Revenue Mobilization through the VAT in Low-Income Countries

Marina Mendes Tavares
ITAM and IMF

Adrian Peralta-Alva
IMF

Xuan S. Tam
City University of Hong Kong

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Abstract
Low income countries have a particularly low tax revenue to GDP. Paradoxically, these countries are also the ones with the larger infrastructure development needs, and require larger fiscal space to protect against external shocks. Substantial efforts have been made during the last two decades to strengthen revenue collections in developing and low income countries through VAT. In this paper, we investigate the impact on output and on the income distribution of raising revenue mobilization through VAT in a low income country. Our tool of analysis is a heterogeneous multi-sector model carefully calibrated to capture key features of a low-income country. We find that in low income countries the cost of raising government revenue is higher in terms of both output and poverty than in middle income countries. This also means compensatory measures to alleviate the regressive aspects of VAT are costlier to implement.

Keywords: VAT, development, heterogeneous agents model.
JEL codes: E62, D30, O11.
1 Introduction

Developing countries, particularly low income countries, have relatively low tax revenue to GDP ratios (15% on average vs the average of 30% in advanced economies). Paradoxically, these countries are also the ones with the largest infrastructure development needs, and the ones that require larger fiscal space to respond to their high output volatility. Indeed, substantial efforts have been made during the last two decades to strengthen revenue collections. Peru, over the 1990s, increased its revenue ratio from 6 to 13 percent of GDP, with a further increase to some 17 percent by 2010; Tanzania and Vietnam have achieved sustained increases of 4 to 5 percentage points of GDP over periods of 5 to 6 years; while Mauritania increased the tax revenue ratio (excluding revenues from the mining sector) by 6 percentage points of GDP between 2011 and 2014.

An important component of reforms leading to higher revenue mobilization has been increases in VAT. An advantage of this tax is that it has relatively broad reach, which matters greatly for countries facing large informal sectors. Indeed, evidence suggests countries with a VAT raise more revenue than those without, all else equal (see Keen and Lockwood (2010), Ufier (2014), Adhikari (2014) and Ebeke and others (2015)). The “use of a broad-based VAT, with most items subject to a single rate and a high threshold,” has also advocated by the IMF as one of the principles to producing a balanced domestic revenue base (see IMF (2015)).

The optimal taxation literature shows that, if all goods can be taxed, then the optimal taxation system is characterized by an equal tax rate for all goods (this is the classical uniform commodity taxation principle; see Chari and Kehoe (1999). One possible implementation of indeed implies a common VAT rate for all goods. Things are not so simple once some goods cannot be taxed (in the case of low income or developing economies this can be associated with the informal sector), or when subsistence plays an important role in preferences (subsistence levels are a common element of the structural transformation literature for low
income and developing countries), as then the uniform commodity taxation principle no longer applies.

An additional complication with revenue mobilization through increases in VAT rates is that it may conflict with distributional objectives as these taxes are regressive. Poorer people spend a larger fraction of their incomes on consumption goods. Hence a tax on consumption imposes a disproportionately heavy burden on the poor. In principle, the negative distributional implications of higher VAT can be mitigated through government expenditures that target the poor, and even directly through cash transfers. Not much analysis in general equilibrium settings has been done to study the quantitative aspects of such compensatory measures and their possible impact on the macroeconomy or the fiscal envelope.

The objective of this paper is thus to evaluate quantitatively the macroeconomic and distributional consequences of increased revenue mobilization through increases in the VAT rate, for developing and low income countries. The tool of analysis is a dynamic general equilibrium model that marries ingredients from the structural transformation literature (which emphasizes the role of differential productivities across different economic sectors and the role of frictions preventing allocations to be efficiently allocated) together with ingredients of the income inequality literature (income inequality driven by individual shocks that generate an equilibrium distribution of income in a rational expectations setting). This framework allows us to consider questions such as: (i) is the macroeconomic impact of VAT different in developing and low income countries where misallocation of factors plays a prominent role; (ii) which groups and economic sectors can be more affected by VAT changes, and are these effects different across countries at different levels of development; and (iii) are standard compensatory measures enough to attenuate the negative distributional impact of changes in VAT.

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1 A review on the structural transformation literature can be found in Aghion and Durlauf, eds (2014) and Matsuyama (2008)
The paper is organized as follows. In section 2, we present the full general theoretical model that we will use in computation, and discuss some implications of the general model. Section 3 presents our calibration strategy. Section 4 presents the main results. Section 5 concludes.

2 The Quantitative Model

We consider a small open economy populated by a continuum of heterogeneous households who live forever and face idiosyncratic shocks. All types of households have the same preferences over the consumption of food, \( c^f \), manufacturing \( c^m \), and services, \( c^s \). There are three types of households in the model: large farmers, rural households, and urban households. Rural households own a small plot of land. They can produce food using labor and land as input. Rural households also have the option to work for large farmers for a competitive wage \( w^f \). Urban households can produce services using only labor as an input, or they work in manufacturing for a competitive wage \( w \). We assume that households can not move across sectors.

Large farmers own a large plot of land they can produce food for the domestic market or export. They hire labor from small farmers and also accumulate capital, both of which are used to produce agriculture goods for export. Finally, there are competitive firms that produce manufacturing goods using capital and labor as an input. Manufacturing can also be used indistinctly for investment, \( x \) or consumption. The stock of capital follows a standard law of motion

\[
K_{t+1} = x + (1 - \delta)K,
\]

and capital depreciates at a constant rate \( \delta \). Markets are incomplete, urban and rural households can save at a risk-free interest rates \( r \), as in Huggett (1997).

The government collects value added taxes, on food \( \tau^a \) and manufacturing goods \( \tau^m \), trade
taxes $\tau^*$, corporate taxes $\tau^r$, and labor income taxes $\tau^w$. The government spends part of its resources on manufacturing goods and gives or collects lump-sum taxes that may be specific to each household type. In the next section we explain the urban households’ problem.

2.1 Urban Households’ Problem

Households that live in urban areas maximize the expected present value of utility from stochastic consumption sequences. We will use the superscript $u$ for urban households’ allocations. Urban households are endowed with one unit of time and they can choose between working in their own household enterprise to produce services $y^s$ or working on manufacturing for a wage $w^u$. Urban households face idiosyncratic shocks to their productivity in manufacturing and they can save in a risk-free bond $b$. The problem of an urban households is given by:

$$
\max_{\{c^u,a,c^u,m,c^u,s,h^u\}} \mathbb{E} \sum_{t=0}^{\infty} \beta^t u(c^u,a, c^u,s, c^u,m) \\
\text{s.t.} \quad (1 + \tau^a)p^a c^u,a + (1 + \tau^m)c^u,m + p^s c^u,s + b^u = (1 - \tau^w)\epsilon^u w^u h^u + p^s y^s + (1 + r)b^u + T^u \\
y^s = z^s (1 - h^u)^{1-\alpha^s}, \\
\epsilon^u = \rho \epsilon^u + \epsilon^u, \quad \epsilon^u \sim N(0, \sigma^2_{\epsilon^u}) \\
h^u \in [0, 1]
$$

2.2 Rural Household’s Problem

Households that live in rural areas maximize the expected present value of utility from stochastic consumption sequences. The superscript $r$ denotes rural households’ allocations.
Rural households are endowed with one unit of labor and with a small plot of land. They choose between working on their own plot or working to large farms for a wage $w^r$. They face idiosyncratic shocks on their productivity on their own plot and they can save in a risk-free bond $b^r$. The maximization problem of an rural households is given by:

$$\max \{c^u,a,c^u,m,c^r,s,c^r,m\} \quad E \sum_{t=0}^{\infty} \beta^t u(c^r,a,c^r,s,c^r,m)$$

s.t.

$$(1 + \tau^a)p^a c^r,a + (1 + \tau^m)c^r,m + ps c^r,s + b^r_+ = (1 - \tau^w)w^f h^r + p^a y^a + (1 + r)b^r + Tr$$

$$y^a = z^a \epsilon^r (d^r)^{\alpha^a} (1 - h^r)^{1 - \alpha^a}$$

$$\epsilon^r_+ = \rho \epsilon^r + \epsilon^r, \quad \epsilon \sim N(0, \sigma^2_\epsilon)$$

$$h^u \in [0, 1]$$

In the next section we describe the large farms’ problem.

### 2.3 Large Farmers’ Problem

Farmers that own larger plots of land also maximize the present value of their consumption. Differently from rural households, large farmers can export. The production of exports also requires capital. They choose how much labor to hire for producing to the domestic and to the external market, and they choose how much capital to accumulate. The problem of larger farmer is given by:
In addition to pay consumption taxes, large farmers also pay taxes on their profit received by selling to the domestic market at rate $\tau^r$, and on the profits (after depreciation allowances) received by exporting at rate $\tau^*$. In the next section, we present the firm's problem.

### 2.4 Firm's Problem

We assume that there is a competitive firm that rent capital $k^m$ and hire effective labor $h^m$ to maximize profit. The firm’s problem is given by:

$$\max_{\{k^m, h^m\}} \sum_{t=0}^{\infty} \beta^t u(c_{f,a}^{t}, c_{f,s}^{t}, c_{f,m}^{t})$$

s.t.

$$(1 + \tau^a)p^a c_{f,a}^{t} + (1 + \tau^m)c_{f,m}^{t} + p^s c_{f,s}^{t} + k_{t}^{f} = (1 - \tau^r)\pi^a + (1 - \tau^*)\pi^* + \tau^* \delta k^f + (1 - \delta)k^f + T^f$$

$$\pi^a = p^a z^a(d)\alpha_1^a (h^a)^{1-\alpha_1^a} - w^f h^a$$

$$\pi^* = p^* z(d^*)\alpha_1^* (h^*)^{1-\alpha_1} (k^f)^{(1-\alpha_1^r-\alpha_2^r)} - w f h^*$$

$$h^a, h^* \geq 0$$

In the next section, we discuss the market clearing.

### 2.5 Market Clearing

In this economy five markets clear in equilibrium. Since labor markets are segmented between urban and rural workers, there are two labor market clearing conditions one for each sector. The capital must clears guarantee that all households saving are equal to the cap-
ital demanded by manufacturing firms and by large farmers. Last in equilibrium, the two goods market for non-tradable goods also clear. The following conditions guarantee market clearing in all five markets.

\(i\) Urban labor market

\[
\mu^u \int h^u \Gamma (b^u, \epsilon^u) = h^m
\]

\(ii\) Rural labor market

\[
\mu^r \int h^r \Gamma (b^r, \epsilon^r) = \mu^f (h^a + h^*)
\]

\(iii\) Capital Market

\[
k^m = \mu^u \int b^u \Gamma (b^u, \epsilon^u) + \mu^r \int b^r \Gamma (b^r, \epsilon^r)
\]

\(vi\) Service Market

\[
\mu^u \int c^{u,s} \Gamma (b^u, \epsilon^u) + \mu^r \int c^{r,s} \Gamma (b^r, \epsilon^r) + \mu^f z^{s} (1 - h^u) ^{\alpha} \Gamma (b^u, \epsilon^u)
\]

\(v\) Food Market

\[
\mu^u \int c^{u,a} \Gamma (b^u, \epsilon^u) + \mu^r \int c^{r,a} \Gamma (b^r, \epsilon^r) + \mu^f z^{a} (d^f) ^{\alpha} (1 - h^r) ^{\frac{\alpha}{1 - \alpha}} \Gamma (b^r, \epsilon^r) + \mu^f z^{a} (d^f) ^{\alpha} (h^f) ^{1 - \alpha}
\]
2.6 Government Budget Constraints

The government collects taxes and spend its revenue on manufacturing and lump-sum transfers. In equilibrium the government budget constraint must hold. The expression of the government budget constraint is given by:

\[
\tau^a C^a + \tau^m C^m + \tau^* \pi^* + \tau^f \pi^f + \tau^w \left( \mu^u \int h^u \Gamma (b^u, \epsilon^u) + \mu^r \int h^r \Gamma (b^r, \epsilon^r) \right) = G + T^r + T^u + T^f.
\]

On the right hand side, government revenue from consumption taxes, from corporate taxes and from labor income tax. In equilibrium government revenue must be equal to the government spending in manufacturing and transfers to households.

2.7 Equilibrium

A competitive equilibrium for this economy is constituted by stochastic sequences of agricultural prices, manufacturing wages, rural wages and interest rates \( \{p^s, p^a, w^r, w^f, r\} \), together with allocations of consumption, investment, time use and bond holdings for each type of households, such that given manufacturing prices and exported goods prices \( \{p^m, p^r\} \), sequences of sectoral productivity, idiosyncratic shocks, and predetermined taxes \( \{\tau^a, \tau^*, \tau^w, \tau^c, \tau^r\} \) and transfers functions \( \{T^F, T^H, T^A\} \), the stochastic sequence of allocations solve their respective constrained optimization problem, clear markets, and satisfy the government budget constraint.
3 Calibration

The period is one year and the model is calibrated to 2011, because it where we can find most of the data. In the cases where 2011 data do not exist, we choose the available year closest to 2011. Some parameters are calibrated jointly in the model, while the rest are calibrated separately.

Preferences - Households have preferences over food, manufacturing, and services. We select the following functional form for the household utility:

$$u(c^a, c^*, c^o) = \log(c^a - \bar{a}) + \psi \log(c^*) + \gamma \log(c^m).$$

This preferences have been used in literature and Herrendorf et al. (2013) shows that this functional form is able to match many stylized facts about structural transformation in the United States. We calibrate the share of manufacturing consumption $\gamma$ to match household expenditure on manufacturing in Ethiopia, which is 33 percent of household total consumption, according to Household Consumption Expenditure Survey (HCES). We calibrate the share of food consumption $\psi$ to match household expenditure on food in Ethiopia, which is 40 percent of household total consumption, according to HCES. We calibrate the subsistence level $\bar{a}$ to match the share of food consumption at the bottom quintile of the income distribution, which is equal to 53 percent according to HCES. The discount factor $\beta$ is set to 0.96, which is the standard annual value in literature.

Idiosyncratic Shocks - We choose the persistency of the idiosyncratic shocks $\rho$ according to Tavares et al. (2014), which estimate a income shock process to Ghana using a household panel survey to urban workers. We calibrate the variance of the process to match the Gini coefficient of the urban and rural sector from World Bank Group (2015).

Export Sector - The export sector production function is of Cobb-Douglas type and uses
as input land, capital, and labor. We calibrate the productivity of the export sector $z^*$ to match the share of exports over GDP in Ethiopia, which is 8.3 percent, according to the National Bank of Ethiopia (2011). We assume that the share of land in the production function is equal to 0.49 as in Adamopoulos and Restuccia (2014) estimates to the United States. Export’s price $p^*$ is chosen to match the Ethiopian exchange rate. We choose the labor share $1 - \alpha_1$ to be equal 0.70, which is the standard value of the United States. We assume that capital depreciates at 6 percent per year, which is also a standard value in the United States.

**Manufacturing Sector** - We assume that the production function of the manufacturing sector is Cobb-Douglas. We normalize the price of manufacturing to 1 and we calibrate the productivity of manufacturing to match the share of manufacturing over GDP from the National Bank of Ethiopia (2011). We choose the labor share $1 - \alpha^m$ equal to 0.70 which is the range to United States estimates. We assume that the depreciation rate of capital in this sector is also 6 percent per year.

**Agricultural Sector** - The agriculture sector productivity $z^a$ is calibrated to match the share of the agricultural sector on GDP, which is equal to 45 percent according to National Bank of Ethiopia (2011). We normalize the land hold of large farmers to 1 and we calibrate the land hold of small farmers to 0.27 following Teshome et al. (2014). We choose that land share $\alpha^a$ to be equal 0.49 according to Adamopoulos and Restuccia (2014)

**Service Sector** - The productivity of the service sector $z^s$ is calibrated to match the share of this sector in GDP. We adjust this measure from the original measure to reflect that this service sector is close to informal sector, which according to our estimates is 16 percent. We choose the curvature of labor on the service sector to be equal to 0.7, which in line to manufacturing.

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2In order to arrive on this estimates we exclude all services that are done sector, more precise we excluded Ethiopia Telecom, Banking Sector, and Ethiopia Airlines
**Labor Force Shares** - We set the share of urban households $\mu^u$ equal to 0.28 according to World Bank Group (2015). The rest of households are all rural households.

**Fiscal Policy** - The tax schedule is calibrated to match the revenue estimates from each type of tax according to the World Bank Group (2015), our taxes rates are presented in Table 1. It is important to notice that our tax estimates are below that statutory tax rates in Ethiopia, this difference captures both inefficiency, informality, and tax exemptions.

<table>
<thead>
<tr>
<th>Fiscal Policy</th>
<th>Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption Tax on Agriculture</td>
<td>$\tau^a$</td>
<td>0.05</td>
</tr>
<tr>
<td>Consumption Tax on Manufacturing</td>
<td>$\tau^m$</td>
<td>0.05</td>
</tr>
<tr>
<td>Corporate Taxes</td>
<td>$\tau^r$</td>
<td>0.35</td>
</tr>
<tr>
<td>Trade Taxes</td>
<td>$\tau^s$</td>
<td>0.35</td>
</tr>
<tr>
<td>Labor Income Tax</td>
<td>$\tau^w$</td>
<td>0.06</td>
</tr>
</tbody>
</table>

In Table 6, we report the calibration values, and Table 2 reports the value of targets and the respective moments. There are 10 targets used to calibrate 10 parameters in the model $\{\lambda, \psi, \bar{a}, z^*, z^a, z^s, \sigma^r, \sigma^u, \tau^c, \tau^w, \tau^p\}$.

### 4 Results

We perform two different exercises, first we quantify the impact of increasing the VAT on manufacturing and food by 10, 50, 200 percent. The 200 percent increase is value close to which Ethiopia would have to increase its VAT to reach the LICs average of Government Revenue over GDP. Second, we analyze the impact of two complementary measures: (i) tax exemptions and (ii) cash-transfers in mitigate the negative VAT impact on poverty and inequality. Third, we analyze which fetters of LICs are important to explain the challenges of revenue mobilization in LICs. In all exercises we assume that the increase in government
Table 2: Calibration

<table>
<thead>
<tr>
<th>Target</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of Labor Income Tax on Government Revenue</td>
<td>0.10</td>
<td>0.12</td>
</tr>
<tr>
<td>Share of Corporate Tax on Government Revenue</td>
<td>0.18</td>
<td>0.23</td>
</tr>
<tr>
<td>Share of VAT on Government Revenue</td>
<td>0.27</td>
<td>0.25</td>
</tr>
<tr>
<td>Share Export over GDP</td>
<td>8.3</td>
<td>11.9</td>
</tr>
<tr>
<td>Share of Manufacturing over GDP</td>
<td>0.33</td>
<td>0.30</td>
</tr>
<tr>
<td>Share of Services over GDP</td>
<td>0.21</td>
<td>0.15</td>
</tr>
<tr>
<td>Share of Household Manufacturing Consumption over Total Consumption</td>
<td>0.33</td>
<td>0.29</td>
</tr>
<tr>
<td>Share of Household Services Consumption over Total Consumption</td>
<td>0.16</td>
<td>0.19</td>
</tr>
<tr>
<td>Share of Food Consumption over the bottom quintile</td>
<td>0.52</td>
<td>0.53</td>
</tr>
</tbody>
</table>

revenue is used exclusively to consume manufacturing goods.

4.1 Aggregates

In the first exercise we quantify the impact of an increase on 10, 50, 200 percent increase in the VAT on the main aggregates. All results are presented as the percentage change with respect to the benchmark economy. Table 3 presents the results:

<table>
<thead>
<tr>
<th>VAT Percent Change</th>
<th>0%</th>
<th>50%</th>
<th>200%</th>
<th>300%</th>
</tr>
</thead>
</table>
| Output            | -0.32 | -1.67 | -3.31 | -5.04 |}

The first main result is that independent of the magnitude of the increase in VAT rate the
impact on output is negative and significant, and this impact is larger the new VAT rate
is. Second, as one would expect, the impact on output is driven by a decrease in consump-
tion. Although investment increases in all three cases, because government spends more on
manufacturing, which is capital intensive, the increase in investment does not compensate
the reduction on consumption. Overall, we observe that for Ethiopia to reach a level of
government revenue comparable to X countries, the cost in terms of output is potentially
very high: a 3.31 percent drop in output. This, of course, has abstracted from the impact
that some uses of higher revenue may have on the economy (say, better infrastructure, which
could increase productivity and thus GDP). In the next section, we analyze the impact of
revenue mobilization on the distribution of income in LICs.

4.2 Distribution

Although VAT may be efficient collecting taxes due to its broad base, it is well-known that
VAT are also regressive. In LICs regressiveness is a severe problem, because LICs have a
large share of the population below the poverty line. As a result an increase in VAT can
potentially increase poverty. In order to mitigate the negative impact of VAT on poverty
and inequality, we consider two complementary policies that have been used: one is tax
exemptions on food, and another one is a cash-transfer program targeted to the poorest
households. We consider these two alternatives and we assume that the cost is the same
(5 percent of the government budget). In Table, 4 we present the main results, in the first
column, we increase the VAT by 200 percent, in the second column we increase the VAT by
200 percent and implement tax exemptions on food, and on the last column we increase the
VAT by 200 percent and implement a cash-transfer program. All the results are percentage
change with respect to the benchmark.

VAT is a regressive tax, after the VAT reform the poverty rate increases by 15.87 percent and
inequality increases by 4.29 percent. The increase in poverty is mostly driven by an increase
Table 4: VAT Distributional and Poverty Impact

<table>
<thead>
<tr>
<th>Percent Change</th>
<th>VAT Exemption</th>
<th>VAT + Cash Transfers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty</td>
<td>15.87</td>
<td>15.01</td>
</tr>
<tr>
<td>Urban Poverty</td>
<td>−1.46</td>
<td>−4.31</td>
</tr>
<tr>
<td>Rural Poverty</td>
<td>18.35</td>
<td>17.76</td>
</tr>
<tr>
<td>Gini</td>
<td>4.29</td>
<td>2.23</td>
</tr>
<tr>
<td>Urban Gini</td>
<td>1.34</td>
<td>−0.02</td>
</tr>
<tr>
<td>Rural Gini</td>
<td>−1.32</td>
<td>−2.63</td>
</tr>
</tbody>
</table>

in poverty for rural households. These households are poorer after the reform mainly because both the relative price of food goes down and wages paid by farmers also go down. As a result, overall rural households are poorer now. Urban households on the other hand are better off, mainly because government increase the demand for manufacturing goods, which increases the salary of urban workers. As a result, urban poverty goes down, because now poorer urban households that work on service can afford cheaper food. This different impact on urban and rural households caused inequality to grow by 4.29 percent. Although, the inequality in urban and rural areas change very little, urban households benefit from the VAT and from the higher demand for manufacturing, while rural households are worse off, which causes inequality to increase.

Next, we analyze the impact of food tax exemptions and cash-transfers. In the last two columns of Table 4 we quantify the impact of these two programs. The main result is that tax exemptions are not as efficient as cash-transfers in alleviating the negative impact of VAT on poverty. Regarding inequality, we observe the same result, cash-transfer is more efficient in reducing the impact on inequality and in reducing inequality within urban and rural households.

Regarding macroeconomics aggregates, both programs impact output negatively further than

3In Table 7 in the Appendix contains the impact on relative prices from the VAT reform.
VAT alone. Although these complementary measures alleviate the impact of VAT on consumption, investment does not grow as much as in the case of only VAT. Overall the package VAT and exemption reduces output by 4.47 percent, while the package VAT and cash transfer reduces output by 4.97 percent. The main difference between these two packages is that VAT with exemptions provide a tax break to all households, including wealthy households that save, while cash-transfers programs only give resources to hand to mouth households. As a result, the VAT economy with tax exemptions has higher savings rates, higher investment, and consequently output than the VAT with cash-transfers economy.

4.3 Low Income Countries vs Low Middle Income Countries

LICs face many challenges to mobilize more revenue, as our empirical estimates indicates, these challenges are more substantial than in countries that are more developed. In this section, we study which characteristic of a LIC is fundamental to generate the negative impact of revenue mobilization on the economy and on the distribution. We explore three channels: (i) low total factor productivity, (ii) large share of the population in the rural sector, (iii) large share of subsistence farmers.

We quantify the impact of each channel, by simulating a new economy in which each restriction is chosen to resemble a Low Middle Income Country (LMIC). We then compute the impact of doubling the VAT on each economy and finally we compute the impact on a economy that combines all the three characteristics, which is similar to a Low Middle Income Country. We choose the total factor productivity, share of the population in the rural sector, and share of subsistence farms to resemble a LMICs, examples are Philippines, Egypt, or Bolivia. We use total factor productivity estimated by Adamopoulos and Restuccia (2014) and we use data on population shares from the World Bank Development Indicators. Table 5

\^According to the World Bank LMICS are countries that have GDP per capita between US$ 1,046 to US$ 4,125 in 2015
summarizes the results, all numbers are percentage change with respect to their benchmark:

<table>
<thead>
<tr>
<th></th>
<th>LICs</th>
<th>LICs</th>
<th>LICs</th>
<th>LICs</th>
<th>LMICs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>−3.31</td>
<td>−1.34</td>
<td>3.82</td>
<td>−3.30</td>
<td>−0.70</td>
</tr>
<tr>
<td>Consumption</td>
<td>−9.08</td>
<td>−7.03</td>
<td>2.94</td>
<td>−9.05</td>
<td>−6.47</td>
</tr>
<tr>
<td>Investment</td>
<td>1.68</td>
<td>2.87</td>
<td>6.23</td>
<td>1.61</td>
<td>3.61</td>
</tr>
<tr>
<td>Exports</td>
<td>2.97</td>
<td>5.80</td>
<td>7.56</td>
<td>2.77</td>
<td>8.35</td>
</tr>
<tr>
<td>Government</td>
<td>41.98</td>
<td>44.92</td>
<td>41.20</td>
<td>41.79</td>
<td>44.42</td>
</tr>
</tbody>
</table>

The first important result from Table 5 is that the overall effect of doubling VAT in a LMICs are less severe than in LICs. In a LMICs outputs decreases by only 0.70 percent, while in LICs, output decreases by 3.31 percent. In addition, the same increase in VAT generates higher government revenue, 44.42 percent compared to 41.98 percent in LICs. These differences between LICs and LMICs are mostly due to the facts that in LMICs consumption does not follow as much as in LICs and investment is higher in LMICs than in LICs. Next, we analyze the main source of this difference.

From Table 5, we observe that differences in TFP and in the share of the population on the urban sector are the most important factors to explain the differences between LMICs and LICs. In the case in which the economy has TFP from LMICs the impact of raising VAT is not as severe as in LICs. The main reason is because manufacturing is relative more productive than in LICs. The increase in the demand of manufacturing by the government is match with higher investment and a lower drop on consumption when the productivity is higher. As a result, the economy shrink much less than in LICs case.

In the second case, when the share of the population in the urban areas is relative higher than in a LICs, we have the opposite result. Instead of the economy shrinks it grows 3.82 percent. The main difference is that the supply of labor to manufacturing is abundant in this economy. As a result, higher demand for manufacturing is easily match with the abundant...
cheap labor, which reduces the impact of the restriction on mobility across sectors. Last, we observe that the existence of a large of substance is farmers is not important in explaining the impact of VAT on LICs.

5 Conclusion

In this paper, we evaluate quantitatively the macroeconomic and distributional consequences of increasing revenue mobilization, through increasing VAT rate, in low income and middle low income countries. We employ a dynamic general equilibrium model that marries ingredients from the structural transformation literature together with heterogeneous agent models. We calibrate the model to Ethiopia and we find that revenue mobilization is more difficult in LICs than in MILCs. We investigate what are the main source of this difference and we find that is the small share of urban workers and differences in TFP.

In addition, the paper also analyze the distributional impact of VAT in LICs, and we find that VAT can be extremely regressive, causing increases in poverty and inequality. In order to mitigate this negative impact, we study two compensatory measures: tax exemptions and cash-transfers. We find that cash-transfers are more effective in combating poverty and inequality.
References


Teshome, Akalu, Jan de Graaff, Coen Ritsema, and Menale Kassie, “Farmers’ Perception about the Influence of Land Quality, Land Fragmentation and Tenure Systems on
Sustainable Land Management in the North Western Ethiopian Highlands,” *Land Degradation and Development*, 2014, pp. n/a–n/a.


## Appendix

### Table 6: Calibrated Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsistence level $\bar{a}$</td>
<td>0.012</td>
</tr>
<tr>
<td>Preference over services $\psi$</td>
<td>0.363</td>
</tr>
<tr>
<td>Preference over manufacturing $\gamma$</td>
<td>0.597</td>
</tr>
<tr>
<td>Variance of the income process rural households $\sigma^r$</td>
<td>0.260</td>
</tr>
<tr>
<td>Variance of the income process urban households $\sigma^u$</td>
<td>0.527</td>
</tr>
<tr>
<td>Service sector productivity $z^s$</td>
<td>1.000</td>
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<tr>
<td>Agriculture sector productivity $z^a$</td>
<td>0.564</td>
</tr>
<tr>
<td>Manufacturing sector productivity $z^m$</td>
<td>10.677</td>
</tr>
<tr>
<td>Export sector productivity $z^e$</td>
<td>1.068</td>
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</tbody>
</table>

### Table 7: Changes in relative prices

<table>
<thead>
<tr>
<th>Percent Change</th>
<th>VAT</th>
<th>VAT + Exemption</th>
<th>VAT + Transfers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price of Food</td>
<td>−9.36</td>
<td>−8.63</td>
<td>−8.75</td>
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<tr>
<td>Price of Services</td>
<td>−3.12</td>
<td>−2.95</td>
<td>−3.14</td>
</tr>
<tr>
<td>Urban Wages</td>
<td>0.96</td>
<td>−1.22</td>
<td>−1.73</td>
</tr>
<tr>
<td>Rural Wages</td>
<td>−6.06</td>
<td>−5.91</td>
<td>−5.94</td>
</tr>
<tr>
<td>Interest Rates</td>
<td>4.97</td>
<td>9.89</td>
<td>18.87</td>
</tr>
</tbody>
</table>