0.37	0.00	-0.28	4.24	1.78	-0.42	-1.78
Punjab	1.47	0.78	0.38	0.05	4.99	3.35	1.17	-0.34
Other Pakistan	1.18	0.28	-0.09	-0.36	4.15	1.44	-0.79	-2.12
Non-farm								
Quintile 1	2.44	1.36	0.83	0.44	8.41	6.03	3.26	1.56
Quintile 2	2.55	1.47	0.95	0.56	8.79	6.47	3.82	2.15
Other	-1.26	-1.73	-1.57	-1.51	-3.94	-6.93	-7.22	-7.33

Table 4. Change in Aggregate Real Consumption Compared to Baseline (Elasticity = 1.5)

	8%-target				15%-target			
	5-years	10-years	15-years	20-years	5-years	10-years	15-years	20-years
	(%)				(%)			
Urban households								
Quintile 1	2.06	1.42	0.98	0.70	6.73	5.63	3.54	2.13
Quintile 2	2.39	1.40	0.88	0.61	7.96	5.74	3.24	1.79
Other	2.24	1.44	0.96	0.68	7.41	5.80	3.50	2.07
Rural households								
Medium Farm								
Sindh	-2.52	-2.86	-2.51	-2.18	-7.44	-10.43	-10.37	-9.92
Punjab	-1.38	-2.13	-2.09	-1.94	-4.14	-7.88	-8.79	-8.93
Other Pakistan	-1.16	-1.95	-1.97	-1.86	-3.49	-7.23	-8.33	-8.60
Small Farm								
Sindh	-1.06	-1.86	-1.90	-1.79	-3.12	-6.86	-8.01	-8.32
Punjab	-0.85	-1.70	-1.75	-1.65	-2.37	-6.12	-7.35	-7.71
Other Pakistan	-0.73	-1.61	-1.67	-1.58	-1.95	-5.76	-7.05	-7.41
Landless Farmer								
Sindh	-0.44	-1.24	-1.47	-1.51	-1.33	-4.69	-6.36	-7.16
Punjab	-0.22	-1.04	-1.29	-1.34	-0.60	-3.85	-5.61	-6.47
Other Pakistan	0.00	-0.82	-1.11	-1.19	0.09	-3.02	-4.88	-5.83
Waged Landless Farmer								
Sindh	1.09	0.15	-0.24	-0.41	3.73	0.92	-1.30	-2.51
Punjab	1.37	0.62	0.19	-0.04	4.53	2.55	0.37	-1.00
Other Pakistan	1.04	0.04	-0.35	-0.50	3.61	0.54	-1.71	-2.88
Non-farm								
Quintile 1	2.29	1.17	0.64	0.38	7.72	4.92	2.29	0.86
Quintile 2	2.41	1.28	0.78	0.52	8.10	5.37	2.88	1.48
Other	-1.43	-2.01	-1.89	-1.74	-4.29	-7.48	-7.95	-8.02

The urban sectors gain income primarily because the increased in VAT collection lowers the tax burden on capital (the corporate income tax) and therefore makes capital holders richer. The lower interest rates generated by higher VAT collections, and lower deficits, generate similar outcomes and point to the importance of using a general equilibrium methodology. The lowest non-farm rural sectors have a similar small increase in real consumption. The reason for this is that they are waged retail employees whose consumption is not so directly impacted by the VAT

increases as are the other rural sectors, possibly because their consumption comes partially from their own stores' stocks. On the other hand, the highest income rural non-farm cohort does suffer a consumption loss. We attribute this to the fact that retail store ownership, which belongs to the high income rural non-farm cohort, experiences a decline in sales and income under the higher VAT collections.

7. Discussion and Conclusion

In our computable general equilibrium analysis, we generate alternate scenarios of higher VAT collection. Direct taxes as a share of GDP remains essentially unchanged between the base and the two alternate simulations. As a result, there has been an approximately 1.5 percentage point and 7.1 percentage points improvement in the share total share of tax revenues in GDP respectively in the 8%- and 15%-target scenarios. Note that we are not specifying how the increased revenue might be spent. Rather we assume it is used entirely for deficit reduction. Interestingly, the share of public expenditure in GDP rises only slightly in the 8%-target simulation and around 2 percentage points in the 15%-target simulation, as compared with the do-nothing base case. One might expect that the increase in enforcement spending would lead to a significant increase in public spending, but there is a countervailing decline in the interest rate which reduces spending on public debt.

We find that the interest rate in the 15%-target scenario drops significantly, and as a result, average public spending increases by only about 2.3% of GNP despite the huge increase in enforcement spending. Although not shown in the Table 2, private consumption actually declines. The average inflation rates drop considerably as a result of the VAT increases and resulting declines in consumption.

How should we evaluate the overall implications of the enforcement changes? They

enhance the sustainability of the government's budget deficit without causing a decline in real GDP over the 20 periods of the simulation. A recent cross-country study finds that increased tax enforcement measures adversely impact economic growth, while higher tax revenue collection promotes growth (McClellan, 2018). Our growth results may be attributable to a combination of these two impacts. Interest and inflation rates are also lowered, so from a general macro-economic perspective the reforms seem to be beneficial. On the other hand, there is a small but significant regressive impact on real consumption for the rural sector, which is very large in Pakistan. On the other hand, the urban sector's consumption benefits slightly over time. This change is primarily caused by a data issue. Namely, the Pakistan SAM attributes almost all capital ownership to the urban consumers. Since the return to capital improves as a result of the shift in the tax burden to consumption (the VAT), capital owners also experience an income and hence consumption increase.

Pakistan, as many other developing countries, appears to have been stuck in a suboptimal political economy equilibrium with a lower tax to GDP ratio. The low tax performance can be linked to types of societal institutions and to the level of corruption in the tax administration (Bird et al., 2014). The corrupt practices pervade the tax system through different channels involving policy makers, tax collectors, taxpayers, and the general public. In this paper, we, however, do not explore the political economy of tax evasion in Pakistan. Rather, we mainly focus on the enforcement spending required to achieve a revenue target given the status quo societal institutions and degree of corruption. Were there better institutions or less corruption, the elasticity might be greater and the required spending could be smaller. We do not analyze how to develop better institutions or how to curb corruption, which are a different set of issues. We contribute to the literature by analyzing what best can be done given the existing state of affairs.

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