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AN ANALYSIS OF SOUTH AFRICA'S VALUE ADDED TAX

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ABSTRACT

In this paper, we describe South Africa's value added tax (VAT), showing that (1) the VAT is mildly regressive and (2) it is an effective source of government revenue, compared to other tax instruments in South Africa. We evaluate the VAT in the context of other distortions in the economy by computing the marginal cost of funds—the effect of raising government revenue by increasing the VAT rates on household welfare. Then we evaluate alternative, revenue-neutral tax systems in which we reduce the VAT and raise income taxes. For the analysis, we use a computable general equilibrium (CGE) model with detailed specification of South Africa's tax system. Households are disaggregated into income deciles. We demonstrate that alternative tax structures can benefit low-income households without placing excess burdens on high-income households.

1. Introduction

In September 1991, South Africa replaced its general sales tax (GST) with a consumption-type value added tax (VAT). The original statutory rate was 10 percent, which was subsequently raised to 14 percent in 1993. The South Africa VAT is levied on the domestic supply and imports of goods and services, while exported goods (such as gold) and services[1] are zero-rated. With a rebate for intermediates and investment purchases, the VAT is generally seen as a consumption tax as the consumer pays it at the final stage of production.[2] The advantage of a VAT is that, unlike other indirect taxes, it eliminates the cascading effects of taxes on intermediate inputs and, as such, it removes distortions affecting input choices in production.

Initially, there were concerns about the regressiveness of the VAT. To assist the poor, selected foods (such as brown bread, maize meal, milk and milk powder, rice, unprocessed vegetables and fruits) and paraffin were zero rated. There were also concerns that it would be difficult to administer and that it would place a burden on small businesses. There were doubts that a VAT could replace the GST as a source of government revenue.

Some of these initial concerns about a VAT have not materialized. For example, small firms were excluded for social reasons as well as to simplify the system. The VAT has proven to be a stable and broad-based source of government revenue. The tax collection method of a VAT encourages "self-policing"—producers are more likely to purchase intermediates from sellers who can verify that they have paid the value added taxes due.[3] However, the VAT is mildly regressive (see Fourie and Owen (1993) and Figure 1 in section 2.1), despite efforts to zero rate commodities important to low-income households.[4]

In this paper, we analyze the welfare and income distribution effects of possible reforms to South Africa's value added tax in order to improve its equity impact while maintaining its strong revenue features. We use a computable general equilibrium (CGE) model of South Africa, with data for 2001.[5] We extend the model to include VAT payments with rebates on intermediate inputs. There are 10 households according to income deciles. We allow for unemployment in the semi-skilled and unskilled labor categories.

First, we describe the incidence of the VAT. Following Devarajan and Hossain (1995) we remove the VAT from the price system and replace it with a proportional increase in the income tax. With this approach, we maintain public expenditure levels because government revenue does not change and, because we use a direct tax to restore government revenue, we do not distort the

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[1]Exports do not attract VAT – an important feature of all VAT systems. There are some definitional and administrative problems with regard to international traded services that are under review.

[2] Go and Mitra (1999) use a CGE model that incorporate a similar VAT for India. For the history and issues about VAT as a tax instrument, see Baker and Elliott (1997) and Ebill et al. (2001) for example.

[3] See Kearney (2004).

[4] This does not mean that the whole tax system is regressive—see tax structure in section 2.

[5] In this paper we expand upon the tax specification in the CGE model originally programmed by Marna Kearney (see Go and Kearney, 2003) and which uses the standard CGE model code developed by Lofgren et al. (2001). The Social Account Matrix in that model was commissioned by the World Bank and constructed by Quantec of South Africa.

pattern of indirect tax-incidence.[6] Next, we consider the welfare effects of a uniform increase in the VAT rates to increase government revenue. This scenario indicates the marginal cost of funds (MCF) and is a measure of how the VAT operates in the context of other model distortions. Finally, we describe alternative tax structures that are revenue neutral and that shift the tax burden away from low-income households: (1) we uniformly reduce VAT tax rates and increase income taxes on high-income households; (2) we remove the VAT on agriculture and food and replace the lost government revenue with either an increase in the income tax rates on high-income households or an increase in the other VAT rates.

We will use a variety of measures to describe the effect of a VAT on welfare. We report the regressiveness of the VAT, the progressiveness of the complete tax system, and the equivalent variation derived from the changes in household consumption. We also show the effects of changes in the tax system on total government revenue, the components of government revenue, and the structure of the economy.

We begin with a brief description of the CGE model, focusing on the tax structure and the changes necessary to represent a VAT with rebates. We then simulate alternative tax structures to describe the welfare effects of a VAT on various household groups. Our conclusions follow.

2.   The CGE Model

CGE models incorporate consumer and producer behavior as well as the interaction between other economic agents and therefore incorporate all effects on the distribution of income and economic welfare. We use the CGE model by Löfgren et al (2001).[7] The CGE model equations are solved simultaneously with the computer software package GAMS and the solver PATH.

2.1   The Tax Structure of South Africa

Typical of a middle-income or more advanced developing country, the tax base of South Africa is derived more from manufacturing activities and formal services, which now account for more than two-thirds of the economy. The production structure of South Africa is reflected in Table 1, which is derived from a recent social accounting matrix (SAM). While the mining sector remains a significant source of export revenue, its share in the economy is less than 7 percent and, as an export sector, it does not contribute to VAT revenue.

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[6] Devarajan and Hossain (1995) analyze the combined incidence of taxes and public expenditure in the Philippines. They simulated the price effect of a particular tax, by eliminating the tax from the Philippines tax system and simultaneously replacing it with an increase in proportional income tax (Devarajan and Hossain,1995:10).

[7] A detailed discussion on the mathematical structure of the standard model can be found in Löfgren et al (2001).

Table 1: Production structure of the economy by aggregate sector

Aggregated Sector	Components	Percent of Total Output
Agriculture	Agriculture Forestry and Fishing	3.3
Fuels & Minerals	Coal Mining Gold and Uranium Ore Mining Other Mining	6.7
Food Products	Food Beverages and Tobacco	5.5
Textiles	Textiles Wearing Apparel Leather and Leather Products Footwear	1.5
Other Manufacturing	Wood and Wood Products Paper and Paper Products Printing Publishing and Recorded Media Coke and Refined Petroleum Products Basic Chemicals Other Chemicals and Man-Made Fibers Rubber Products Plastic Products Glass and Glass Products Non-metallic Minerals Basic Iron and Steel Basic Non-ferrous Metals Metal Products Excluding Machinery Machinery and Equipment Electrical Machinery TV Radio and Communication Equipment Professional and Scientific Equipment Motor Vehicles Parts and Accessories Other Transport Equipment Furniture Other industries	23.3
Utilities	Electricity Gas and Steam Water supply	2.4
Construction	Construction and Civil Engineering	4.5
Services	Wholesale and Retail Trade Catering and Accommodation Transport and Storage Communication Financial Services Business Services Health Community Social and Personal Services Other producers	39.6
Government Services	General Government Administration General Government Defense General Government Law and Order General Government Education General Government Health General Government Social Services General Government Economic Services	13.2
Note: Production shares are calculated from SA SAM 2003.		

The SAM for South Africa also reports taxes paid by institutions, commodity sales, and production activities. The tax instruments and their share in total revenue are summarized in Table 2.

Table 2: South African Taxes included in the CGE model

Tax Category	Description	Model parameter	Percent of total government revenue collected
Institutional taxes (direct taxes)			
Corporate Tax	Taxes Levied on Firms	$tins(firms)$	20.5
Income Tax	Taxes Levied on Individuals (Households)	$tins(h)$	37.3
Commodity taxes (indirect taxes)			
VAT	Value Added Tax	$tvat(c)$	20.4
Fuel tax	Government levy on fuel	$tfuel(c)$	5.3
Excise tax	Excise taxes on goods	$texcise(c)$	3.1
Net taxes on products	Other taxes on products excluding subsidies	$tproducts(c)$	2.0
Tariffs	Taxes levied on imports of goods and services	$tm(c)$	2.2
Activity taxes			
Net taxes on production	Other taxes on production	$ta(a)$	9.2
Note: government revenue shares are calculated from SA SAM 2003.			

Consistent with other studies, we find that the VAT for South Africa is mildly regressive, see Figure 1. Low-income households pay a higher share of their income to VAT than do high-income households. It is also evident in Figure 1 that the VAT is more regressive or at least no better than the other indirect taxes in South Africa. For this reason, there is room for changes to the tax system that would make the VAT less regressive.

It should be emphasized that the whole tax system of South Africa is progressive. Indeed, Davis and Kay (1985) as well as Fourie and Owen (1993) stress that the progressiveness of the complete tax system should be taken into account and one should not look at the distributional impact of VAT in isolation. When evaluating total taxes paid, including direct taxes on households, it is evident that high-income households pay a larger percentage of their income to taxes than low-income households, see Figure 2.

Figure 1: The Regressiveness of Indirect taxes on Consumption in 2001

Consumption Tax Payments per Household as a Percentage of Income
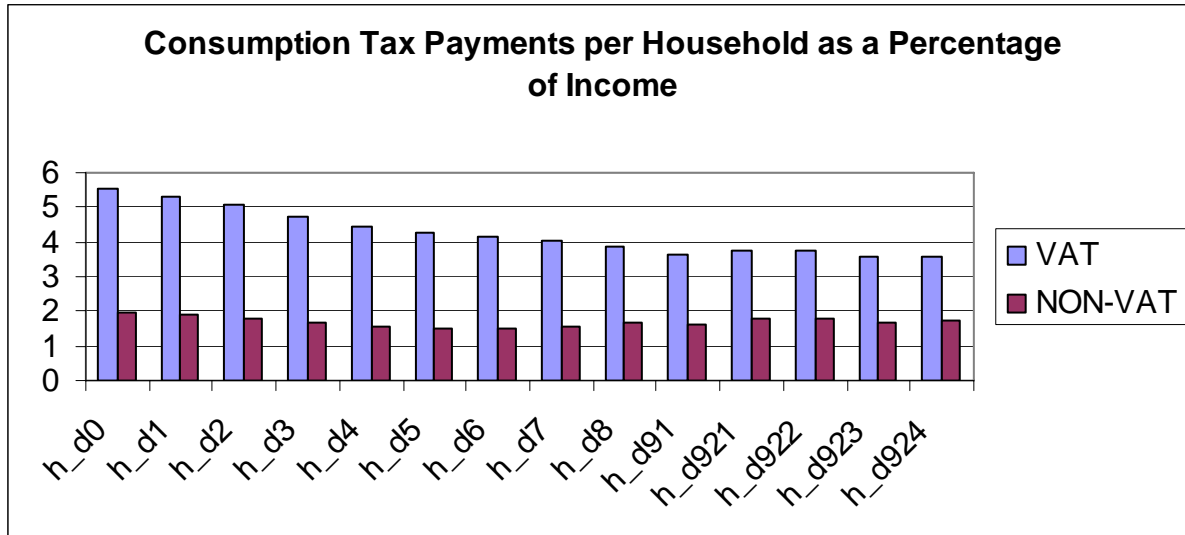
Source: SA SAM 2003

Figure 2: The progressiveness of the complete tax system in 2001

Total Tax Payments per Household as a Percentage of Income
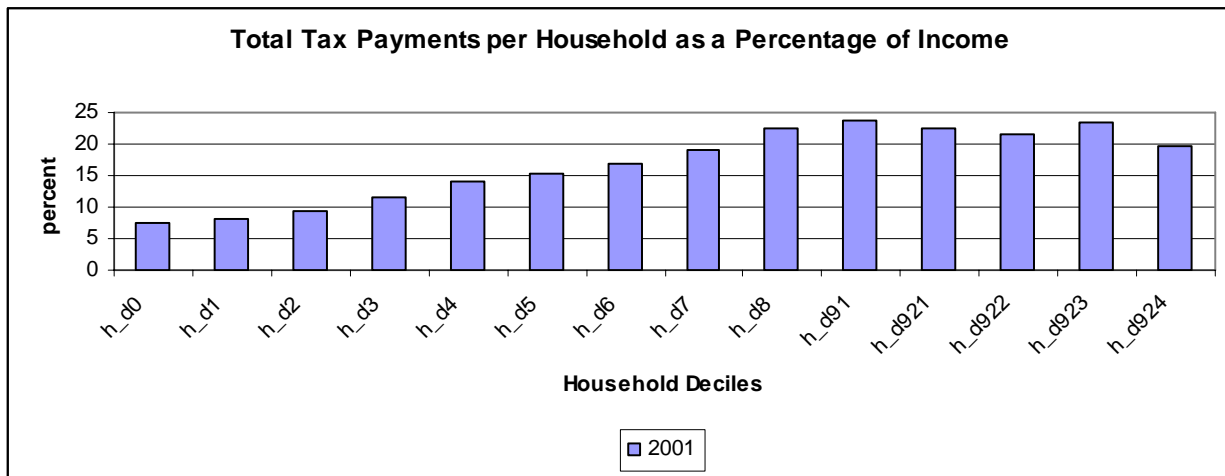
Source: SA SAM 2003

Devarajan and Panagariya (2000) show that a uniform value-added tax would closely mimic a lump-sum tax. However, when commodities are left out of the tax base, there is an efficiency loss. This is certainly the case for South Africa as the South African Value-Added Tax Act No.89 of 1991 makes allowances for exemptions, exceptions, deductions and adjustments that effectively lower the VAT liability. At inception various basic food items such as brown bread, maize meal, samp, mealie rice, dried mealies, dried beans, lentils, pilchards, milk powder, milk, rice, unprocessed vegetables and fruit, vegetable oil, and eggs were exempted from VAT (SA Tax, 2001:Schedule 2 Part B). To reduce the regressiveness of VAT even further, paraffin, an energy source used by most poor households, was exempted in 2001. However, suppliers absorbed most of the benefits and did not pass it on to the consumers as intended. Various other exclusions exist: Small firms supplying less than R300 000 per year are not required to register

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as a VAT payer (SARS,2003). Some services provided within the financial sector are also exempt. (International VAT Monitor,1995:376).

In this paper, we take the economic and tax structure of the SAM, including the VAT and its exceptions, as the basis for the CGE model and we examine possible tax reforms that will improve welfare impact.

2.2 Specification of a VAT with Rebates on Intermediate Inputs

Rather than treat consumption tax payments as a retail sales tax, we specify a European-style value added tax with rebates for intermediate input and investment purchases. With this treatment, there is no cascading effect on prices of taxes on intermediate goods.

We assume the VAT is administered using the "invoice method." All transactions are taxed at a fixed proportional rate regardless of whether they are final or intermediate transactions. Firms can deduct taxes paid on intermediate inputs and that tax amount is reported on the invoices for intermediates. Import sales are subject to a VAT, export sales are not.

To calibrate the model, we assume the observed VAT tax revenue in the SAM is the gross payment by sector.[8] Producers must pay the VAT on retail sales and can collect a rebate on taxes paid by intermediate input use. For each production activity, we compute the rebate on intermediate expenditure using data on input-output relationships. We assume a Leontief production structure with fixed input-output shares defining intermediate demand.

The rebate to activity, A, is based on total intermediate input use:

$$REBATE(A) = \sum_c tvat(C) \cdot PQ(C) \cdot QINT(C,A)$$

where:
- tvat(C)   is the value added tax by commodity sales
- PQ(C)   is price of commodity c
- QINT(C, A) is the quantity of intermediate commodity, c, purchased by activity, a

The price of the aggregate intermediate input now includes the rebate per unit of aggregate intermediate input:

$$PINTA(A) = \sum_c PQ(C) \cdot ica(C,A) - REBATE(A)/QINTA(A)$$

where:

- PINTA(A)   is the price of the intermediate aggregate input
- PQ(C)   is the price of the composite commodity
- ica(C,A)   is the intermediate input c per unit of aggregate intermediate
- QINTA(A)   is the quantity of aggregate intermediate input

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[8] We use the effective tax rates based on tax collection data. The rates differ by sector and differ from the reported statutory rate of 14% due to sector aggregation, the treatment of the informal sector and/or measurement error.

The price, PINTA(A) is used in the producer's first order condition over the intermediate aggregate input and the primary factor aggregate input.

The original SAM data does not include a rebate account. Taxes paid by the activity to the government are net of subsidies. The rebate is a subsidy on the use of intermediate inputs. When we use rebates explicitly in the model, the tax payment from the activity to the government must be adjusted upward to add back in the subsidy payment. The indirect tax rate, ta(A), must be recomputed to take into account the adjustment to the SAM.

The value added tax revenue paid to the government (VATREV) becomes:

$$VATREV = \sum_c tvat(c) \cdot PQ(c) \cdot QQ(c) - \sum_a REBATE(a)$$

Much of the analysis of tax policy reform depends on the initial tax rates in the base data. We use the following tax rates as found in the SAM for South Africa:

Table 3: Base tax rates

	Consumption			Production	
Commodity	Tariff	VAT rates		Indirect	Rebate
Agriculture, Forestry, and Fisheries	0	1.2	1.6	0	0
Coal Mining	0	0	0.3	1.3	0
Gold and Uranium Ore Mining				1.5	0
Other Mining	0	0	0.1	0.6	0
Food	0.2	2.3	5.5	0.3	0
Beverages and Tobacco	7.3	39.3	10.1	0.7	0
Textiles	0.9	8.9	2.4	1.5	2.5
Wearing Apparel	0.3	11.9	3.8	1.6	2.9
Leather and Leather Products	0.5	0.9	0.2	3.5	5.7
Footwear	0.5	6.1	3.3	1.1	1.7
Wood and Wood Products	0	1.1	0.5	1.6	1.9
Paper and Paper Products	0.2	6.3	0.4	1.3	1.8
Printing, Publishing, and Recorded Media	0.2	1.3	3.6	1.3	1.9
Petroleum	20.6	0.2	11.7	1.8	1.0
Basic Chemicals	0.2	1.2	0.8	2.8	3.2
Other Chemicals and Man-Made Fibers	0.3	1.4	2.8	2.3	2.6
Rubber Products	4.2	6.1	0.9	1.4	1.8
Plastic Products	1.7	1.4	0.3	0.9	1.4
Glass and Glass Products	1.6	1.3	0.3	1.4	2.3
Non-metallic Minerals	0.3	2.3	0.8	1.8	1.8
Basic Iron and Steel	0	1.1	0.1	1.5	1.9
Basic Non-ferrous Metals	0	0.2	0	1.2	1.7
Metal Products Excluding Machinery	0.8	3.5	1.5	1	1.4
Machinery and Equipment	0.3	2.3	3.7	1.7	2.3
Electrical Machinery	2.3	4.9	1.5	1.3	1.6
TV, Radio, and Communication Equip	3.5	2.5	3.6	1.8	3.1
Professional and Scientific Equip	3.7	0.4	2.4	2.8	2.7
Motor Vehicles Parts and Accessories	0.2	2.6	4.1	2.4	3.7
Other Transport Equipment	5	0	1.1	2.1	1.5
Furniture	1	14.9	6.4	0.9	1.6
Other Industries	2.5	5.3	11.3	0.9	1.4
Electicity, Gas, and Steam	0	0	2.9	1.3	1.7
Water Supply	0	0	2.1	1.9	2.4
Construction and Civil Engineering	0	0	3.3	2.3	2.9
Wholesale and Retail Trade	-0.4	0	1.4	3	2.5
Catering and Accomodation	0	0	4.9	4.7	6.2
Transportation and Storage	-0.3	0	0.2	4.1	8.4
Comunication	0.2	0	2.1	1.9	3.4
Financial Services	2.2	0	0.9	2.4	1.8
Business Services	1.4	0	2	7.3	2.9
Health, Community, Social, and Personal Services	0	0	4.5	3.1	3.9
Other Producers	0	0	2.5	2.5	3.3
General Govt Administration	0	0	0.1	0.4	0
General Govt Defense	0.8	0	0.8	3.6	0
General Govt Law and Order	0	0	0.1	0.4	0
General Govt Education	0	0	0.1	0.3	0
General Govt Health	0.1	0	0.1	0.8	0
General Govt Social Services	0.1	0	0.1	0.6	0
General Govt Economic Services	0	38.8	0.2	1.1	0

Note: Rebate is defined here as the rebate payment as a percent of the aggregate intermediate used in production: rebate/qinta Consumption

It is evident in Table 3 that the value added tax rates vary by commodity, with high VAT rates applying to beverages (10.1 percent) and food (5.5 percent).

2.3   Tax Incidence

From basic welfare economics it is known that per-unit taxes like VAT are more likely to introduce price distortions than lump-sum taxes. The question that often arises is "who pays the tax?" (McLure,1987:1). With consumption taxes consumers and producers share the burden, however, the producer often tries to shift the burden to the consumer. The extent to which a per-unit tax can be shifted to the consumer is determined by the elasticity of supply and demand (Ebrill et al,2001:15).

A CGE model is very useful to analyze tax incidence because it captures the effect of each tax on prices. When we simulate the removal of the VAT (or any other indirect tax instrument), the model solves for market clearing prices and quantities that are consistent with the individual optimizing behavior of consumers and producers, a given set of world prices, and the policy environment.[9] The model also has data on consumption expenditures by households, and therefore indicates the effects of tax changes on real purchasing power for each income decile.

As seen in Table 4, poor households spend the majority (61 percent) of their income on food. In contrast, high-income households spend 15 percent of their income on food. The reverse pattern holds for services: high-income households spend over 45 percent of their income on service while low-income households spend less than 20 percent on services. Low-income households do not purchase motor vehicles, an example of a luxury good.

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[9] See Devarajan and Hossain (1995) for a more detailed discussion of mechanisms at work in a CGE model when one removes an indirect tax and replaces it with a direct tax.

Table 4: Household Expenditure Shares

	Agriculture	Food Products	Textiles	Other Mfg	Motor Vehicles	Utilities	Services
h_d0	0.07	0.61	0.05	0.07	0.00	0.05	0.14
h_d1	0.06	0.59	0.06	0.07	0.00	0.05	0.17
h_d2	0.06	0.55	0.07	0.08	0.00	0.04	0.20
h_d3	0.06	0.51	0.08	0.08	0.00	0.03	0.24
h_d4	0.05	0.46	0.08	0.09	0.00	0.03	0.29
h_d5	0.04	0.41	0.08	0.11	0.01	0.03	0.31
h_d6	0.04	0.36	0.08	0.13	0.01	0.03	0.35
h_d7	0.03	0.31	0.07	0.15	0.03	0.03	0.37
h_d8	0.03	0.25	0.06	0.18	0.05	0.03	0.41
h_d91	0.02	0.19	0.05	0.19	0.06	0.02	0.46
h_d921	0.02	0.15	0.04	0.22	0.07	0.02	0.49
h_d922	0.02	0.15	0.04	0.21	0.07	0.02	0.50
h_d923	0.02	0.15	0.04	0.21	0.08	0.02	0.49
h_d924	0.02	0.15	0.03	0.19	0.09	0.01	0.52

Note: household expenditure for the commodities "fuel and other minerals" and "government services" were very close to zero and are not reported in this table.

3. Model Closure Rules

A CGE model specifies closures for factor markets, savings, the government, and the rest of the world. The following closure rules are chosen to represent macroeconomic conditions in South Africa; they are used in all scenarios except those used to compute the marginal cost of funds. The changes needed to compute the MCF are described with that scenario in section 6.3.

To represent the labor market situation in South Africa, we assume capital and high-skilled labor are fully employed and activity specific, while semi-skilled and low-skilled labor are unemployed and mobile. For capital and high-skilled labor total employment will not change, only the factor payment, which is activity-specific, will change. For semi- and unskilled labor nominal wages will remain constant as these factors experience high levels of unemployment.[10] The only factor that would change for semi- and unskilled labor is employment.

We assume investment is savings driven. The marginal propensity to save for all non-government institutions will be fixed, while capital formation is flexible. The level of savings determines investment. Nell (2002) examines the long-run exogeneity between saving and investment in South Africa and finds that private savings is strongly exogenous to private investment in the period 1977 to 2001. This implies that the savings level will determine investment. (Nell, 2002:26).

When analyzing tax reforms, we assume government revenue does not change. Instead, other tax rates adjust when we remove or reduce the VAT.

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[10] Depending in the choice of numeraire, real wages may also be held constant when the nominal wages are held constant. For example, when the consumer price index is the numeraire, real wages are held constant. In this version of the model, the producer price index is the numeraire. Tax changes can affect the consumer price index.

We assume a flexible exchange rate with fixed foreign savings. This is a common specification in real trade models. It is assumed that any changes in the trade balance are determined by macroeconomic forces working mostly in asset markets which are not included in the model.

4.   The Data

The South Africa SAM is based on 2001 data including:

- SSA IO 1971-1993
- SSA SUT 1993-1998
- SAM 1998
- SARB published and unpublished data 1970-2001
- SSA industry censuses and surveys
- 1970-1996 population census
- OHS 1994-1999
- LFS 2000-2002
- HH Income and expenditure survey 2000
- McGregor BFA 1970-2001
- ASSA 2000 Demographic model
- RSA Standardized Industry Database developed by Quantec.[11]

The SAM consists of 49 commodities at industry level as well as 49 activities. The government produces six of the 49 activities. There are four factors of production, capital, high-skilled, semi-skilled and unskilled labor. The households are divided into the 10 income deciles. Due to the magnitude of the 10th decile it is further divided into 95 percent, 96.25 percent, 97.5 percent and 98.75 percent.[12] Elasticities used in the model are from Gibson(2003), Van Heerden and Van der Merwe (1997), the CGE model of Lewis (2001) and Thurlow and Van Seventer (2002).

From the data in the SAM, we compute effective tax rates. These are the tax rates that change when we evaluate tax reforms. In South Africa, there are indirect taxes levied on either products or production and direct taxes levied on households and firms. Indirect taxes on products include value added tax, fuel levies, excise duties, and tariffs, while indirect on production would include payroll taxes.

5.   Simulations and Results

First, we evaluate the current tax structure. We remove the VAT and consider the following revenue neutral tax changes: (1) a uniform adjustment to all direct taxes on households and firms; (2) a uniform adjustment to income taxes for households in the 10th decile; and (3) a uniform adjustment to all commodity tax rates. The first scenario allows us to evaluate the

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[11] The data construction was commissioned by the World Bank in 2002/2003 and developed by Claude Van der Merwe from Quantec. See Van Der Merwe (2002) for a description of the sources used.

[12] The SA SAM (2003) includes residuals on the capital factor payment column as well as residuals on the commodity receipts row. The capital factor residual was removed by assuming the capital factor returns of firms contains undisclosed items, the factor returns was increased as well as the savings of firms to the same extent. The residual in the commodity row was entered into the change in stock variable. A balanced SAM was estimated using entropy by assuming the production technologies and the tax structure is known.

incidence of the VAT, similar to the analysis in Devarajan and Hossain who analyze sales taxes rather than a VAT. We also describe how effective the VAT is at generating government revenue and compare it to other tax instruments. To further evaluate the current tax structure, we describe the marginal cost of funds (MCF), computed as the change in welfare per unit of tax revenue collected from each household, for the VAT, tariffs, and indirect taxes.

Next, we describe the trade-off between a VAT and income tax adjustments to high-income households. We reduce the VAT rates by 25% (50%, 75%) and show the necessary increases in the income tax rate for households in the 10th decile.

Finally, we consider changes in the structure of VAT rates. We remove the VAT for agriculture, food, and beverages, commodities on which low-income households spend a large portion of their incomes, and replace the lost revenue with (1) a uniform adjustment to all direct taxes on households and firms; (2) a uniform adjustment to income taxes for households in the 10th decile; and (3) a uniform adjustment to other VAT rates.

5.1   Remove VAT with Tax Replacement

When we remove the VAT and replace lost revenue with a proportional increase in direct taxes, we can compute the incidence of the VAT. As noted in Devarajan and Hossain, this allows us to examine the "true" price-distorting effect of the tax; we avoid price changes generated by macroeconomic imbalances as government revenue declines. In addition to a proportional increase in direct taxes, we also consider a proportional increase in commodity taxes and a proportional increase in income taxes on rich households only.[13] As seen in Figure 3, each change reduces the tax burden of low-income households.

Figure 3: Tax Burden when VAT is removed, with tax replacement
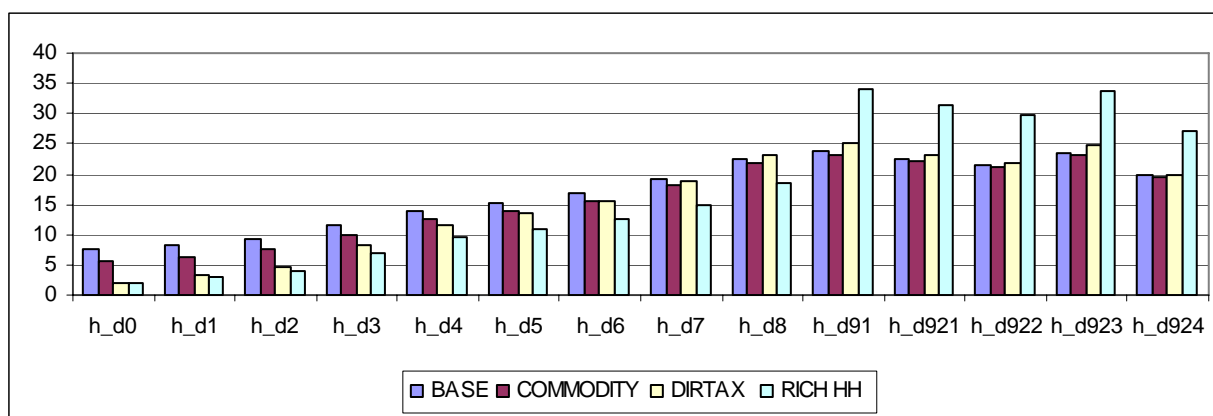
Source: South Africa CGE model simulations

When the tax revenue is replaced by a tax increase on high-income households, the overall tax system becomes even more progressive as the tax burden on rich households actually increases.

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[13] We also considered raising tariffs to replace tax revenue. As seen in Table 2, tariffs contribute a small share of total government revenue; given this low tax base, it is not feasible to increase tariffs to replace the lost tax revenue when the VAT is removed.

In contrast to the VAT, which is broad-based, the other indirect taxes levied on products, in South Africa, apply to a few sectors such as petroleum, beverages, and transport equipment. Indirect taxes on products (excluding VAT) account for 12.6 percent of total government tax revenue (see Table 2).When we remove the VAT and replace government revenue with a commodity tax, each rate must increase 262 percent. The overall tax burden is slightly more progressive as the tax burden for low-income households declines by more than the tax burden for high-income households. The tax burden is more progressive when either direct taxes or taxes on rich households adjust. A commodity tax still affects commodities that low-income household's purchase and this offsets the gains from setting the VAT to zero.

To describe the welfare effect of each tax shock, we report equivalent variation (EV), the income change that, at base prices, would yield the same utility as observed in the simulation (see Table 5). In the base column, we report consumption value at base-year prices. For each scenario we report equivalent variation as a percent of base year consumption, a positive value indicates a welfare gain. Removing the VAT and replacing government revenue with a direct tax improves welfare for low and middle income households (i.e. those in the first six deciles), with the largest gain to the poorest households who spend a large share of their income on food which faces a relatively high VAT rates. In this scenario, firms bear some of the adjustment cost, as their direct tax rate increases (as do direct tax rates on all households) to replace the lost revenue from the VAT. As would be expected, the high-income households face a welfare loss when that group pays a higher income tax as the VAT is removed. High-income households also face a welfare loss when commodity taxes increase to replace lost VAT revenue. This is because the high-income households have higher consumption shares for goods that face a commodity tax and whose tax rate increases dramatically in this scenario.

*Table 5: Equivalent Variation when Remove VAT with Tax Replacement*

| | | Remove VAT and replace with a uniform adjustment to : | | |
	Base	Direct taxes	Rich HH income taxes	Commodity taxes
h_d0	8.524	4.254	4.338	0.998
h_d1	11.921	3.02	3.421	1.022
h_d2	16.32	3.452	4.371	0.902
h_d3	21.233	2.059	4.131	0.756
h_d4	27.408	1.817	4.975	0.563
h_d5	35.165	1.399	5.213	0.399
h_d6	49.336	0.964	5.602	0.124
h_d7	70.317	0.138	5.906	-0.176
h_d8	106.417	-0.932	6.255	-0.501
h_d91	83.058	-1.663	-12.132	-0.656
h_d921	28.58	-0.48	-9.847	-0.902
h_d922	33.727	-0.699	-8.714	-1.062
h_d923	38.089	-1.89	-11.329	-1.103
h_d924	78.538	-1.573	-6.361	-1.613

Source: South Africa CGE model simulations

5.2 Tax revenue

Another way to evaluate the current tax structure is to report the effectiveness of each instrument as a source of government revenue. We consider 5 (10, 15, 20, 25) percent increases in indirect tax rates and report the percent change in government revenue in Figure 4. Both production taxes and the VAT have a broad tax base and therefore are more effective at generating government revenue than tariffs.

Figure 4: Increase in government revenue as indirect taxes are increased
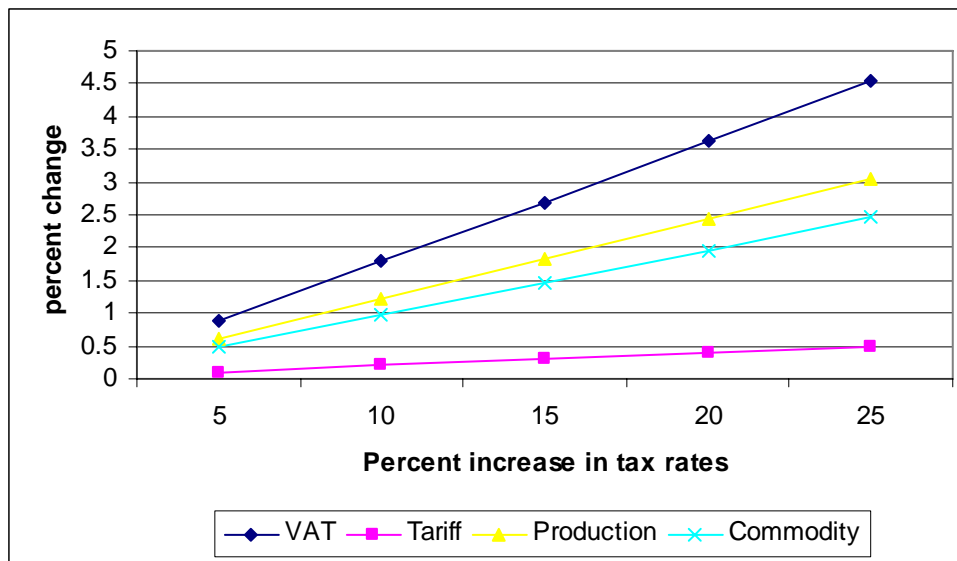
Source: South Africa CGE model simulations

5.3   Marginal Cost of Funds

In addition to measuring how effective each tax instrument is at generating tax revenue, we also calculate the marginal cost of increasing taxes. To focus on the effect the tax change has on consumer welfare, we modify closure assumptions. We assume long run equilibrium in factor markets with all factors mobile across all sectors. The wage is endogenous and the supply of each factor is fixed. Investment is constant and savings adjusts. Real government spending is constant. There are no changes in the flow of foreign capital, instead the exchange rate adjusts. With this specification, any increase in government revenue is redistributed to households in a lump-sum fashion. The transfer amount to each household depends on the household's initial savings rate.[14] High-income households receive a larger share. Our model does not include a labor-leisure trade off and it does not measure the administrative costs of the VAT.[15] In this context, the MCF is a measure of the inefficiencies in the structure of production. It depends not just on the tax being raised, but also on other distortions in the economy—and whether they increase or decrease in response to the tax increase. For instance, in an economy with a very high tax on coffee, the MCF raised by taxing tea may be quite low, since the tax would induce consumers at the margin to buy more coffee, reducing the distortion associated with the coffee tax.[16]

To describe the MCF by household, we report the change in household welfare, relative to the change in household taxes paid.

Table 6: Marginal Cost of Funds

	Increase government revenue with a uniform increase in:	
	VAT	Commodity Tax
h_d0	0.762	0.594
h_d1	0.541	0.290
h_d2	0.699	0.561
h_d3	0.402	0.167
h_d4	0.475	0.360
h_d5	0.419	0.345
h_d6	0.314	0.286
h_d7	0.194	0.215
h_d8	0.283	0.458
h_d91	0.194	0.409
h_d921	0.550	0.907
h_d922	-0.067	0.136
h_d923	-0.290	-0.157
h_d924	-1.224	-1.233
Total	0.003	0.022

Source: South Africa CGE model simulations

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[14] Since investment is constant, an increase in government savings (due to an increase in tax rates in this scenario) is offset by a decrease in household savings; in effect there is a lump sum transfer to the households.

[15] Ballard and Fullerton (1992) note, that while administration and compliance costs are important, they have been ignored by economists studying the marginal cost of funds since the 1970s.

[16] For more discussion of the MCF of indirect taxes in developing countries, see Devarajan, Thierfelder, and Suthiwart-Narueput (2001). See Ballard et al (1985) for a description of the MCF for the United States.

The marginal cost of funds of a VAT is higher for low-income households than for rich households. Indeed the rich households are better off because they receive a bigger share of the total lump sum transfer from the tax increase. The low-income households now pay higher prices for commodities such as food that are subject to a higher VAT in this scenario. It is interesting to note that in the aggregate, the marginal cost of funds is negligible for a VAT. A similar MCF pattern across households and in aggregate holds for commodity taxes. The low MCFs in aggregate reflect the fact that South Africa's tax rates are within a narrow range.

5.4   VAT Reforms

5.4a   Income tax changes

Given the regressive nature of the value added tax in South Africa, we consider alternative tax structures that are less regressive. First, we describe the trade off between value added taxes and income taxes on the rich households, which we define as those in the tenth decile. In Table 7 we report the new household income tax rates when we reduce the VAT and when we remove the VAT for food.

We find that when we reduce the VAT rates by 25 percent, the income tax rate on rich households must increase by 21 percent, when the VAT is reduced by 75 percent, the income tax rate on rich households must increase by 60 percent. As seen in Table 7, even when we remove the VAT and replace tax revenue with an increase in income taxes on high-income households, the tax rates are all under 33 percent.

Low-income households benefit from this tax change as the VAT burden becomes less regressive, as seen in Figure 5.

We also report the effects of removing the VAT on food, a commodity upon which low-income households spend a high proportion of their income. We find that when the rich households bear the burden as their income taxes increase, the new income tax rates are all under 23 percent.

Table 7: Effects of VAT reforms on tax rates when high-income income taxes adjust

	Base rates	Reduce VAT:				0 FOOD VAT
		25%	50%	75%	100%	
Firms	0.128	0.128	0.128	0.128	0.128	0.128
h_d0	0	0	0	0	0	0
h_d1	0.011	0.011	0.011	0.011	0.011	0.011
h_d2	0.024	0.024	0.024	0.024	0.024	0.024
h_d3	0.052	0.052	0.052	0.052	0.052	0.052
h_d4	0.08	0.08	0.08	0.08	0.08	0.08
h_d5	0.095	0.095	0.095	0.095	0.095	0.095
h_d6	0.111	0.111	0.111	0.111	0.111	0.111
h_d7	0.135	0.135	0.135	0.135	0.135	0.135
h_d8	0.169	0.169	0.169	0.169	0.169	0.169
h_d91	0.185	0.223	0.259	0.294	0.328	0.221
h_d921	0.168	0.203	0.236	0.268	0.299	0.201
h_d922	0.16	0.193	0.224	0.255	0.284	0.191
h_d923	0.181	0.219	0.255	0.289	0.322	0.217
h_d924	0.144	0.173	0.202	0.229	0.255	0.172

Source: South Africa CGE model simulations

*Figure 5: Regressiveness of VAT as VAT rates are reduced*
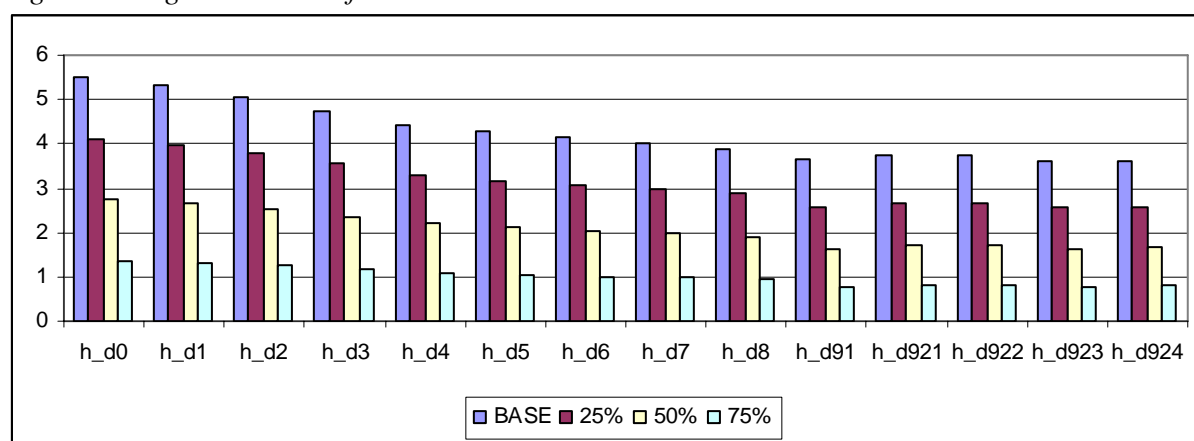
Source: South Africa CGE model simulations

5.4b   VAT Rate Reforms

Finally, we consider restructure the VAT rates to make the tax instrument less regressive. We remove the VAT for food and increase the other VAT rates by 16.4 percent to replace the lost government revenue. As seen in Figure 6, the revised VAT structure is no longer regressive: the VAT payments as a percentage of household income increase as income increase, reversing the pattern observed with the initial VAT rates in place.

Figure 6: VAT payments as a percentage of household income
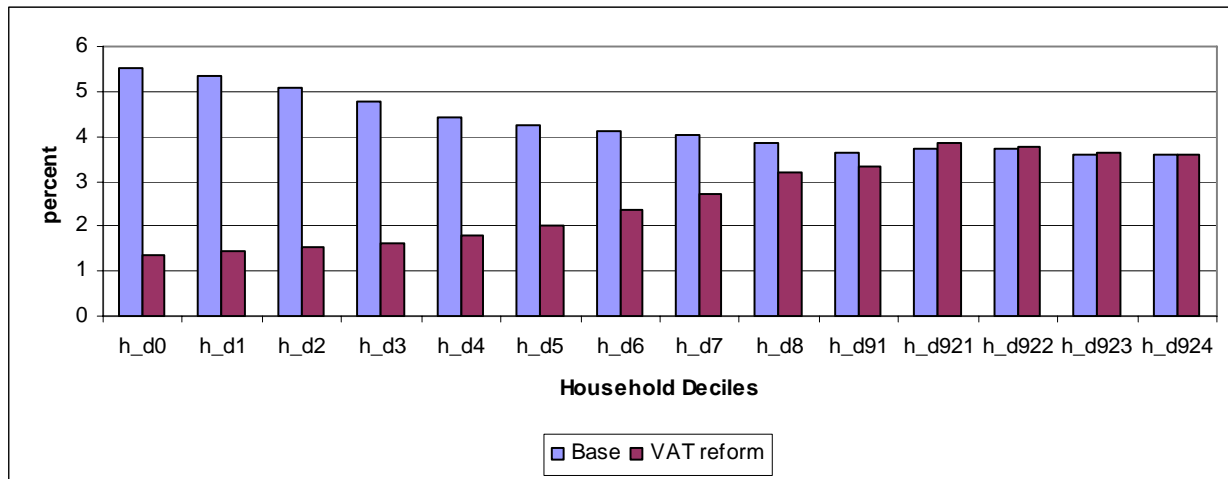
6.   Conclusion

In this paper, we analyze the VAT in South Africa, using the effective rates observed in the Social Accounting Matrix for 2001. We find:

- The VAT in South Africa is mildly regressive; the over all tax system is not.

- The marginal cost of funds for the VAT is higher for low-income households than for high-income households.

- A VAT is the most effective instrument for generating government revenue.

- One can restructure the VAT system to make it less regressive, or even progressive.

- There is scope for redesigning the tax system without imposing serious strain on high-income households. Minor changes in the tax structure can have a substantial impact on the tax burden for low-income households. We illustrate a few possibilities in this paper. When we remove the VAT and increase the income tax rates for high income households, all rates are under 33 percent. Alternatively, when we restructure the VAT rates and eliminate the VAT on commodities important to low-income household consumption, other VAT rates increase by 16.4 percent. One can construct an alternative mix of VAT and other taxes that is more progressive than the existing VAT system.

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