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WHO BENEFITS FROM ZERO-RATINGS? A BRIEF NOTE ON THE SOUTH AFRICAN VAT SYSTEM

SEBASTIAN BEER AND MATTHIAS KASPER

1. Introduction

Twenty years after overcoming Apartheid, South Africa still suffers from poverty and inequality. Recent data (Income and Expenditure Survey 2011) indicates that one third of the population lives on less than USD 0.70 per day while the upper tercile has USD 28 available. The country also faces other complex challenges, including high levels of unemployment, a resource-biased economy and low levels of education, and structural reforms are much needed to put the economy on a path of sustained growth. However, structural reforms require a broad consent within society, and inequality, clearly, is a major hindrance to this.

By choosing how to collect revenue and how to spend it, South Africa's government has two instruments at their disposal in order to alleviate inequality and facilitate reform. Like most modern economies, South Africa is increasingly relying on indirect taxation. The combined revenue generated by VAT, excise taxes, and the fuel and gas levy, make up 35% of total revenue. In the light of growing income inequality, this development is remarkable as wealthy individuals tend to spend a smaller proportion of their income on consumption. Indirect taxation thus potentially places a relatively higher burden on the poor.[1]

To counteract an aggravation of income inequality, a range of commodities, held to be important for the poor, are currently zero-rated under South Africa's VAT system.[2] And some studies find that this policy measure is partly effective in reducing the regressive effect (Fourie and Owen, 1993; Jansen et al., 2012). However, while studies on the regressive effect of VAT are potentially valuable, they are certainly non-conclusive in appraising the welfare consequences of zero-ratings. Increasing the rates on such commodities would not only entail an increased burden on the poor, but also an increase in governmental revenues. Depending on the redistribution of such additional revenues, the poor could either benefit or not from this reform and the conclusion would be fairly independent from the overall regressiveness of the system.

[1] Go, Kearney, Robinson, and Thierfelder (2005) indeed confirm a mildly regressive effect of South Africa's VAT.

[2] Producers of exempt commodities are not required to collect output tax, nor are they eligible for refunds. Input VAT thus sticks to them and increases their marginal costs of production. This leads to a cascading of taxes – even under VAT systems (see Keen, 2013, for a more detailed discussion). Zero-rating, on the other hand, does not introduce distortions of this kind since input taxes paid by VAT-registered sellers are fully recovered.

In this paper, we re-evaluate the effectiveness of zero-rating as a measure to alleviate poverty in South Africa and extend earlier work by incorporating both sides of fiscal action in our analysis. We clarify the interlink between welfare effects and consumption taxation by retracing a simple model developed by Keen (2013), in Section 2, which we then apply to the South African case. In doing so, we employ data from the most recent Income and Expenditure survey to derive distributions of household spending and governmental spending in Section 3. We conclude in Section 4.

2. The effect of changing the tax on some commodity

In this section we briefly discuss the welfare effects of a partial, non revenue neutral, tax reform.[3] We assume that producer prices are fixed and only a fraction α_j^i of household i's consumption of commodity j is purchased from VAT-registered retailers. Furthermore, we expect that this fraction is increasing with income. One rationale for the latter assumption is that high-income households, having higher opportunity costs of time, prefer to purchase their consumption items in bulk at sufficiently large (VAT-registered) retail stores.[4]

We hypothesize that zero-rating of commodities originates from a concern for equity and evaluate a proposed reform accordingly. The most simple example of social preferences reflecting such a concern are Rawlsian, where the welfare of the poorest serves as the benchmark.

If the tax on some zero-rated commodity, say x_k, is slightly raised, the utility of the poorest is perturbed for two reasons: First, a fraction of income is lost on tax; clearly having a negative impact on well-being. Second, the reform leads to an increase in revenue and thus public spending, whose size is conditional upon the consumption level of that commodity prior to reform (the direct revenue effect) as well as the behavioral response in consumption patterns (the indirect revenue effect). If the valuation of increased spending exceeds the negative income effect, the poorest would prefer to raise a small tax on a zero-rated commodity.

In order to gain some intuition for the above mentioned, neglect for the moment the indirect revenue effect and consider the case where public revenue is uniformly distributed across all households in the form of lump-sum transfers. Disregarding that small retailers are exempt from VAT, a marginal increase in the tax rate on commodity k, say $d\tau_k$, would increase public revenue by $dG = d\tau \sum x_k^i$, where $\sum x_k^i$ is the total amount of good k consumed prior to reform. Since nothing is wasted in this simple setup, the government distributes dG/H to each household, where H is the number of households. Thus, the poorest would profit if

[3] We derive the main result, condition (2), in the Appendix and follow Keen (2013) closely in doing so.

[4] The South African VAT system allows voluntary registration for businesses earning more than R 50.000 per year. Vendors generating annual turnovers of more than R 1 million, however, are obliged to register (Roeleveld et al., 2012).

$$x_k^p < \frac{1}{H}\sum_{i=1}^{H} x_k^i. \tag{1}$$

That is, income lost due to taxation is more than compensated by additionally received governmental spending. Note that this condition holds for all *normal* goods; that is goods whose consumption is increasing with income. Clearly, most of the assumption involved in this special case are not likely to hold.

The more general condition for the poorest to profit from a marginal increase in the tax rate τ_k is

$$\frac{\tilde{x}_k^p}{\phi^p} < s^p \sum_{i=1}^{H} \tilde{x}_k^i \frac{1+\delta}{1-\gamma}, \tag{2}$$

where $\tilde{x}_j^i = \alpha_j^i x_j^i$ is the share of consumption of commodity j purchased at VAT-registered retailers, ϕ^p is the marginal valuation of public spending in terms of income, s^p measures the fraction of public spending that is allocated to the poorest, δ gives the (weighted) indirect revenue effect of a shift in consumption patterns that is caused by a change in relative prices and γ reflects the indirect revenue effect of a shift in consumption that is due to an increase in public spending.[5]

While we will use data of the National Income and Expenditure survey, in the next section, to estimate some of the parameters in (2), we may only hypothesize about the potential role of others. Begin with the valuation of public spending. Most revenue is not distributed in the form of lump-sum transfers, and other distribution mechanisms might both slacken or tighten the condition in (1) to the extent that ϕ becomes smaller or bigger than one. The free provision of electricity, for instance, serves a need for security and might thus be valued, by most members of society, above its marginal costs of production. The benefit of public education, on the other hand, certainly depends on household characteristics and might be below its cash-equivalent for the poorest. In the empirical section, we take $\phi = 1$ as a benchmark and note that this may be regarded a lower bound if public spending is targeted to serve the most basic needs.

To understand the role of the indirect revenue effect, assume, until further notice, that all cross-price elasticities are zero, so that changing the price of one commodity does not affect the demand for another. The indirect revenue effect than reduces to $1/(1-\gamma)$ and behavioural consequences for revenue are limited to the effect a changed provision of public goods has on individual demands.

[5]Substituting the assumption that indirect revenue effects cancel out, $(1+\delta)/(1-\gamma) = 1$, that revenue is distributed uniformly $s^p = 1/H$ in the form of lump-sum transfers, $\phi^i = 1$, and disregarding VAT exemptions $\tilde{x} = x$, gives expression (1) above.

If governmental spending comes in a form that is complementary to consumption, like lump-sum transfers possibly are, γ is positive[6] and revenue collections will exceed the mechanical increase due to changing the tax on some fixed amount of consumption. However, increased spending might also trigger substitution effects, decrease private consumption, and imply that overall less tax is collected. The second (indirect) cause for the change in revenue collections, cross-price elasticities, may as well both slacken or tighten the condition in (1). Their effect on governmental revenue will be the more beneficial, the less complementary the newly taxed commodity is to economy-wide consumption; implying $\delta > 0$.

Most of South Africa's zero-rated products are basic food items, such as bread or rice, fruits, or vegetables. Cross-price elasticities within this group are immaterial for revenue collections as no tax was collected before the reform. However, the judgement whether vegetables, for example, are regarded as substitutable, or as an indispensable ingredient of a meal, most likely differs across households and ultimately determines the overall revenue effect the taxation of vegetables had. In the empirical section we will consider neutral, positive and negative indirect revenue effects.

3. Empirical evaluation of zero ratings

In the following, we evaluate the effect a marginal tax reform had on the well-being of an income decile by employing data of the Income and Expenditure Survey 2011 (IES).[7] We will consider if the welfare measure

$$W(\Gamma, s^j) \equiv \Gamma s^j \sum_{i=1}^{H} \alpha^i x_k^i - \alpha^j x_k^j, \tag{3}$$

where Γ subsumes the indirect revenue effect, is positive for the j'th income decile. If it is, the decile under consideration would be better off if the corresponding tax was slightly raised. In particular, we are interested to uncover the beneficiaries from taxing commodities that are currently zero-rate in the South African VAT-system.

While information of consumption spending in the formal sector ($\alpha^i x_k^i$) is immediately available from the survey, we have to estimate the fraction of public spending that is allocated to the j'th income decile (s^j) and do so in section 3.1. As we lack information to estimate cross price-elasticities and the effect public provision has on consumer demand, we analyse the proposed reform for three indirect revenue effects: that each unit of tax additionally imposed, increases governmental revenue by 0.8, 1, or 1.2 units; that is we evaluate reform for $\Gamma \in \{0.8, 1, 1.2\}$. Section 3.2 present the results.

[6]Note that δ is strictly smaller than one, given that governmental spending can not finance itself; that is $\partial G(\tau, G)/\partial G < 1$.

[7]The Income and Expenditure Survey 2011 was conducted by Statistics South Africa (Stats SA) and provides detailed information on expenditure and income components of South African households. A total of 25,823 households was required to complete their daily acquisitions in diaries (provided by Stats SA) for two weeks and to answer a variety of questions over a four week period. Using information on the latest Census (2001), the survey sample was weighted to be representative for the South African population.

3.1. **Discussion of public spending and its allocation to income deciles.** Governmental spending may be categorised in, at least, two broad groups. Spending which is not targeted, but rather necessary to run the state, and whose consumption is not rivalry nor exclusive. Military expenses and debt-service are prime examples in this group which should contribute, in principle, to the use of all members of society in the same way. The second category subsumes spending which is, in contrast, not enjoyed equi-proportionally; either due to its exclusive design (e.g. child-care grants) or because its value is contingent upon household characteristics (cars, for instance, are necessary to enjoy governmental spending on roads).

The IES may only be used to estimate the allocation of such governmental spending which comes in the form of direct payments, and those, clearly, only account for a marginal fraction of total spending.[8] Looking at the allocation of direct payments, however, may be illuminative nonetheless as few welfare measures may be better targeted. In addition to information on direct payments,[9] the IES also provides data on the free provision of water, electricity, and sanitation as well as on grants given for educational purposes.

TABLE 1. Public Expenditure by Income Decile

Selective distributions of governmental revenue, IES 2011											
	Income Deciles										
Type of Spending	1	2	3	4	5	6	7	8	9	10	Weight
Social pension	2.2	9.9	12.6	15.9	16.1	14.6	12.3	8.7	5.0	2.6	0.95
Public education grants	12.6	2.1	3.3	2.9	10.4	6.2	7.7	12.4	21.0	21.5	0.03
Water, sanitation, electricity	12.2	8.8	10.1	10.0	9.0	10.7	11.8	12.2	8.7	6.5	0.02
Total (weighted)	2.7	9.6	12.3	15.4	15.8	14.3	12.2	8.9	5.6	3.2	

Note: The table presents the allocation of governmental expenditure to income deciles for three categories of household income and is based on the IES 2011. The weights are proportional to total expenditure for each type.

Table 1 summarizes the allocation of governmental spending per income decile. The last row presents an average (which will later be referred to as the derived distribution) by using total spending in each group as a weight. If all deciles of society would profit in the same way from governmental spending, the distribution was uniform with 10% of total expenditure going to each decile. However, the table clearly conveys that this is not the case. While spending for social protection tends to help the poor, around 56% of total spending is allocated to the poorer half of society, they are not effective in alleviating the situation of the poorest. The first decile only receives a marginal fraction of 2.9% of overall spending and the second decile is, with 9.6%, also comparatively disadvantaged.

[8]While the relative consumption of education, public transport, roads, health institutions and other publicly provided goods could in principal be used to allocate administrative costs, arguably accounting for quite some proportion of total spending, this exercise is out of the scope of this paper.

[9]This category includes old age pensions, disability grants, family and other allowances, care-dependency grant, foster care grant, grant in aid, war veteran's grant as well as other assistance from government

The amount spent on social pensions, grants, and free water, sanitation, and electricity, clearly, only accounts for a marginal fraction of total spending (which is briefly discussed below) and other forms of governmental action could change the distribution of total spending across income deciles in any form – it may render it more or less progressive or leave it unchanged. While some components of South Africa's social system are designed regressively – fees for the use of public institutions, for instance, such as schools and hospitals, are typically increasing with income – other components, like spending on roads, might well be progressive.

We lack information on this and assume that all components of governmental spending, other than those discussed in Table 1, are uniformly distributed across all income deciles. To account for the fact that this is a very crude approximation to reality, we construct three distributions of total spending by taking weighted averages of a uniform distribution and the distribution derived above.

According to the South African Budget Review 2013, around 40% of total revenue was spent on non-targeted measures, including spending on defence, general public services (such as international relations and state debt costs), public order and safety, science and technology and economic affairs. In the following, we take this percentage to be the lower bound of total expenditure that is distributed uniformly. A markedly larger fraction of revenue was allocated to social welfare programs including spending on education (20%), social protection (12%), health care (12%), housing and community amenities (12%), and social security (4%).

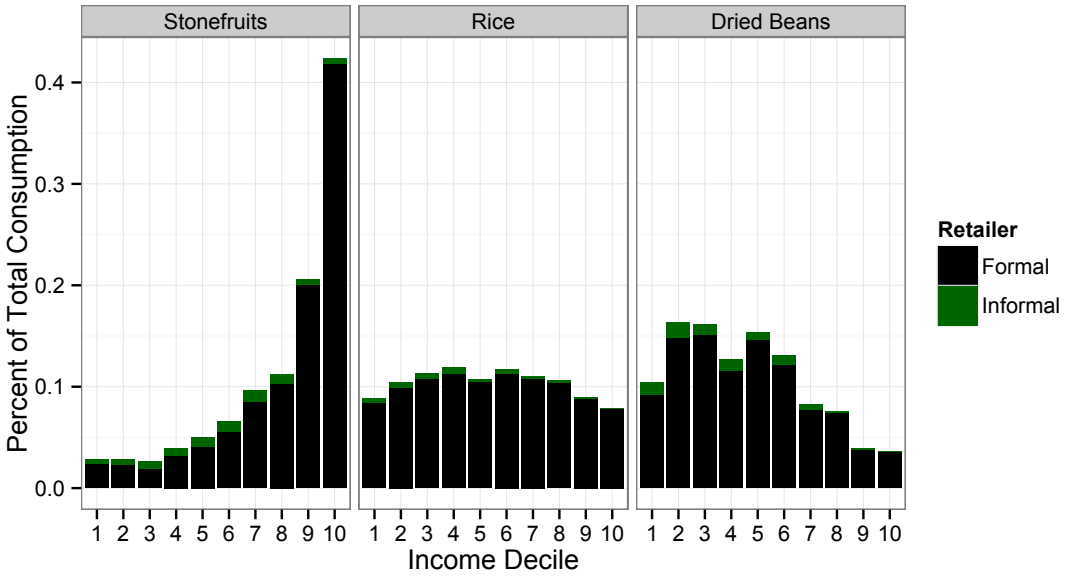
Table 2. Distribution scenarios considered

Distribution scenarios for s^i										
	Income Deciles									
Public spending scenarios	1	2	3	4	5	6	7	8	9	10
Baseline	7.8	9.9	10.7	11.6	11.7	11.3	10.6	9.7	8.7	8.0
Disadvantaged	5.6	9.8	11.4	13.2	13.5	12.6	11.3	9.3	7.3	5.9
Uniform	10	10	10	10	10	10	10	10	10	10

Note: The table presents the hypothesised allocation of total governmental expenditure and is constructed by taking weighted averages between the distribution presented in Table 1 and a uniform distributions. The weights on the uniform are: 0.7, 0.4, and 1

Spending for social protection and the free provision of water, electricity and sanitation accounts for approximately 14% of total spending. However, as some forms of public spending might further add to the progressivity observed in the lower deciles, we attach, in a baseline scenario, a weight of 0.3 to the distribution derived above. This implies that around 8% of total revenue is allocated to the first decile of the income distribution. In a second, more pessimistic scenario, we assume that all revenue spent on social welfare programs, that is 60% of total spending, follows the observed distribution so that only 5.6% of tax collections are redistributed to the 1st income decile. In a third scenario, we

FIGURE 1. Relative Consumption of selected items



Note: The figure shows relative consumption of selected commodities by income decile. Estimates are based on the IES 2011 and own calculations.

consider the hypothetical benchmark of a uniform distribution. Table 2 summarises these scenarios.

3.2. **Welfare effects of taxing zero-rated commodities.** To get an intuition for the results presented in the following, we first discuss some illustrative examples of consumption patterns. Figure 1 depicts the relative consumption of citrus fruits, rice, and dried beans – all zero-rated commodities – by income deciles. The figure clearly conveys two messages: First, not all zero-rated commodities are inferior goods whose relative consumption decreases with income. And second, the relative share of VAT-exempt consumption, measured as the fraction of commodities purchased in the informal sector,[10] seems to decreases with income.

This latter observation is statistically underpinned in Table 3, where the share of VAT-exempt consumption is regressed on the income decile (and its square) for three subsets of commodities: all commodities, zero-rated commodities, and fruits – which are also zero-rated. The first two columns show that around 4% of the 1st income decile's overall consumption value is generated in the informal sector. Although this fraction decreases

[10]This includes street trading and other types of retailers which are not part of the formal sector

only slightly with income (0.4% per decile), it does so significantly.[11] The share of informal sector activity is higher for zero-rated commodities and fruits. Fruits are (in the quadratic specification) estimated to have an informal sector share of around 21% in the first and 0% in the 10th decile. Importantly, all (linear) specifications confirm that the reliance on the informal sector is monotonically, and significantly, decreasing with income.

TABLE 3. VAT-exempt purchases per income decile

Weighted Least Squares Regression						
Dependent: Share of VAT-exempt purchases						
Sample	All commodities		Zero-rated		Fruits	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.040***	0.042***	0.164***	0.135***	0.263***	0.207***
	(0.001)	(0.001)	(0.012)	(0.006)	(0.025)	(0.016)
Decile	-0.004***	-0.006***	-0.012***	0.010*	-0.023**	0.021*
	(0.000)	(0.000)	(0.002)	(0.003)	(0.005)	(0.009)
Squared Decile		0.000**		-0.003***		-0.005**
		(0.000)		(0.000)		(0.000)
Adj. R2	0.97	0.99	0.74	0.97	0.67	0.93

Note: Observational unit is the income decile. Weight corresponds to number of households per income decile. *Decile* is defined as income decile minus one. The intercept therefore gives mean of 1st decile.

This observation has important implications for the taxation of zero-rated commodities. To see this, neglect for the moment indirect revenue effects and assume that the first income decile receives a lower than average fraction, say 9%, of total revenue in the form of lump-sum transfers. If society's objective is to maximise the welfare of the poorest, commodities should not be taxed when the poor's share in VAT revenue is bigger than 9%. While South Africa's first decile consumes around 9.2% of all dried-beans traded, it only contributes 8.6% of total VAT-revenue; for 13% are purchased in the informal sector and this fraction is zero for the wealthiest. In this simplistic scenario, dried beans should thus be taxed (at least marginally) and relying on consumption statistics alone would misguide policy. Furthermore, note that the estimates for the 1st decile's share in total revenue used are lower bounds if the poor tend to buy from retailers who are below the threshold for VAT-registration.

Table 4 summarises the effect a marginal tax on currently zero-rated commodities had on the welfare of the first income decile. Columns (1) to (3) report the effect under the assumption that 7.8% of total revenue is allocated to the first income decile, Columns (4) to (6) asses the partial reform hypothesising that only 5.6% is distributed to the poor and Columns (7) to (9) report the corresponding effect for a uniform distribution. Each distribution scenario is evaluated for negative ($\Gamma = 0.8$), neutral ($\Gamma = 1$), and positive

[11]The squared term in Column (2) does not change the main conclusion from the linear specification and is only presented for completeness.

TABLE 4. Welfare effects of taxing zero-rated commodities for South Africa's 1st income decile

If $W_j^i(\Gamma, s^1) > 0$, table gives 1, otherwise 0										
Share allocated to 1st decile (s^1)		7.8%			5.6%			10.0%		
Indirect revenue effect (Γ)		0.8	1	1.2	0.8	1	1.2	0.8	1	1.2
#	Commodity	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	brown bread	0	1	1	0	0	0	1	1	1
2	rice	0	0	1	0	0	0	0	1	1
3	mealierice	0	0	0	0	0	0	0	0	0
4	dried beans	0	0	1	0	0	0	0	1	1
5	milk	1	1	1	1	1	1	1	1	1
6	vegoil	0	1	1	0	0	1	1	1	1
7	eggs	1	1	1	0	0	1	1	1	1
8	citrusfruits	1	1	1	1	1	1	1	1	1
9	normalfruits	1	1	1	1	1	1	1	1	1
10	stonefruits	1	1	1	1	1	1	1	1	1
11	berries	1	1	1	1	1	1	1	1	1
12	tropicalfruit	1	1	1	1	1	1	1	1	1
13	driedfruits	1	1	1	1	1	1	1	1	1
14	nuts	1	1	1	1	1	1	1	1	1
15	cannedfruit	1	1	1	1	1	1	1	1	1
16	freshveg	1	1	1	0	0	1	1	1	1
17	frozenveg	1	1	1	1	1	1	1	1	1
18	onioncarrot	1	1	1	0	1	1	1	1	1
19	driedveg	1	1	1	1	1	1	1	1	1
20	cannedveg	1	1	1	0	1	1	1	1	1
21	otherveg	1	1	1	0	0	1	1	1	1

Table reports welfare effects for the 1st income decile as a function (see equation (3)) of their share of public revenue received (s^1) and indirect income effects (Γ). Column (1)-(3) gives baseline scenario, (4)-(6) the disadvantaged scenario and (7)-(9) the uniform distribution scenario. Entries with a 1 indicate that taxing the respective commodity would be beneficial for the poorest.

($\Gamma = 1.2$) indirect revenue effects and lump-sum transfers are implicitly assumed for all cases.

What strikes out is that even under the most disadvantageous conditions considered, the first decile of South Africa's income distribution would profit from the taxation of fruits and nuts (rows number $9 - 16$). Given the distribution of (VAT-inclusive) fruit and nut consumption, this result is obvious: The top decile contributes 35% of total VAT-revenue collected, the 9th decile around 20% (which is the same as the combined fruit and nuts revenue collected from the poorer half of South Africa's society) and the first quintile merely accounts for 6%.

A similar but somewhat weaker conclusion holds for the taxation of vegetables (rows number $17 - 20$). The baseline scenario indicates that the 1st decile would gain from a general taxation of vegetables, excluding lentils and dried beans. This result is also quite robust. Even if only 5.6% of the gain in revenue were redistributed to the poor and indirect revenue effects were neutral, the poor would still gain from a small VAT on vegetables.

However, the analysis also reveals that the zero-rating of some commodities effectively helps the poor. In particular, the 1st income decile's consumption share of mealie rice, rice, brown bread, vegetable oil, and dried beans is too big, to compensate the income loss, due to a marginal tax on these items, by public spending – at least under the distribution and indirect revenue scenarios considered. The question remains who benefits from not taxing the other items?

This question is addressed in Table 5, showing the welfare effects of taxing some zero-rated commodity for the whole income distribution. To simplify the presentation, results are only reported for the baseline distribution scenario and under the assumption that revenue effects are neutral. The table conveys that around 70% of South Africa's population could gain from taxing fruits and nuts and only the wealthiest 30% would choose not to introduce a tax. For vegetables, the result is – with the exception of dried vegetables – alike: the first seven deciles could profit from introducing a tax. The zero-rating of brown bread, milk and eggs contributes to the well-being of the richer half of South Africa's society.

TABLE 5. Welfare effects of taxing zero-rated commodities for all income deciles

If $W_j^i(1, s^i) > 0$, table gives 1, otherwise 0											
		Income Decile									
		1	2	3	4	5	6	7	8	9	10
#	Commodity	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	brown bread	1	1	1	1	1	0	0	0	0	0
2	rice	0	1	1	1	1	1	0	0	0	0
3	mealierice	0	1	1	1	0	1	0	1	1	0
4	dried beans	0	0	0	1	0	0	1	1	1	1
5	milk	1	1	1	1	1	1	0	0	0	0
6	vegoil	1	0	0	1	0	1	0	0	1	0
7	eggs	1	1	1	1	1	1	0	0	0	0
8	citrusfruits	1	1	1	1	1	1	1	1	0	0
9	normalfruits	1	1	1	1	1	1	1	0	0	0
10	stonefruits	1	1	1	1	1	1	1	0	0	0
11	berries	1	1	1	1	1	1	1	0	0	0
12	tropicalfruit	1	1	1	1	1	1	1	0	0	0
13	driedfruits	1	1	1	1	1	1	1	0	0	0
14	nuts	1	1	1	1	1	1	1	1	0	0
15	cannedfruit	1	1	1	1	1	1	1	0	0	0
16	freshveg	1	1	1	1	1	1	1	0	0	0
17	frozenveg	1	1	1	1	1	1	1	0	0	0
18	onioncarrot	1	1	1	1	1	1	1	0	0	0
19	driedveg	1	1	1	1	1	1	0	0	0	0
20	cannedveg	1	1	1	1	1	1	1	0	0	0
21	otherveg	1	1	1	1	1	1	1	0	0	0

Table reports welfare effects for the all income deciles as a function (see equation (3)) of their share of public revenue received (s^i) and assuming indirect income effects are neutral ($\Gamma = 1$). For the share received, the baseline scenario is assumed. Entries with a 1 indicate that taxing the commodity was beneficial for the income decile considered.

4. Conclusion

The South African economy faces many complex challenges, including high levels of unemployment, shortcomings in public education, a resource-intensive economy bias, and drastic income inequality (see South African Budget Review 2013) – according to the Income and Expenditure Survey 2011, the wealthiest ten percent of society have more than 50% of total income at their disposition while the 1st decile's share is only 0.4%. The governing party recognises that structural reforms are much needed to achieve a more rapid and sustained growth. However, the implementation of such reforms demand broad consent, which may be hindered by the inequality the economy faces.

In this paper we employ data of the Income and Expenditure Survey 2011 to evaluate the effectiveness of zero-rating in alleviating the situation of the poorest.[12] In doing so, we consider both sides of fiscal action: how much the government takes and how much it gives. We find that only 2.9% of direct payments – a targetable measure, accounting for around 14% of total revenue – are allocated to the 1st income decile. Lacking information on other forms of governmental spending, we assume that these are uniformly distributed across all households and create a hypothesised distribution of total spending by assigning a range of weights to the two components mentioned.

The main finding of this paper is that the marginal taxation of fruits and, to a lesser extent, the taxation of vegetables – both of which are currently zero-rated – was beneficial to the 1st income decile under most scenarios considered. In particular, the taxation of fruits alleviated the situation of the 1st decile, also, if only 5.6% of total spending were allocated to their use and revenue collection was rather inefficient (meaning that Rand 1.25 had to be additionally collected in tax to provide Rand 1 of spending). Furthermore, we find that the zero-rating of some commodities, including brown bread, mealie rice, rice, dried beans, and vegetable oil, effectively helps the poor.

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[12] 21 basic food items are not taxed under the South African VAT-system.

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Appendix A. Derivation of Equation (2)

There are $i = 1, \dots H$ households and $j = 1 \dots K$ commodities traded. Producer prices are fixed and normalised to one and consumption prices are given by $q_j = 1 + \alpha^i \tau_j$. Households maximise utility $U(x, g)$, with respect to the vector of commodities x and subject to their budget constraint $\sum qx = I$. They take public expenditure $g^i = s^i G$, allocated to their use, as given. The solution to this problem are uncompensated demand functions $x^i_j(q_1, \dots, q_K, g^i)$, which give the maximised value of utility of individual i as a function $V^i(t_1, \dots, t_K, g^i) = U(x^i_1(q_1, \dots q_K, g^i), \dots x_K(q_i, \dots, q_K, g_i), g^i)$ of the tax rates and public expenditure, which is given by $G = \sum \sum \alpha^i x^i_j \tau_j$. Differentiating the value function with respect to τ_k and G gives, upon using Roy's identity,

$$dV^p = -V_I x^p_k \alpha^i d\tau_k + V_g s^p dG. \tag{4}$$

The corresponding change in public spending is easily seen to be

$$dG = \sum_{i=1}^{H} \alpha^i x^i_k d\tau_k + \sum_{i=1}^{H} \sum_{j=1}^{K} \alpha^i \tau_j \left[\frac{\partial x^i_j}{\partial q^i_k} d\tau_k + \frac{\partial x^i_j}{\partial g^i} s^i dG \right].$$

Combining these results and defining $\phi^p = V_g / V_I$, $\delta = (\sum \alpha^i x^i_k)^{-1} \sum \sum \alpha^i \tau_j \partial x^i_j / \partial \tau_k$, $\gamma = \sum \sum \alpha^i \tau_j \partial x^i_j / \partial g^i$ gives equation (2) in the text.