DISTRIBUTIONAL IMPACTS OF CARBON TAXATION ON SOUTH AFRICAN HOUSEHOLDS

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Overview

Several countries are moving towards a low-carbon economy and South Africa is leading other African countries in this regard. The South African government committed to ambitious greenhouse gas emissions reductions of 34% by 2020 and 42% by 2025 against a business as usual curve. Among the approaches adopted to achieve this target is the planned carbon tax policy by the South African government. As a carbon tax is introduced to mitigate emissions, prices of energy related product are expected to increase accordingly. Households are likely to be greatly affected since their energy-related expenditure is a substantial fraction of their incomes. Survey data shows that in 2015, household expenditure on housing, water, electricity, gas and other fuels and transportation accounted for nearly 50% of total annual household consumption expenditure in South Africa.

Households are heterogeneous in terms of economic, socio-economic, demographic and physical features. Thus, energy usage patterns differ substantially from one household to another, especially across income groups. Energy expenditure among various South African income groups varies significantly. Households in the lowest income decile spend an average of 8% of their income on electricity compared to the richer households who spend as low as 2% of their income. On the other hand, richer households spend up to 17% of their income on transportation while the poorest households spend only about 8% of their income on transportation. Hence, it is most likely that the tax burden would be unequal across income groups. Kerkhof 2008 noted that the tax payments of households in different income groups does not only depend on the increased product prices but also on the expenditure share of the income group. Therefore, our main objective is to study how the implementation of a carbon tax policy affects different income groups in South Africa.

Though the existing literature on carbon tax in South Africa focused on different questions, they all used the Computable General Equilibrium (CGE) model for their analysis (PMR 2016; Alton et al., 2012; Devarajan et al 2009; Pauw, 2007; van Heerden et al., 2006). The most recent study by the World Bank Partnership for Market Readiness (PMR 2016), to the best of our knowledge, is the first and only paper to model the actual design features of the tax scheduled to be implemented in South Africa in 2019. However, it does not provide an in-depth understanding of the welfare impacts of households as a result of the tax. Our paper aims to complement this study by using household data to evaluate direct distributional effects of the proposed carbon tax on households in various income groups. We contribute to the existing literature by providing empirical evidence on the distributional effects of the proposed carbon tax in South Africa. We calculate the welfare effects of the tax for electricity and transportation and assess how revenue recycling would improve households' welfare.

Methods

We estimate a household demand system by using the QUAIDS model (Banks et al., 1997) to evaluate the distributional and welfare impacts of carbon taxation in South Africa. Using South African household income and expenditure survey data with over 54,000 observations, we analyze four expenditure categories - electricity, transport, food and other goods – and derive income and price elasticities for them. We use the results from the demand model estimation to simulate the effects of the proposed marginal carbon tax rate (R120) on the South African Households. It is expected that our results would play a crucial role in understanding the welfare impacts of the proposed carbon tax and suggest feasible ways to implement the policy to ensure that the tax incidence is relatively equal among the various income groups. This study will also provide valuable insights on the potential effects of the planned carbon tax on South African Households.

Results

This study is currently on-going, therefore, only preliminary results are presented here. We estimated the QUAIDS model and computed elasticities to evaluate the response of consumers to changes in expenditure and prices. There is no economic interpretation of the coefficients of the estimated QUAIDS model, thus only the elasticities are shown in Table 1. The budget elasticities indicate that for the average South African household, electricity and food are necessities while transportation is a luxury good. Both uncompensated and compensated own-price elasticities all show the expected negative signs. With regards to the energy goods – electricity and transportation, we find an

inelastic household response to electricity price changes and an elastic household response to transportation price changes. Cross-price elasticities show that electricity and transportation are complements and the relationship is symmetric. This is probably due to the decrease in purchasing power an increase in the price of electricity (or transport) would cause.

Subsequently, we would derive elasticities for different income groups to understand how they respond to changes in income and prices. These responses would be used to simulate the proposed South African carbon tax and derive the welfare effects of the tax on households.

Table 1: Demand Elasticities

		Price			
		Electricity	Transport	Food	Other
Uncompensated elasticities					
Demand	Electricity	-0.369	-0.393	-1.465	1.729
		(0.019)	(0.053)	(0.072)	(0.084)
	Transport	-0.224	-3.661	1.735	0.921
		(0.025)	(0.117)	(0.129)	(0.173)
	Food	-0.213	0.500	-0.963	-0.261
		(0.009)	(0.035)	(0.069)	(0.074)
	Other	0.195	0.272	-0.322	-1.212
		(0.011)	(0.048)	(0.075)	(0.106)
Compensated elasticities					
Demand	Electricity	-0.342	-0.337	-1.256	1.935
		(0.019)	(0.053)	(0.072)	(0.085)
	Transport	-0.157	-3.522	2.251	1.428
		(0.025)	(0.117)	(0.129)	(0.174)
	Food	-0.162	0.606	-0.569	0.125
		(0.009)	(0.035)	(0.069)	(0.074)
	Other	0.253	0.392	0.127	-0.772
		(0.011)	(0.048)	(0.075)	(0.106)
Budget elasticities					
		0.498	1.229	0.937	1.067
		(0.005)	(0.005)	(0.002)	(0.002)

Standard errors in parentheses

Conclusions

This study aims to provide insights on how the proposed carbon tax would affect households' welfare. Given the differences in expenditure for various income groups, we expect that the tax incidence would be greater for certain income groups. We would make policy suggestions on how to attenuate these effects and provide deeper understanding on the distributional effects of the South African carbon tax.

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