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PROVIDE PROJECT

The Provincial Decision-making Enabling Project

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The impact of a higher fuel levy on the Western Cape

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PROVIDE PROJECT

The Provincial Decision-making Enabling Project

Overview

The Provincial Decision-Making Enabling (PROVIDE) Project aims to facilitate policy design by supplying policymakers with provincial and national level quantitative policy information. The project entails the development of a series of databases (in the format of Social Accounting Matrices) for use in Computable General Equilibrium models.

The National and Provincial Departments of Agriculture are the stakeholders and funders of the PROVIDE Project. The research team is located at Elsenburg in the Western Cape.

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For the original project proposal and a more detailed description of the project, please visit www.elsenburg.com/provide

The impact of a higher fuel levy on the Western Cape[1]

Abstract

The Western Cape Provincial Government's proposal to introduce a provincial fuel levy within a band of 10 and 50 cents per litre raises concerns on the impact this may have on the economy, especially at a time of high international oil prices. This study reports the results of a computable general equilibrium (CGE) analysis of the impact of higher tax rates on petroleum products on the economy, with specific focus on prices, employment and household expenditure. The results show that increasing the tax rate on petroleum products results in higher petroleum prices, which again put upward pressure on intermediate input costs. Households in the Western Cape will experience a decrease in per capita expenditure, as unemployment increases and returns to factors employed decrease. The impact is however very small. The impacts on agricultural activities differ among regions, but the net effect is a contraction in agricultural output.

[1] The main authors of this paper are Sanri Reynolds (Western Cape Project Committee member) and Melt van Schoor.

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Executive Summary

The Western Cape Provincial Government submitted a proposal to National Treasury to levy an additional provincial tax on the price of fuel, within a band of 10 and 50 cents per litre. If National Treasury approves the proposal, the MEC of the Western Cape has the discretion to lower or raise the provincial fuel levy within this band. The initial level proposed is 10 cents per litre, with implementation from April 2006. This proposed increase in fuel taxes raises concerns on the effect of increasing fuel prices on the economy, especially at a time of high international oil prices.

In this study we simulate the effect that increasing tax rates on petroleum products may have on the economy, using a computable general equilibrium (CGE) model. The input data used is arranged in the form of a social accounting matrix (SAM). The SAM is a 258 account aggregation of the PROVIDE SAM for South Africa in 2000. A structural analysis of the SAM reveals that transport services is the most fuel intensive industry spending 13% of total expenditure directly on petroleum products, followed by activities producing petroleum products (7%), forestry and fishing (5%) and agricultural activities (4%).

Various tax rate changes were simulated, but the results focus on a 3 percentage point increase in the tax rate on petroleum products, which corresponds to the initial proposed level of 10 cents per litre. Though the proposal is only for a Western Cape provincial fuel levy, it is expected that, if the proposal is approved, other provinces will follow suit; therefore we simulated an increase in the national fuel levy, but as the Western Cape will be first to introduce the levy, results relating to agriculture, factor markets and households focus on the Western Cape.

Considering a 3 percentage point increase in the tax rate on petroleum products, the GDP and investment will decline by 0.002 and 0.11 per cent respectively. The exchange rate appreciates by 0.11%, resulting in South African exports losing competitiveness in the international market. All sectors, except for the food industry, show a decline in volume exported and total exports decline by R887 million. Total imports decline by R803 million as a result of lower domestic demand.

The direct effect of increasing the tax rate by 3 percentage points is a price increase of 2.26% in the composite commodity price of petroleum products. Higher fuel prices cause the intermediate input prices of most activities to increase. The largest increases take place in those activities spending the largest proportion of their budget directly on petroleum products. Intermediate input prices of transport services increase by 0.40%, while other industries experiencing relatively large increases in intermediate input prices include forestry and

fishing (0.14%) and agriculture (0.09%). Within the agricultural sector, activities in the Great Karoo experience the largest price increase in intermediate inputs (0.16%), followed by the Free State (0.15%). The price of intermediate inputs of agricultural activities in the Western Cape increases by 0.03%.

Returns to factors decrease in all activities, implying a contraction of economic activity in all regions and industries. Value-added of agricultural activities shrinks by R3 million, that is a modest 0.01%. The services industry experience the largest decline in value-added by losing R1,674 million in value-added, followed by the manufacturing sector which loses R364 million. Total economic activity contracts by R2 222 million. Only 0.14% of this contraction takes place in agricultural activities, while the services and manufacturing industries account for 75 and 16 per cent respectively.

Total employment in South Africa falls by 0.08% and employment within the Western Cape falls by 0.09%. Wage rates of all fully-employed factors in the Western Cape decline. Per capita real household expenditure declines for all households with the exception of White households with tertiary education as these households experience a large reduction in their tax rates. The fiscal incidence of increasing the tax rate on petroleum products is marginally regressive, measured by per capita household expenditure.

1. Introduction

The Western Cape Provincial Government submitted a proposal to National Treasury to levy an additional provincial tax on the price of fuel, within a band of 10 and 50 cents per litre. If National Treasury approves the proposal, the MEC of the Western Cape has the discretion to lower or raise the provincial fuel levy within this band. The initial level proposed is 10 cents per litre, with implementation from April 2006. This proposed increase in fuel taxes raises concerns on the effect of increasing fuel prices on the economy, especially at a time of high international oil prices.

The proposal was submitted following an investigation into the feasibility of a provincial fuel tax. In 2003, the Western Cape Provincial Treasury requested the Bureau for Economic Research at the University of Stellenbosch (BER) to investigate the "constitutional and legal feasibility, economic feasibility, and feasibility of tax administration of a provincial fuel levy" (Smit *et al.*, 2003: i) in accordance with the Provincial Tax Regulation Process Act, 2001. In the report Smit *et al.,* (2003) concluded that the provincial fuel tax is feasible on all above mentioned criteria.

This study is an investigation of the economic impact of increasing the fuel levy nationally and contains findings on the effect of a higher fuel levy on the macro-economy, the agricultural sector, other industries, employment and household expenditure. Though the proposal is only for a Western Cape provincial fuel levy, it is expected that, if the proposal is approved, other provinces will follow suit; therefore a national fuel levy increased, but as the Western Cape will be first to introduce the levy, the results relating to agriculture, factor markets and households focus on the Western Cape.

Section 2 provides some background information on the composition of fuel prices and the contribution government levies make to the price consumers pay for fuel. Section 3 is a brief summary of the BER's results on the economic impact of a 10 cents per litre fuel price increase. Section 4 is a short description of the Computable General Equilibrium model and the Social Accounting Matrix, while section 5 provides information relating to the various simulations and closure rules. The model results are discussed in section 6 and section 0 contains some concluding remarks.

2. Overview

2.1. The role of petroleum products in the South African economy

Approximately 20 billion litres of fuel were sold in South Africa in 2004 of which about 3 billion litres were sold in the Western Cape. 5% of the 3 billion litres were sold to agricultural co-operatives and farmers (SAPIA website). An examination of the social accounting matrix (SAM), reveals that in terms of direct input costs transport services is the most fuel intensive activity with 13.37% of total spending on petroleum products (see **Table** 1). Activities producing petroleum products also spend a relatively large share of total expenditure on petroleum products (7.2%). The agricultural industry has the 4th highest fuel intensity. On average, agricultural activities in the Free State (6.89%) and North West (5.62%) spend the largest proportion of their expenditure on fuel. In the Western Cape, agricultural activities spend on average 3% of total expenditure on petroleum products, but it varies between 6.93% (Great Karoo) and 1.75% (Cape Town area).[2]

Table 1: Petroleum expenditures of various production activities

	Total expenditure by activity (b) (R100 million)	**Direct expenditure on petroleum products (a) (R100 million)**	**Rank by direct expenditure on petroleum products**	**Fuel intensity (a)/(b)**	**Rank by intensity**
Transport services	100,564	13,445	1	13.37%	1
Petroleum	57,895	4,170	4	7.20%	2
Forestry and fishing	9,874	536	8	5.43%	3
Agriculture	54,074	2,358	5	4.36%	4
Manufacturing	457,953	10,007	3	2.19%	5
Mining	117,265	1,616	6	1.38%	6
Other services	975,308	11,577	2	1.19%	7
Food	104,865	957	7	0.91%	8
Total	**1,877,798**	**44,666**		**2.38%**	

Source: SAM

2.2. Pricing of fuel

The prices of petrol at the pump and the maximum wholesale prices of diesel and paraffin are regulated by government. The prices consist of two components: the international component that is determined by the Basic Fuel Price (BFP) formula and the domestic cost components. Though South Africa imports crude oil and refines it locally, the BFP was designed to estimate what it would cost to import large volumes of refined fuel. The import parity price is based on the spot prices quoted daily on international markets and includes freight costs from

[2] See Appendix 9.1 for a detailed table on fuel intensities of various industries and agricultural activities.

refining centres to South African ports; demurrage; insurance and minor shipping costs; an allowance for product loss through evaporation during marine transportation; cargo dues; coastal storage to cover the cost of providing storage and handling facilities; and stock financing. The BFP is reviewed once monthly and the domestic fuel price is adapted according to the under- or over recovery of the previous month on the first Wednesday of each month.

The following price elements are then added to the BFP price to obtain the retail price of petrol and the wholesale price of diesel:

- "**Government taxes and levies:** (Customs and Excise duties, Fuel levy, Equalisation fund Levy[3], Road Accident Fund Levy, Illuminating Paraffin Marker Levy).

- **Oil Company Margin:** (Cents per litre gross marketing margin set by an annual oil industry profitability review and subject to the approval of Minister (of Department of Minerals and Energy)).

- **Service Differential:** (Covers oil company depot operating costs and road delivery expenses (from depot to customer). This is determined annually, subject to ministerial approval).

- **Transport Costs:** (Cents per litre costs of moving fuels from coastal port/refinery locations to inland distribution centres, by pipeline, rail or road. These are determined by individual Magisterial Districts and calculated by the oil industry, subject also to ministerial approval for inclusion in oil company wholesale price structures).

- **Dealer margin:** (Cents per litre which Service Stations are permitted to add to the petrol price. The dealer margin is updated regularly and is subject to the approval of the Minister for Minerals and Energy).

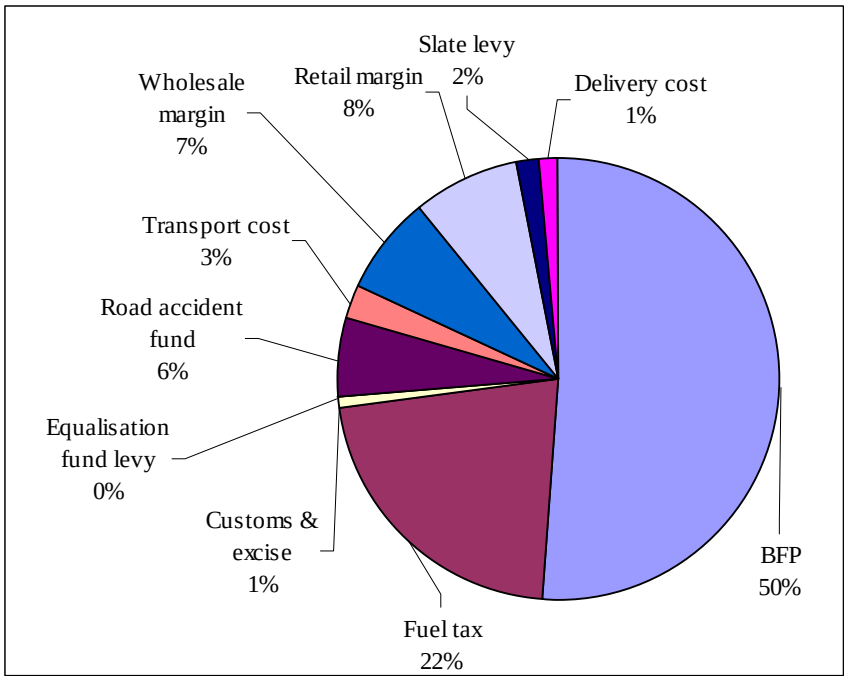
- **Pump Rounding Factors:** (Ensures that oil companies do not gain or lose by charging wholesale price levels in whole cents and so that Service Stations recover the full dealer margin)." (SAPIA 2003b)

Note that only the wholesale price of diesel is regulated (as opposed to the retail/pump price as with petrol) and therefore is no regulated retail/dealer margin is added to the price of

[3] The Equalisation Fund was established in 1979 when South Africa could not obtain crude oil without paying a price differential. More recently, the Fund is used "to smooth out fluctuations in the price of liquid fuel (slate payments); to afford Sasol tariff protection; … (and) the Equalisation Fund also funds fire fighting and security projects at identified fuel installations.…" (Department of Minerals and Energy, 2003)

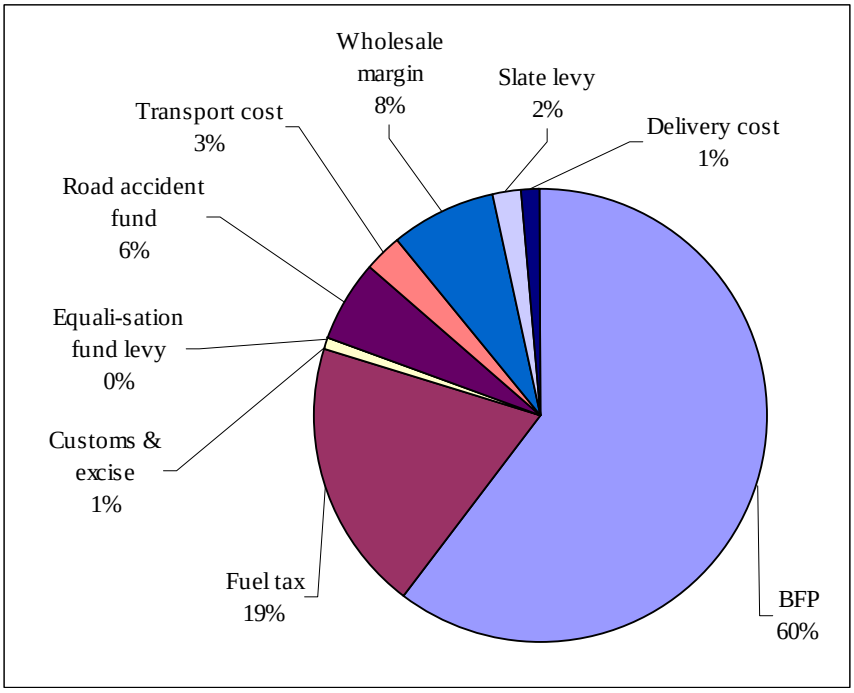
diesel. The following two graphs show the contributions the above-mentioned components made to the price of petrol and diesel in July 2005. The BFP is 50% of the price consumers pay for petrol at the pump, about 4% is for transport and delivery costs, 15% for profit margins and approximately 30% for other government levies (excluding customs and excise duties).

Figure 1: Composition of Octane 93 (Leaded) petrol in July 2005



Source: SAPIA Annual Report 2004

Figure 2: Composition of diesel price in July 2005



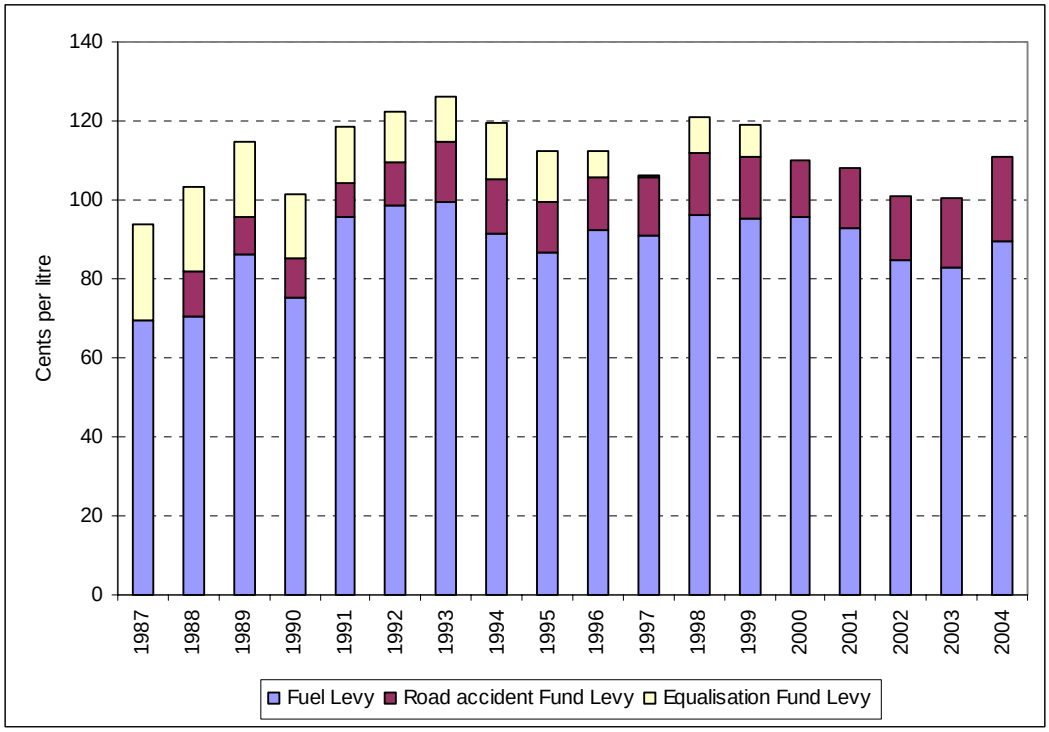
Source: SAPIA Annual Report 2004

2.3. History of government taxes

In nominal terms government levies increased steadily over the past 17 years, but since the 1990's there is no increasing trend in real government levies (2000 prices) as shown in **Figure** 3. The fluctuations in real government levies are mostly due to variations in the CPI.[4]

[4] The CPI for metropolitan areas (all items) was used to deflate government levies to real 2000 prices.

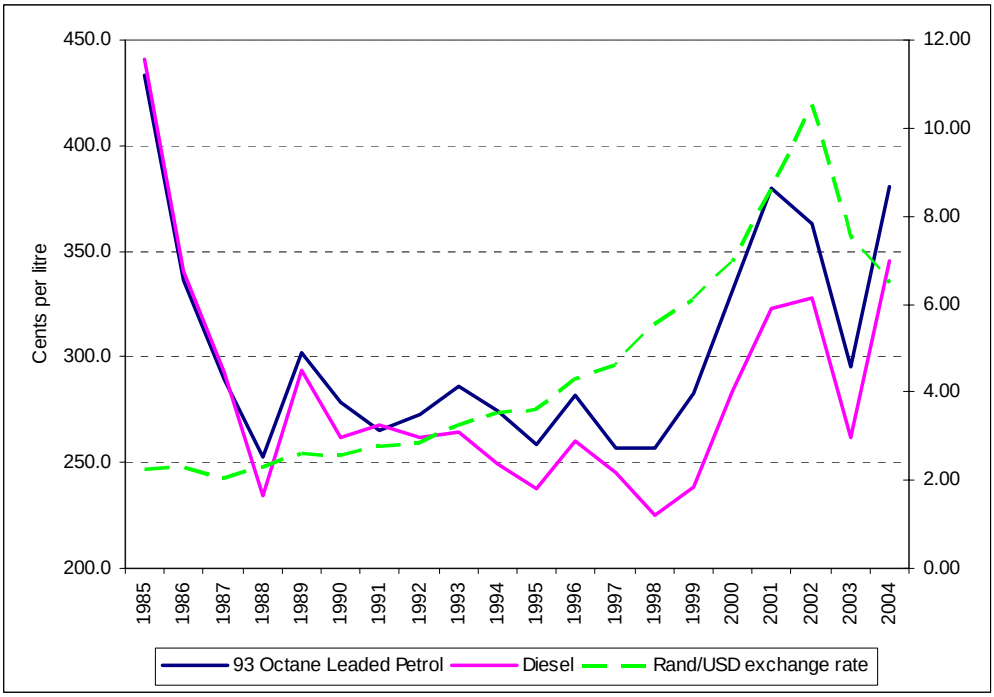
Figure 3: Government levies on leaded petrol (real 2000 prices): 1987-2005



Source: SAPIA Annual Report 2004

Figure 4 shows the increasing trend in the price of 93 Octane leaded petrol and diesel since the late nineties. The movements in the international price of crude oil and the exchange rate are mainly responsible for the fluctuations in the real price of petrol and diesel, as the regulated components of fuel prices increased steadily.

Figure 4: Historic movements in real price of 93 Octane leaded petrol and diesel: 1985 to 2004



Source: SAPIA Annual Report 2004

2.4. Government revenue from fuel

SAPIA estimated that government received R21.15 billion in 2003 and over R25 billion in 2004 from levies and taxes on fuel. Table 2 shows that the bulk of the revenue is from fuel levies.

Table 2: Annual amount of fuel taxes collected in 2004 (Rand Billions)

	Petrol	**Diesel**	**Total**
Customs and excise duties	0.44	0.31	0.75
Fuel Levy	12.19	7.30	19.49
Road Accident Fund	2.91	2.03	4.94
Equalisation Fund*	0.00	0.00	0.00
Value Added Tax	-	-	-
Total**	**15.54**	**9.64**	**25.18**

*The equalisation fund was not applicable in 2004
**This is the total amount collected by the oil industry. Certain classes of consumers are able to claim rebates. These rebates are not allowed for in these figures.
Source: SAPIA Annual Report 2004

3. The BER Report

As mentioned in the introduction, the BER assessed the feasibility of a provincial fuel tax. Their results include, among others, the economic impact of such a tax. These results were obtained using the BER's quarterly econometric model and a Social Accounting Matrix (SAM) framework, which includes Input-Output relationships. The macroeconomic results are based on a 10 cents per litre increase in the national fuel levy, assuming government spends the full proceeds. The factor mobility conclusions were drawn based on fuel sales, population and fuel price differentials in border districts.

The main results presented in the BER report were:

- The higher fuel levy will not compromise the national targeted tax to gross domestic product (GDP) ratio;
- An increase in the fuel levy will not give rise to inflationary pressure. A 10 cents per litre national fuel price increase will raise prices by 0.2% over two years;
- The impact on formal sector employment (0%) and real economic growth is very small (0.01% in the first two years and in year 3 real GDP returns to base level);
- Total real private consumption expenditure and real private consumption expenditure on non-durable goods decreases slightly (less than 0.08% over three years);
- The expected increase in the prime interest rate is very small, ranging from 1 to 4 basis points (100 basis points equal 1 percentage point);
- The current account of the balance of payments is expected to improve moderately;
- An increase of 10 cents per litre in the national fuel levy will have a modest effect (0.34%) on industry output prices;
- A provincial Western Cape fuel levy will have little impact on overall factor mobility, given the relative unimportance of fuel in the input cost structure of most production processes. Smit *et al.*, (2003: 45) argue that "capital is unlikely to relocate on the basis of these cost differentials (of fuel) and labour is not directly affected";
- Cross border shopping is no real concern for the Western Cape as only 5.5% of the population lives in border districts. However, a provincial fuel tax may

disadvantage fuel retailers and surrounding enterprises in border districts that benefit from long distance transport refuelling, e.g. Beaufort-West;

- Finally, results using a regional and national SAM show the tax incidence to be marginally regressive.

A SAM was also used as the data framework for the current study, but it was used to calibrate a computable general equilibrium (CGE) model. The CGE model is a model of the real economy and does not yield results concerning inflation, interest rates and cross-border shopping. However, the CGE model does yield results relating to GDP, investment, trade, prices, employment and household expenditure, and since the CGE model is a flexible price model, it allows for a more in depth analysis of the effect on the labour market and household expenditure.

4. Computable general equilibrium modal and data

4.1. CGE model

The computable general equilibrium (CGE) model (see PROVIDE, 2005c) is a member of the class of single country computable general equilibrium (CGE) models that are descendants of the approach to CGE modelling described by Dervis *et al.*, (1982). More specifically, the implementation of this model, using the GAMS (General Algebraic Modelling System) software, is a direct descendant and development of models devised in the late 1980s and early 1990s, particularly those models reported by Robinson *et al.*, (1990), Kilkenny (1991) and Devarajan *et al.*, (1994). The model is a SAM based CGE model, wherein the SAM serves to identify the agents in the economy and provides the database with which the model is calibrated. The SAM also serves an important organisational role since the groups of agents identified by the SAM structure are also used to define sub-matrices of the SAM for which behavioural relationships need to be defined. As such the modelling approach has been influenced by Pyatt's 'SAM Approach to Modelling' (Pyatt, 1988).

The description of the model here is necessarily brief and proceeds in two stages. The first stage is the identification of the behavioural relationships; these are defined by reference to the sub matrices of the SAM within which the associated transactions are recorded. The second stage uses a pair of figures to explain the nature of the price and quantity systems for commodity and activity accounts that are embodied within the model.

Behavioural relationships

While the accounts of the SAM determine the agents that can be included within the model, and the transactions recorded in the SAM identify the transactions that took place, the model

is defined by the behavioural relationships. The behavioural relationships in this model are a mix of non-linear and linear relationships that govern how the model's agents will respond to exogenously determined changes in the model's parameters and/or variables. **Table** 3 summarises the model relationships by reference to the sub matrices of the SAM.

Households are assumed to choose the bundles of commodities they consume so as to maximise utility where the utility function is a Stone-Geary function that allows for subsistence consumption expenditures, which is an arguably realistic assumption when there are substantial numbers of very poor consumers. The households choose their consumption bundles from a set of 'composite' commodities that are aggregates of domestically produced and imported commodities. These 'composite' commodities are formed as Constant Elasticity of Substitution (CES) aggregates that embody the presumption that domestically produced and imported commodities are imperfect substitutes. The optimal ratios of imported and domestic commodities are determined by the relative prices of the imported and domestic commodities. This is the so-called Armington assumption (Armington, 1969), which allows for product differentiation via the assumption of imperfect substitution (see Devarajan *et al.*, 1994). The assumption has the advantage of rendering the model practical by avoiding the extreme specialisation and price fluctuations associated with other trade assumptions. In this model South Africa is assumed to be a price taker for all imported commodities.

Domestic production uses a two-stage production process. In the first stage aggregate intermediate and aggregate primary inputs are combined using CES technology. Hence aggregate intermediate and primary input demands vary with the relative prices of aggregate intermediate and primary inputs. At the second stage intermediate inputs are used in fixed proportions relative to the aggregate intermediate input used by each activity. The 'residual' prices per unit of output after paying for intermediate inputs, the so-called value added prices, are the amounts available for the payment of primary inputs. Primary inputs are combined to form aggregate value added using CES technologies, with the optimal ratios of primary inputs being determined by relative factor prices. The activities are defined as multi-product activities with the assumption that the proportionate combinations of commodity outputs produced by each activity/industry remain constant; hence for any given vector of commodities demanded there is a unique vector of activity outputs that must be produced. The vector of commodities demanded is determined by the domestic demand for domestically produced commodities and export demand for domestically produced commodities. Using the assumption of imperfect transformation between domestic demand and export demand, in the form of a Constant Elasticity of Transformation (CET) function, the optimal distribution of domestically produced commodities between the domestic and export markets is determined by the relative prices on the alternative markets. The model can be specified as a small country, i.e., price taker, on all export markets, or selected export commodities can be deemed

to face downward sloping export demand functions, i.e., a large country assumption. The other behavioural relationships in the model are generally linear.

Table 3: Relationships for the computable general equilibrium model

	Commodities	**Activities**	**Factors**	**Households**	**Enterprises**	**Government**	**Capital**	**RoW**	**Total**	**Prices**
Commodities	0	Leontief Input-Output Coefficients	0	Utility Functions (Stone-Geary or CD)	Fixed in Real Terms	Fixed in Real Terms and Export Taxes	Fixed Shares of Savings	Commodity Exports (CET)	Commodity Demand	Consumer Commodity Price Prices for Exports
Activities	Domestic Production	0	0	0	0	0	0	0	Constant Elasticity of Substitution Production Functions	
Factors	0	Factor Demands (CES)	0	0	0	0	0	Factor Income from RoW	Factor Income	
Households	0	0	Fixed Shares of Factor Income	Fixed (Real) Transfers	Fixed (Real) Transfers	Fixed (Real) Transfers	0	Remittances	Household Income	
Enterprises	0	0	Fixed Shares of Factor Income	0	0	Fixed (Real) Transfers	0	Transfers	Enterprise Income	
Government	Tariff Revenue Export Taxes Commodity Taxes	Indirect Taxes on Activities Factor Use Taxes	Factor Income Taxes Fixed Shares of Factor Income	Direct Taxes on Household Income	Direct Taxes on Enterprise Income	0	0	Transfers	Government Income	
Capital	0	0	Depreciation	Household Savings	Enterprise Savings	Government Savings (Residual)	0	Current Account 'Deficit'	Total Savings	
Rest of World	Commodity Imports	0	Fixed Shares of Factor Income	0	0	0	0	0	Total 'Expenditure' Abroad	
Total	Commodity Supply (Armington CES)	Activity Input	Factor Expenditure	Household Expenditure	Enterprise Expenditure	Government Expenditure	Total Investment	Total 'Income' from Abroad		
	Producer Commodity Prices Domestic and World Prices for Imports	Value Added Prices								

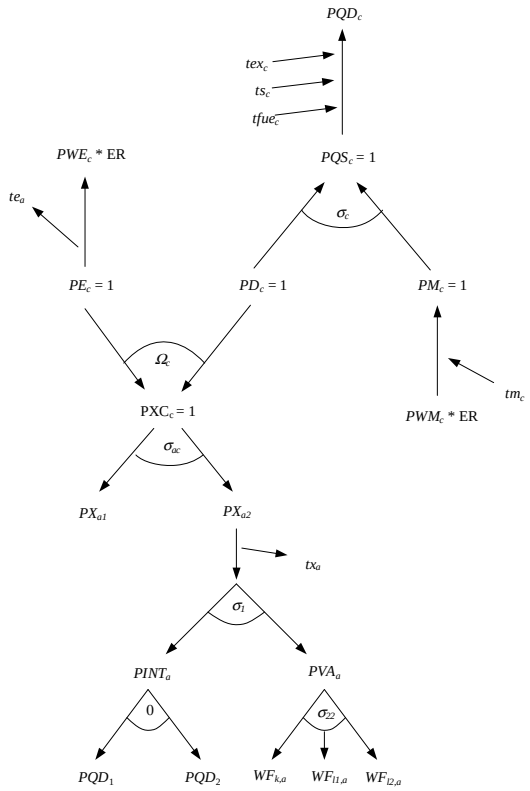
The model is set up with a range of flexible closure rules. The specific choices about closure rules used in this study are defined in the Policy Analysis section below.

Price and quantity relationships

Figure 5 and 6 provide an overview of the interrelationships between the prices and quantities. The supply prices of the composite commodities (PQS_c) are defined as the weighted averages of the domestically produced commodities that are consumed domestically (PD_c) and the domestic prices of imported commodities (PM_c), which are defined as the products of the world prices of commodities (PWM_c) and the exchange rate (ER) uplifted by *ad valorem* import duties (tm_c). These weights are updated in the model through first order conditions for optima. The supply prices exclude sales, excise and fuel taxes, and hence must be uplifted by (*ad valorem*) sales taxes (ts_c), excise taxes (tex_c) and fuel taxes ($tfue_c$) to reflect the composite consumer price (PQD_c). The producer prices of commodities (PXC_c) are similarly defined as the weighted averages of the prices received for domestically produced commodities sold on domestic and export (PE_c) markets; the weights are updated in the model through first order conditions for optima. The prices received on the export market are defined as the products of the world price of exports (PWE_c) and the exchange rate (ER) less any exports duties due, which are defined by *ad valorem* export duty rates (te_c).

The average price per unit of output received by an activity (PX_a) is defined as the weighted average of the domestic producer prices, where the weights are constant. After paying indirect/production/output taxes (tx_a), this is divided between payments to aggregate value added (PVA_a), i.e., the amount available to pay primary inputs, and aggregate intermediate inputs ($PINT_a$). The factor prices paid by activities ($WF_{f,a}$) constitute the components of value added, while total payments for intermediate inputs per unit of aggregate intermediate input are defined as the weighted sums of the prices of the inputs (PQD_c).

Figure 5: Price relationships for a standard model with commodity exports

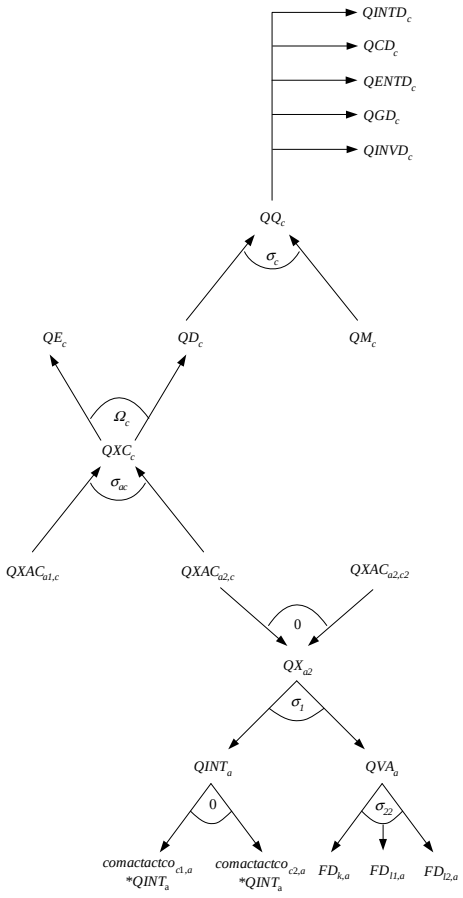


Total demands for the composite commodities, QQ_c, consist of demands for intermediate inputs, $QINTD_c$, consumption by households, QCD_c, enterprises, $QENTD_c$, and government, QGD_c, gross fixed capital formation, $QINVD_c$, and stock changes, $dstocconst_c$. Supplies from domestic producers, QD_c, plus imports, QM_c, meet these demands; equilibrium conditions ensure that the total supplies and demands for all composite commodities equate. Commodities are delivered to both the domestic and export, QE_c, markets subject to equilibrium conditions that require all domestic commodity production, QXC_c, to be either domestically consumed or exported.

The multi-product activities are modelled using the assumption that commodities are differentiated by (source) activity but that activities produced outputs in fixed proportions.[5] Hence the domestic production of a commodity (QXC_c) is a CES aggregate of the quantities of that commodity produced by a number of different activities ($QXAC_{a,c}$), which are produced by each activity in activity specific fixed proportions, i.e., the output of $QXAC_{a,c}$ is a Leontief (fixed proportions) aggregate of the output of each activity (QX_a).

[5] The model allows for the imposition of the alternative assumption that the 'same' commodities produced by different activities are homogenous.

Figure 6: Quantity relationships for a standard model



Production relationships by activities are defined by a series of nested Constant Elasticity of Substitution (CES) production functions. The nesting structure is illustrated in lower part of Figure 2, where, for illustration purposes only, two intermediate inputs and three primary inputs ($FD_{k,a}$, $FD_{l1,a}$ and $FD_{l2,a}$) are identified. Activity output is a CES aggregate of the quantities of aggregate intermediate inputs ($QINT_a$) and value added (QVA_a), while aggregate intermediate inputs are a Leontief aggregate of the (individual) intermediate inputs and aggregate value added is a CES aggregate of the quantities of primary inputs demanded by each activity ($FD_{f,a}$). The allocation of the finite supplies of factors (FS_f) between competing activities depends upon relative factor prices via first order conditions for optima. While the base model contains the assumption that all factors are fully employed and mobile; this assumption can be relaxed.

4.2. Data (Social Accounting Matrix)

The benchmark data are arranged in the form of a social accounting matrix (SAM), which is a system of accounts recording all transactions between agents in the economy. The SAM used for this paper is a 258 account aggregation of the PROVIDE SAM for South Africa in 2000

(See PROVIDE 2005b for a full description of the South Africa SAM database), with special attention given to accounts relating to the Western Cape. The SAM has 14 agricultural commodities, 37 non-agricultural commodities, 17 agricultural activities, 37 non-agricultural activities, 69 factors (including capital (GOS), 9 land and 59 labour factors) and 64 households. There are also accounts for enterprise, government, capital, stock changes and the rest of the world. A full listing of the accounts is given in Appendix B.

The treatment of activities, specifically agricultural activities, is of importance in the SAM. The SAM uses a supply and use structure that allows for the possibility that activities can produce multiple products, which is the case for all activities in this SAM. In other words, each agricultural activity can produce a range of commodities, which is consistent with the fact that farms are typically multi-product firms. Agricultural activities are distinguished by province, except for the Western Cape where agricultural activities are disaggregated according to magisterial districts. Both factors and households are disaggregated according to provinces. In addition, factors are distinguished according to race and the level of skills; and households are distinguished according to race, level of education and whether the household resides in one of the former homelands.

Petrol and diesel do not have a separate account in the SAM, but are included in petroleum products. These fuel items constitute approximately 90% of the value of petroleum (with the remaining 10% constituting jet fuel and illuminating paraffin); therefore is petroleum used as a proxy for petrol and diesel.

5. Policy analysis

5.1. Policy scenarios

Given 2005 prices, the proposed levy of 10 to 50 cents per litre represents an additional tax of between about 3 and 14 per cent on the price of petrol before any government levies. In the model, however, fuel tax is levied as an *ad valorem* tax on all petroleum products. Considering that petrol and diesel constitute approximately 90% of the value of petroleum products, the base tax rate was increased by 3, 6, 9 and 12 percentage points respectively, with particular focus on the 3 percentage point case, which corresponds to the proposed initial level (10 cents per litre) of the levy[6]. The tax rates are summarised in the following table:

Table 4: Simulated tax rates on petroleum products

	Tax rate on petroleum products
Base	32%

[6] Negative tax rate changes of the same magnitude as the positive changes were also investigated to ensure that the results are symmetric over positive and negative changes.

Sim1	35%
Sim2	38%
Sim3	41%
Sim4	44%

5.2. Model closure rules

The model closure rules were selected with the objective of providing a realistic representation of the South African economy.

The *foreign exchange market* is assumed to clear via a flexible exchange rate and therefore the external balance (or current account balance) remains fixed. Since South Africa is a small country it is a price taker on international markets, i.e. all prices of imported and exported goods are fixed in foreign units.

The *capital account*, which records all savings and investment related transactions, is closed by assuming that the share of investment expenditure in total final domestic demand remains constant. This allows for some variation in the volume of investment due to changes in the prices of investment goods and from any change in the total value of domestic absorption. The equilibrating variables are the savings rates of all households and incorporated business enterprises. These rates are allowed to vary equiproportionately, which ensures that savings equal investments in the economy.

The *factor market* closure involves different treatments for different factors. Labour is divided into 'semi- and unskilled' and skilled labour for all racial groups; based on the occupation of workers[7]. The supply of semi- and unskilled African, Asian and Coloured labour is assumed to be perfectly elastic, based on the assumption that there is excess capacity (unemployment) of this labour in the economy. Activities can increase employment of these workers provided they are willing to pay the constant wage. Semi- and unskilled White labour, and skilled labour of all racial groups are assumed to be fully employed and immobile over the short term. The same is true for physical capital where it is assumed that the quantity of capital used by each activity is fixed. This means that industry-specific returns to these factors adjust to maintain the employment level in the sector. Over the long term however, the fully employed labour categories and physical capital can adjust and are assumed to be mobile across various sectors (activities) in the economy, hence the equilibrating variable is the wage rate. In other words, for the fully-employed labour categories and capital one can distinguish between two closures:

[7] See Appendix C for classification of occupations into skill level categories.

- ST: A short term closure rule where White semi- and unskilled labour, skilled labour of all racial groups and capital are fully employed and immobile, forcing the industry-specific returns to these factors to adjust;

- LT: A long term closure rule where the wage rates of White semi- and unskilled labour, skilled labour of all racial groups and capital adjust as these factors move across activities in the economy.

Two different closures are also assumed for the *government account*:

- "Inert": An "inert" policy response is assumed – tax rates and government consumption quantities are left unchanged, leaving government savings (the fiscal deficit) to vary to reach fiscal balance.

- "Neutral": Fiscal neutrality (assuring that the welfare of future generations is not compromised for the sake of the current generation's welfare) and distributional neutrality (distributing losses and gains proportionally across the various households) are imposed by fixing the share of government consumption expenditure in total final demand. Government savings are held constant, while enterprise and household income taxes vary in order to attain fiscal balance. This closure assumes that government policy will adjust in fairly specific terms, but it has the advantage of allowing a fairly unbiased appraisal of household-level and overall welfare effects. The objective of this closure is to isolate the essence of the impact of higher fuel taxes.

Finally, the CPI is fixed to provide the model *numéraire*, that is, price changes are not absolute changes but have to be interpreted relative to the CPI.

In summary, four different closures were investigated for each tax rate change:

- "ST-inert"

- "ST-neutral"

- "LT-inert"

- "LT-neutral"

6. Model results

The results presented in this section focus on the long term impact, as the proposed increase in the fuel levy is expected to be permanent. In addition, the results presented focus on the "LT-

neutral" closure rule to capture the essence, or direct effect, of higher fuel taxes. References to "LT-inert" are made where applicable, specifically concerning the distributional effect on household expenditure. Finally, the results focus on the 3 percentage point increase in the tax rate on petroleum products for two reasons. First, the 3 percentage point increase corresponds to the initial proposed increase of 10 cents per litre; and second, the results change near-linearly as the tax rate is increased by 3 percentage point increments to 44%.

This section begins by discussing the macroeconomic effects. It then turns to the direct price increasing effect on petroleum products and explains how the effect of higher petroleum taxes feeds through the economy.

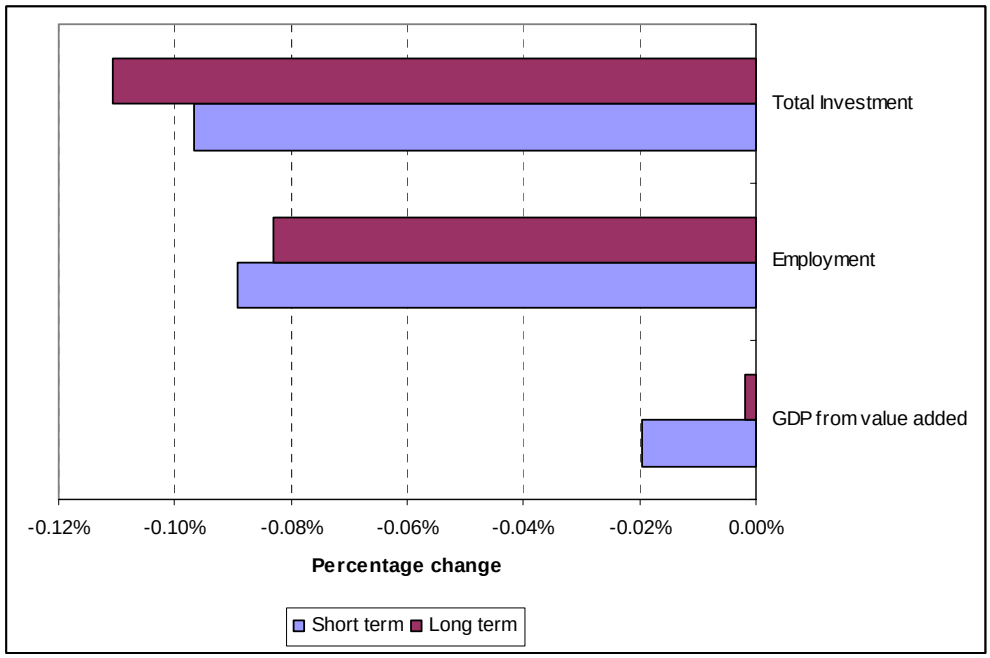
6.1. Macroeconomic effects and government revenue

The short-run effect of increasing the tax rate on petroleum products results in GDP, employment and investment to decline by 0.02, 0.09 and 0.10 per cent respectively; but the economy adjusts as factors of production reallocate over the long term, resulting in a change of only -0.002% in GDP. The effect on employment is also slightly weaker at 0.08%; however, over the long term, the value of investment declines by -0.11%.[8] See Figure 7 for a graphic presentation of these results.

Initially, government revenue from fuel taxes increases by 8.41%, but as the economy adjusts over the long-run, government revenue from fuel taxes is only 8.38% higher. In the long-run, the 8.38% increase in revenue from fuel taxes is offset by a 1.10% decline in revenue from income taxes, leaving total government income 0.08% lower. However, the volume of government consumption increases by 0.08% as the price of government health and social services decline by 0.19%.

[8] The closure "LT inert" yields the same results for investment and employment as "LT-neutral", while GDP decreases by 0.004%.

Figure 7: Macroeconomic effects, at a 35% tax rate on petroleum products



Source: Model estimation results

6.2. Impact on the exchange rate and trade

Increasing the tax rate on petroleum products has an appreciative effect on the Rand. South Africa imports approximately 95% of its crude oil consumption. Thus the decline in demand for petroleum products, following the price increase of petroleum products (see next section), leads to a fall in the volume of crude oil imports. Increasing the tax rate on petroleum products by 3 percentage points, means the volume of crude oil imports falls by 1.14% and the exchange rate appreciating by 0.11%.

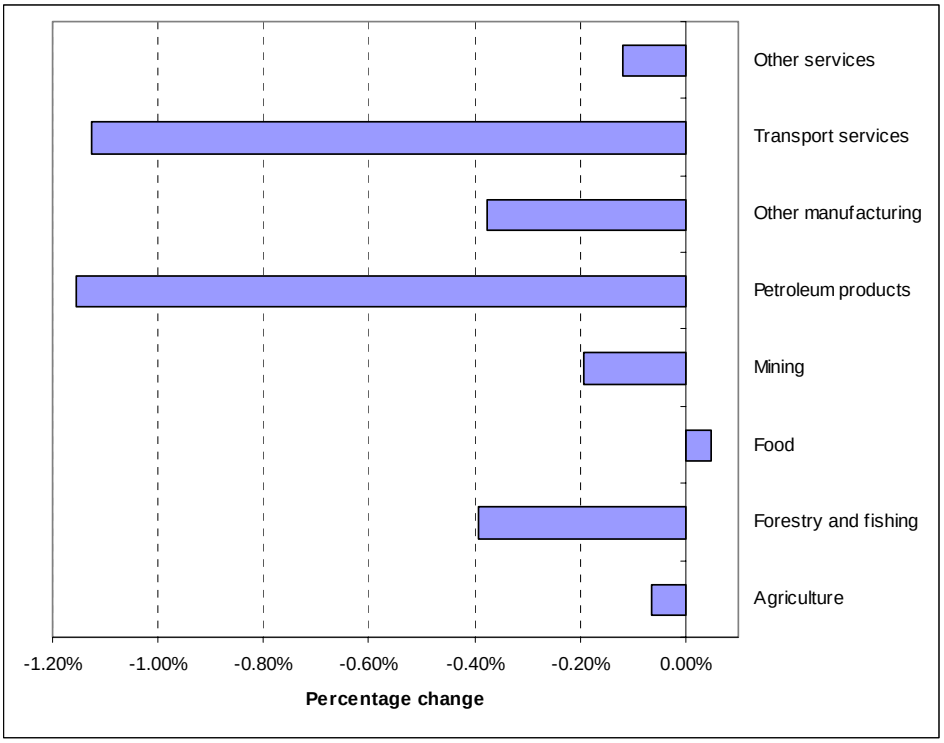
The stronger Rand leads to South African exported products losing competitiveness in the international market and total exports decline by R887 million (-0.35%). On the import side, the effect of lower domestic demand outweighs the effect of relatively cheaper imports, resulting in a decline of R803 million (-0.35%) of imports.

Figure 8 shows the decline in the quantities exported for different broad categories of commodities. The large increase in the relative prices of transport services and petroleum products (see Figures 9 and 10) ensures that these industry's exports are affected most severely. The negative effect on agricultural exports is modest at -0.06%.

Food commodities are the only sectors that show a marginal increase (0.05%) in the volume of exports, with the increase taking place in the fish products, fruit and vegetables,

beverages and tobacco, and the "other food" industries. The domestic demand for these commodities is fairly inelastic (aggregate demand for these commodities falls by 0.06%) and the intermediate input costs for these commodities decrease by 0.15% which is quite high (see Figure 12). Also, the relative decline in the domestic prices of these commodities (-0.18%) outweighs the decline in export prices (-0.11%). These price and demand changes lead producers to decrease domestic production by 0.03% and to increase exports by 0.09% respectively.

Figure 8: Volume of exports (QE), at a 35% tax rate on petroleum products[9]



Source: Model estimation results

6.3. Commodity markets

6.3.1. Petroleum products

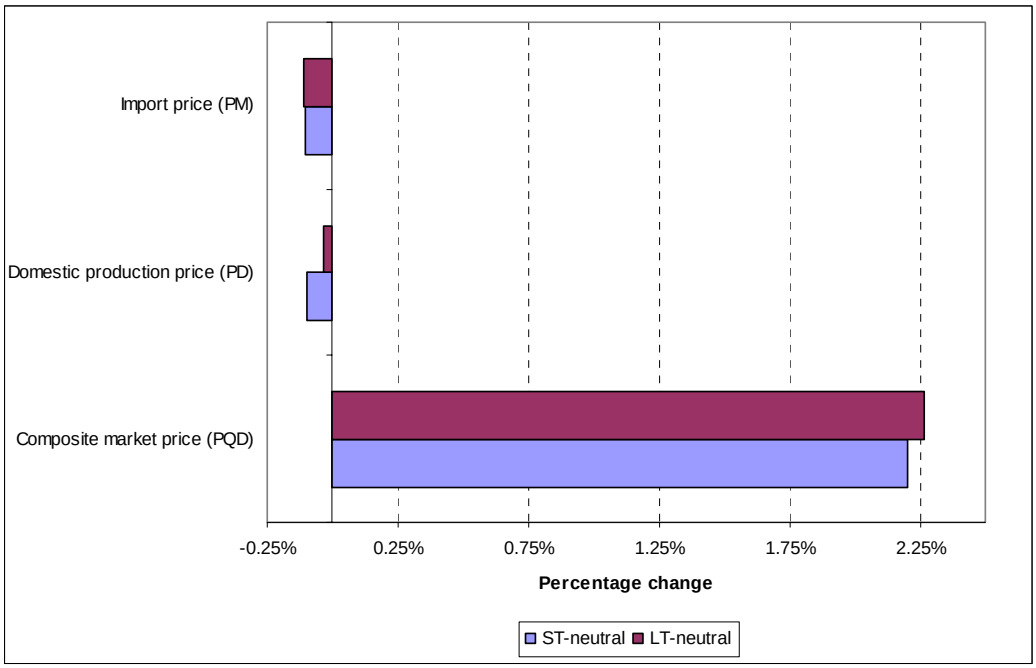
Figure 9 shows the effect of increasing the tax rate by 3 percentage points on different prices of petroleum products. Initially the commodity market price[10] of petroleum products increases by 2.2%; but, in reaction to the higher wedge imposed on their product and in consideration of consumers' downward sloping demand curve, domestic suppliers of

[9] Quantities were weighted using a Paasche index.

[10] The commodity market price of petrol and diesel, for example, can be considered as the price the consumer pays at the petrol station.

petroleum products lower their domestic production price by 0.1%. Over the long term however, producers are willing to reduce their domestic production price by only 0.03% and the commodity market price increases then by 2.26%. The fall in the import price of petroleum products is caused by the appreciation of the Rand.

Figure 9: Petroleum products price effects, at a 35% tax rate on petroleum products



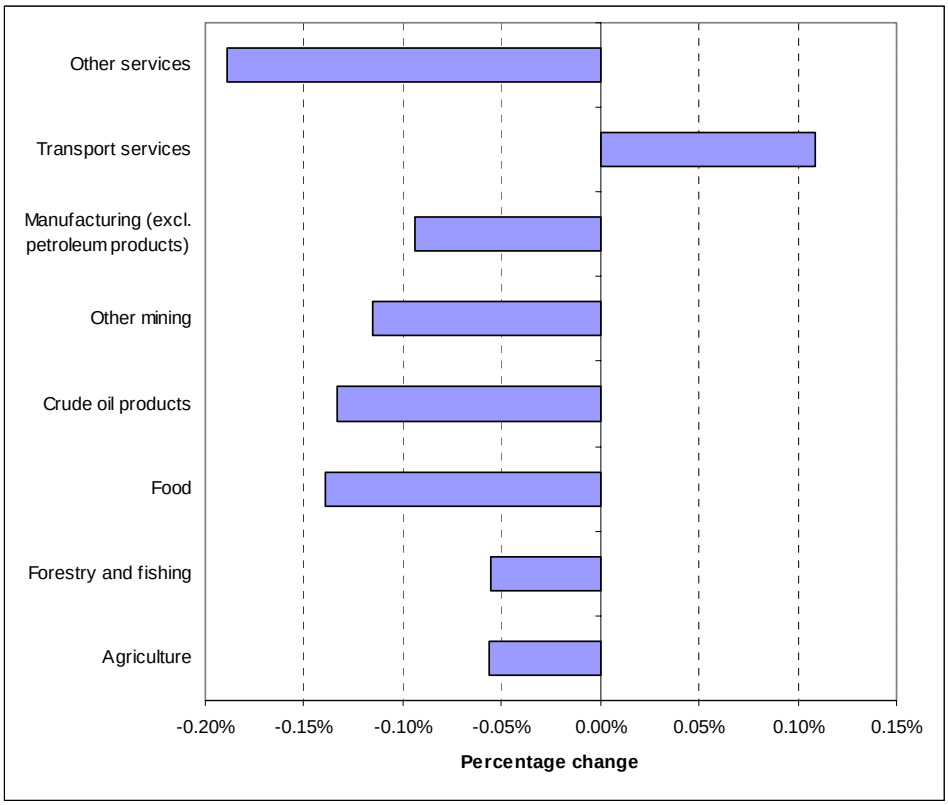
Source: Model estimation results

In reaction to the increase in the price of petroleum products, the quantity demanded by consumers decreases by 1% over the long term. The small decline in demand relative to the price increase indicates a relatively inelastic total demand for fuel of approximately 2.26. The lower quantities demanded by consumers put downward pressure on domestic production (-1.03% over the long term) and to a lesser degree on petroleum imports (-0.85% over the long term).

6.3.2. Other commodity markets

Figure 10 shows that the composite price of all the commodity groups decrease relative to the CPI, except for transport services as petroleum products is an important input cost for this industry. The relative price changes are very small, not one exceeding 0.2%.

Figure 10: Purchaser price of composite commodity (PQD), at a 35% tax rate on petroleum products[11]



Source: Model estimation results

One would expect quantities demanded of the relatively cheaper commodities to increase, however, the incomes of households' decline (see section 6.6) leading to a fall in demand for all commodities and services, with the exception of government health and social services. Hence, quantities demanded decrease. The percentage decreases in demand range between -0.08% (food) and -1.14% (crude oil). The relatively large effect on the demand for crude oil is a result of the 1% decline in the demand for petroleum products, as petroleum companies are the sole consumer/transformer of crude oil. Quantity demanded for agricultural commodities falls by 0.9%.

6.4. Impact on activity output and intermediate input costs

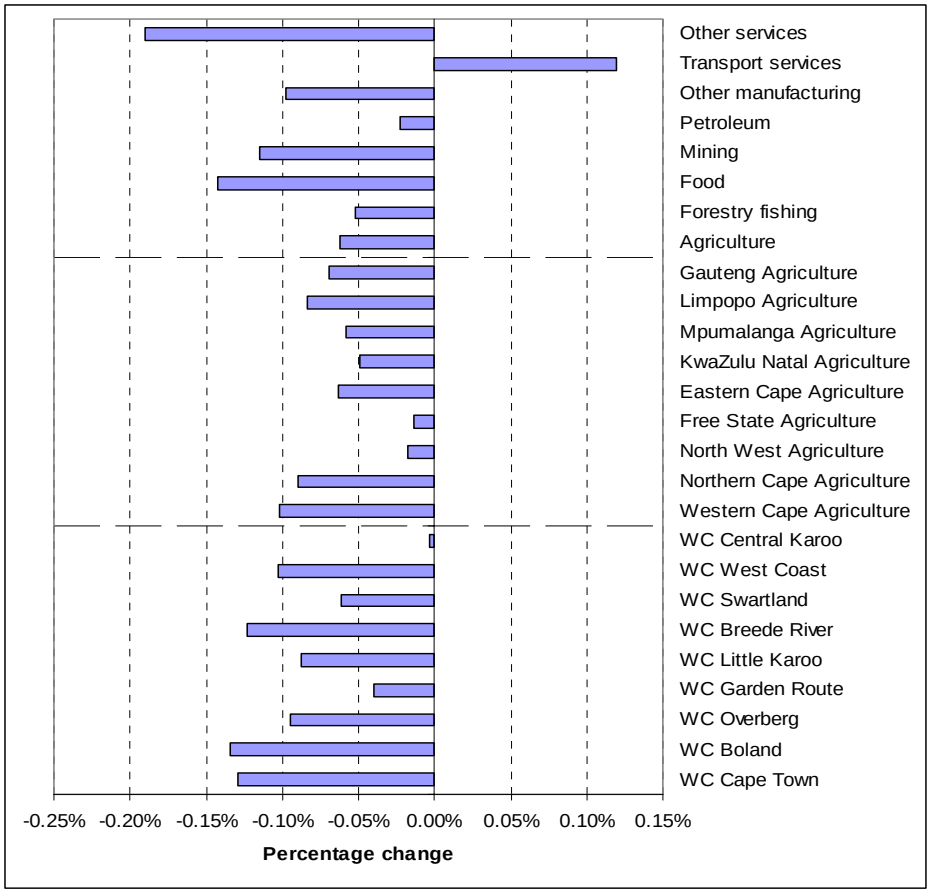
The lower purchaser prices of the majority of composite commodities put downward pressure on domestic production prices and activity output prices.

Figure 11 shows the results for output prices of selected activities. First note the small impact of a 3 percentage point increase in fuel levies on activity output prices, ranging

[11] Prices were weighted using Laspeyres volume indexing.

between -0.2 and 0.15 percent. The producer price of transport services increases by 0.12%, while the output prices of the other activities fall relative to the CPI. The price effect on agricultural activities is very small at -0.06%, with the greatest relative price changes taking place in the regions of the Boland, Cape Town and Breede River Valley.

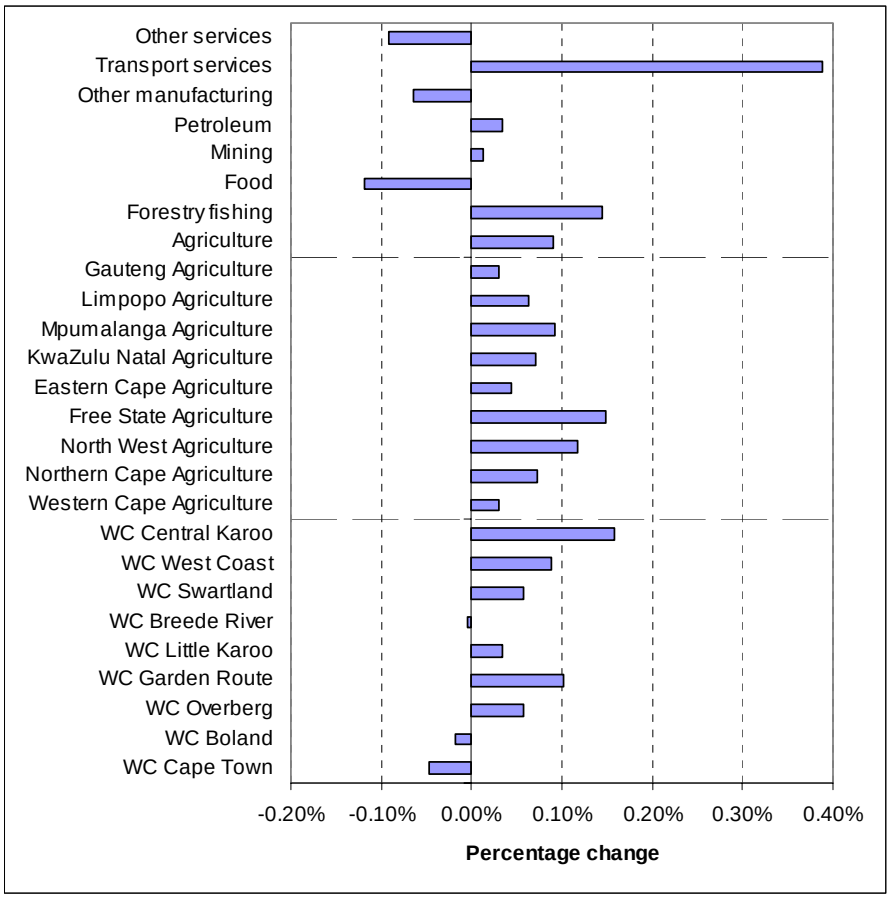
Figure 11: Producer price by activity (PX), at a 35% tax rate on petroleum products



Source: Model estimation results

The price changes of intermediate goods are presented in **Figure** 12. Those activities experiencing a relative increase in the prices of their intermediate inputs spend 6.5% or more of their total expenditure directly on transport services and petroleum products; whereas those activities experiencing a decrease in the prices of their intermediate inputs spend less than 6.5% of their total expenditure directly on transport services and petroleum products. In other words, transport services and petroleum products, the only commodities for which composite commodity prices increase relative to the CPI (see **Figure** 9 and **Figure** 10), are the determining driving forces behind the price changes of intermediate inputs.

Figure 12: Price of intermediate inputs for various activities (PINT), at a 35% tax rate on petroleum products



Source: Model estimation results

Expansion or contraction of industries is primarily affected via changes in returns to factors and subsequent reallocation. The change in the price of value added (PVA) reported in **Table** 5 indicates changes in the overall return to factors in different activities. The table shows that returns to factors decrease in all activities, implying a contraction of economic activity in all the regions and industries.

The services industry experiences the largest absolute decline in value-added by loosing R1 674 million in value (-0.29%), followed by the manufacturing sector, which looses R364 million (-0.31%). Percentage changes in value-added within in these industries ranges from -0.08% (government health and social services) to -0.44% (business services) for the services industry and from -0.10% (audiovisual and agricultural machinery) to -0.76% (petroleum products) for the manufacturing industry. The agricultural sector contracts by R3 million, that is a modest 0.01%. Percentage change in value-added among provinces varies between -0.08% (Northern West) and 0.20% (Gauteng) and for regions in the Western Cape it ranges between -0.23% (Boland) and 0.05% (Cape Town and Little Karoo). There is also much

variation within the natural resources sector. Value-added in coal mining declines by -0.64%, increases by 0.38% in gold mining and decreases by 0.50% in other mining activities.

Table 5 also shows a contraction in total economic activity of R2 222 million. Agriculture accounts for 0.14% of this contraction, while services and manufacturing account for 75.34% and 16.36% respectively.

Table 5: Value added effects (Rand values for 2000), at a 35% tax rate on petroleum products

	Base value added (R100 millions)	Change in prices (PVA) (%)	Change in quantities (QVA) (%)	Value-added change (%)	Change in value added (R100 millions)	Percentage Contribution towards total change
Agriculture	**319.19**	**-0.20**	**0.19**	**-0.01**	**-0.03**	**0.14**
Agriculture: Western Cape	72.24	-0.22	0.15	-0.07	-0.05	0.22
WC Cape Town	3.10	-0.21	0.26	0.05	0.00	-0.01
WC Boland	11.70	-0.23	0.01	-0.23	-0.03	0.12
WC Overberg	14.21	-0.22	0.11	-0.12	-0.02	0.07
WC Garden Route	3.72	-0.18	0.20	0.02	0.00	0.00
WC Little Karoo	2.99	-0.21	0.26	0.05	0.00	-0.01
WC Breede River	21.22	-0.21	0.23	0.02	0.00	-0.02
WC Swartland	8.75	-0.22	0.10	-0.11	-0.01	0.05
WC West Coast	5.60	-0.24	0.15	-0.08	0.00	0.02
WC Central Karoo	0.95	-0.18	0.11	-0.06	0.00	0.00
Agriculture: Northern Cape	29.48	-0.20	0.17	-0.03	-0.01	0.04
Agriculture: North West	28.99	-0.16	0.09	-0.08	-0.02	0.10
Agriculture: Free State	39.98	-0.22	0.17	-0.06	-0.02	0.10
Agriculture: Eastern Cape	24.17	-0.15	0.18	0.03	0.01	-0.03
Agriculture: KwaZulu Natal	39.00	-0.15	0.11	-0.04	-0.02	0.07
Agriculture: Mpumalanga	33.35	-0.23	0.25	0.02	0.01	-0.03
Agriculture: Limpopo	33.22	-0.21	0.33	0.12	0.04	-0.18
Agriculture: Gauteng	18.76	-0.20	0.39	0.20	0.04	-0.17
All Non-agriculture	**7,770.07**	**-0.27**	**-0.02**	**-0.29**	**-22.19**	**99.86**
Forestry and fishing	48.80	-0.27	0.14	-0.13	-0.06	0.28
Natural resources	617.83	-0.25	0.01	-0.24	-1.46	6.59
Food	250.86	-0.26	0.15	-0.11	-0.28	1.28
Industry	1,164.36	-0.26	-0.05	-0.31	-3.64	16.36
Services	5,688.21	-0.27	-0.02	-0.29	-16.74	75.34
TOTAL	**8,089.26**	**-0.27**	**-0.01**	**-0.27**	**-22.22**	**100.00**

Source: Model estimation results

6.5. Factor impacts

6.5.1. Employment

The model results indicate that unemployment will increase in all the provinces among unskilled- and semi-skilled African, Asian and Coloured workers, with total employment in the Western Cape declining by 0.09% at a 35% tax rate on petroleum products.

Table 5 shows the decrease in employment for the Western Cape over the short and long term. Employment levels almost adjust completely over the short-run as there is little difference between the results of the short term and long term closure rules, implying limited adjustment in skilled labour and capital over the long-run. Over the long term, increasing the tax rate on petroleum products to 35% will result in the employment of African and 'Asian and Coloured' workers falling by 0.17 and 0.16 per cent respectively, equivalent to 360 Africans and 983 Asians and Coloureds loosing their jobs, and as the tax rate increases to 44% employment will fall by 0.67 and 0.63 per cent respectively.

Table 6: Changes in employment in the Western Cape, at a 35% tax rate on petroleum products

	Short term		Long term	
	Percentage change	**Number of job losses**	**Percentage change**	**Number of job losses**
African	-0.17%	345	-0.17%	360
Coloured and Asian	-0.17%	989	-0.16%	983

Source: Model estimation results

6.5.2. Wage rates

Table 6 shows the changes in the wage rates of White semi- and unskilled labour and skilled labour of all racial groups, at a 35% tax rate on petroleum products. Africans will experience the largest fall in their wage rates (-0.31%), followed by White high-skilled and skilled workers (-0.30%) and White semi- and unskilled workers (-0.29%).

Table 7: Changes in the wages of labour employed in the Western Cape, at a 35% tax rate on petroleum products

African High-skilled and Skilled	-0.31%
Coloured and Asian Skilled	-0.27%
White High-skilled and skilled	-0.30%
White Semi- and Unskilled	-0.29%

Source: Model estimation results

6.5.3. Factor incomes

Table 8 shows the effect on factor incomes resulting from the changes in wage rates and employment.

Table 8: Changes in the income of labour employed in the Western Cape, at a 35% tax rate on petroleum products

African High-skilled and Skilled	-0.22%
African Semi- and unskilled	-0.16%
Coloured and Asian Skilled	-0.23%
Coloured and Asian Semi- and unskilled	-0.17%
White High-skilled and skilled	-0.32%
White Semi- and Unskilled	-0.27%

Source: Model estimation results

6.6. Impact on households

Household income and expenditure are expected to fall due to the decrease in both employment and wage rates. Figure 13 shows the changes in per capita real household expenditure for the "LT-neutral" closure at the 35% tax rate on petroleum products. Up to now, the closure rule used made little difference in the results, but for household income and expenditure the results for the "LT-inert" and "LT-neutral" closures do differ.

The focus of this section falls on the distributional effect of higher fuel taxes on real household expenditure. Regarding the latter, a regressive distributional impact on household expenditure means that the adverse effect of a change in some variable (price or tax rate) will be greater on lower income households than higher income households, while the opposite is true for a progressive distributional impact. The data indicate that, for each racial group, those households of which the household head has a higher level of education earn higher per capita income than those households of which the household head has a lower level of education. In other words, "higher educated households" are the higher income households.

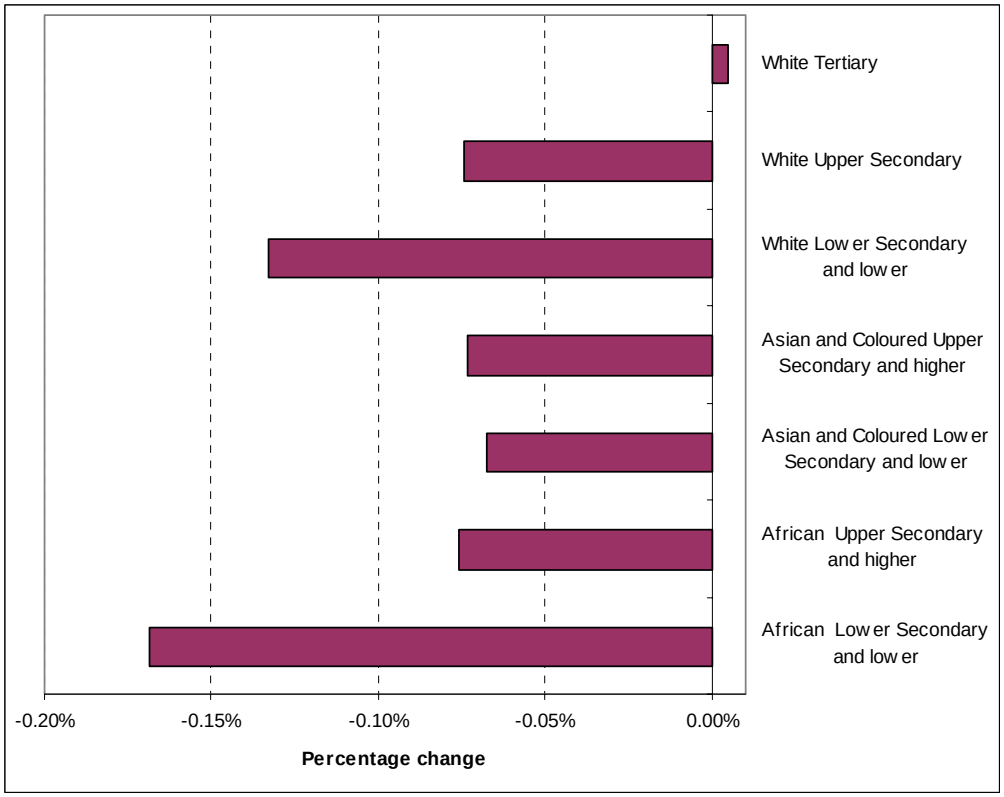
The expenditure patterns of households are important in understanding the distributional effect of higher fuel taxes on real household expenditure. Households spending a larger share of their total income directly on petroleum products and transport services will be most severely affected as the prices of these commodities/services increases. African households of which the household head has lower secondary and lower education, spend the largest share (10.6%) of their total income on petroleum products and transport services, while other households spend between 4.8 and 6.9 per cent of their total income on petroleum products and transport services. This not only explains the relatively large decline in per capita real household expenditure of African households with lower secondary and lower education levels (see Figure 13), but also the regressive distributional impact of higher fuel taxes on real

household expenditure of African households. 'Asian and Coloured' households of which the household head has lower secondary and lower education, spend 6.2% of their total income on petroleum products and transport services, while 'Asian and Coloured' households with higher education levels spend 6.4% of total income on these services/commodities; this leads to the increase in the prices of petroleum products and transport services having a progressive distributional impact on real household expenditures of Asian and Coloured households. There is no correlation between education level of the household head and the share of total income spent on petroleum products and transport services among White households.

Households are also affected differently through fiscal policy as a result of differences in asset ownership (transfers from enterprises to households). Households receive a fixed proportion of enterprise revenue after the deduction of taxes and savings. Enterprise transfers constitute approximately 40% of total income of White households with lower secondary and lower education, 32% of total income of White households with upper secondary education and 23% of total income of White households with tertiary education. African and 'Asian and Coloured' households with higher education levels receive a larger share of their total income from enterprises (20 and 16 per cent respectively) than African and 'Asian and Coloured' households with lower secondary and lower education (4 and 12 per cent respectively).

Under closure "LT-neutral" the government deficit is held fixed and the income tax rates of households and enterprises are allowed to vary. This results in a slight increase in the savings rate of households and enterprises (0.59%) and a fall in the tax rates of households and enterprises (by -0.85%). The net effect of these changes on household expenditure is expected to be positive, as tax rate levels exceed savings rate levels. In addition, this positive net effect will be greater on higher income households paying higher taxes; explaining the regressive distributional impact on real household expenditure of White households and contributing to the regressive distributional impact on real expenditure of African households (see Figure 13). The negative effect of lower wages and higher savings rates on real expenditure of high-income White households (White households headed by an individual with tertiary education) is outweighed by the positive effect of a reduction in the income tax rate, leading to an increase in per capita real household expenditure. The distributional impact on real expenditure of 'Asian and Coloured' households is slightly progressive, indicating that the progressive distributional impact of their expenditure patterns outweighs the regressive distributional effect of the reduction in tax rates.

Figure 13: Changes in per capita real household expenditure, at a 35% tax rate on petroleum products – closure "LT-neutral"

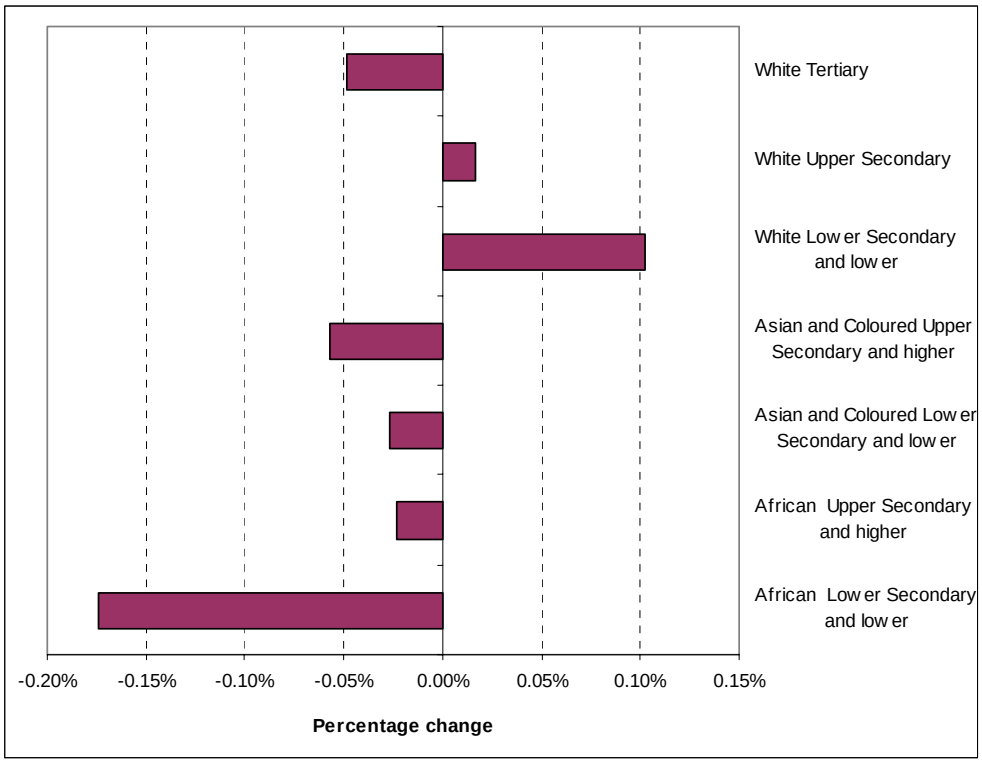


Source: Model estimation results

The two closures, "LT-neutral" and "LT-inert", have different impacts on tax and savings rates, influencing the distributional effect of higher fuel taxes differently. Under closure "LT-inert" the additional government revenue from fuel taxes is pooled into the government savings account, resulting in the government deficit falling as income tax rates of households and enterprises are fixed. In response to the fall in government deficit, the savings rates of households and enterprises adjust downwards (by -2.03% at a 35% tax rate on petroleum products) to keep constant the share of investment expenditure to final demand. This increases household expenditure via two channels. The first channel is obvious: since households save less, they spend more. As higher income households have higher savings rates than lower income households, the decline in the savings rate of households will have a regressive impact on real household expenditure. The second channel by which changes in the savings rate affect household expenditure is via transfers from enterprises to households. As enterprises save a smaller proportion of their income, transfers to households increase. In the case of White households this will have a progressive impact on household expenditure as lower educated households receive a larger share of their total income from enterprises. The opposite is true for African and 'Coloured and Asian' households.

Figure 14 shows that the net effect of above mentioned determinants results in higher fuel taxes having a regressive effect on real household expenditure among African households and a progressive effect on real household expenditure among 'Asian and Coloured' and White households.

Figure 14: Changes in per capita real household expenditure, at a 35% tax rate on petroleum products – closure "LT-inert"



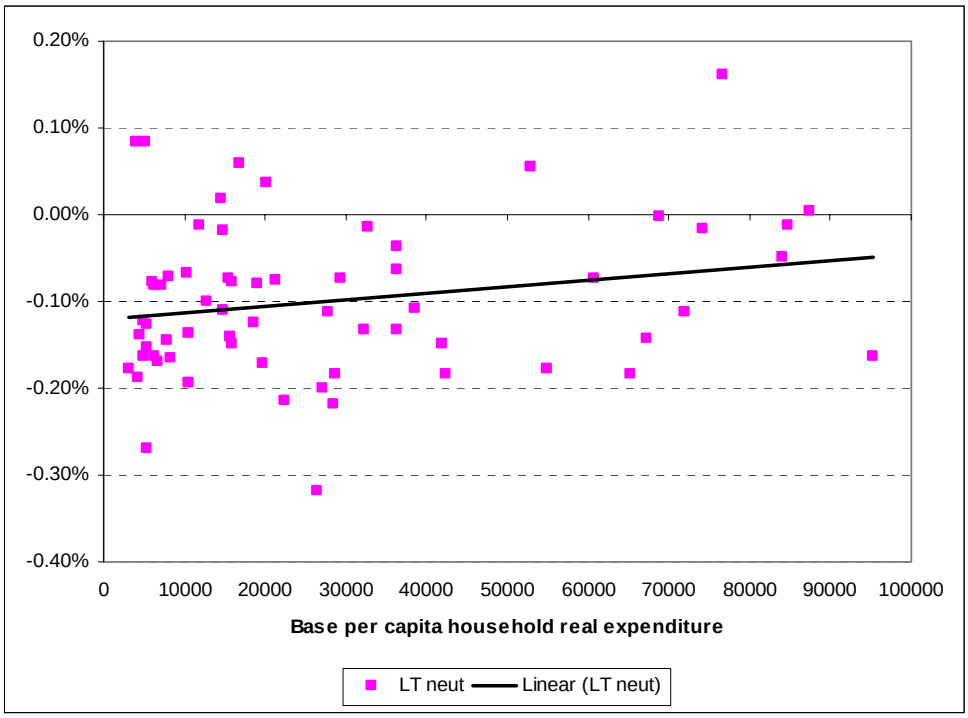
Source: Model estimation results

Under closure "LT-inert", the distributional effect from the current generation to future generations is uncertain as there are two opposing effects. The fall in the government deficit is to the advantage of future generations, but on the other hand, households increase their current expenditure at the expense of future households (via lower savings).

Figure 15 shows that, taking all South African households into account, raising the tax rate on petroleum products has a marginally regressive impact on per capita real household expenditure. The results for closure "LT-inert" is similar to that of "LT-neutral"[12].

[12] Another closure rule ("LT-stax") was investigated, similar to "LT-neutral" except that sales tax rates were allowed to adjust instead of income tax rates. There is no distributional effect under this closure.

Figure 15: Change in per capita real household expenditure vs. per capita real expenditure, at a 35% tax rate on petroleum products – closure "LT-neutral"



Source: Model estimation results

7. Conclusion

The results presented in this study support the findings of the BER report in terms of the very small impact a 10 cents per litre fuel levy will have on economic growth and employment. Both reports also agree on the small negative impact on real household expenditure and the marginally regressive tax incidence of raising fuel taxes. CGE analysis yields additional insights relating to changes in the labour market and household expenditure.

A 3 percentage point increase (relating to a 10 cents per litre increase) in the (national) fuel levy will have a modest impact on the economy. In the long-run, GDP will decline by 0.002%. All industries are affected negatively with the greatest impact on the services industry, specifically transport services, that will experience a decline of R1,674 million in value-added. The second greatest impact is on the manufacturing industry as it looses value-added equal to R364 million. The effect on the agricultural industry is very small, with a decline of R3 million (0.01%) in value added. The model results indicate that increasing the tax rate on petroleum products by 3 percentage points will lead to an appreciation of 0.11% in the exchange rate and a decline of 0.11% in investment.

A 3 percentage point increase in the fuel levy results in consumer prices of petroleum products to increase by 2.26%. Higher fuel prices put upward pressure on prices of intermediate inputs for all activities. The greatest impact, though small (0.40%), is on transport services as 13% of expenditure in this industry is spend directly on petroleum products. The prices of intermediate inputs in agricultural activities rise by 0.06%. Of all the regions considered, agricultural activities in the Free State and Great Karoo experience the largest price increases in intermediate inputs.

In the Western Cape wages fall and employment declines by 0.09% (employment declines nationally by 0.08%). Lower wages and higher unemployment lead to lower household income. The results for closure "LT-neutral", show that all households in the Western Cape are worse off, measured by real household expenditure, except for White households with tertiary education which experience a large reduction in their tax rates. The results show that increasing fuel levies will have a marginally regressive impact on household expenditure.

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9. Appendices

9.1. Appendix A: Fuel intensity of industries

	SAM column total (total payments)	Expenditure on petroleum (a)	(a)/(b)	Rank
Agriculture				
Free State Agriculture	7,858.34	541.52	6.89%	3
North West Agriculture	5,182.11	291.01	5.62%	5
Mpumalanga Agriculture	6,164.03	304.16	4.93%	8
Gauteng Agriculture	3,660.21	135.96	3.71%	10
KwaZulu Natal Agriculture	6,302.75	233.21	3.70%	11
Limpopo Agriculture	5,337.99	193.27	3.62%	12
Northern Cape Agriculture	4,257.85	152.14	3.57%	13
Western Cape Agriculture	11,585.95	383.81	3.31%	14
WC Cape Town	525.94	9.23	1.75%	
WC Boland	1,846.44	44.39	2.40%	
WC Overberg	2,237.08	83.26	3.72%	
WC South Coast	633.45	31.57	4.98%	
WC Little Karoo	503.81	17.71	3.52%	
WC Breede River	3,142.99	73.23	2.33%	
WC Swartland	1,720.90	80.33	4.67%	
WC Olifantsriver	811.29	32.73	4.03%	
WC Great Karoo	164.05	11.37	6.93%	
Eastern Cape Agriculture	3,724.51	122.89	3.30%	15
Forestry and Fishing				
Forestry and fishing	9,873.66	536.43	5.43%	6
Mining				
Coal	22,719.24	420.53	1.85%	21
Other mining	60,649.44	941.65	1.55%	23
Gold	33,896.46	253.44	0.75%	37
Food				
Fish	1,811.39	40.96	2.26%	19
Grain mills	22,982.10	349.87	1.52%	24
Oils	4,931.90	61.58	1.25%	26
Meat	20,223.23	217.16	1.07%	29
Dairy	7,623.46	73.58	0.97%	33
Fruit	4,975.76	44.58	0.90%	34
Confectionery	7,070.37	38.98	0.55%	41
Beverages and tobacco	27,213.01	127.32	0.47%	43
Other food	8,033.83	3.20	0.04%	45
Manufacturing				
Petroleum	57,894.98	4,169.79	7.20%	2
Agricultural machinery	1,121.46	56.56	5.04%	7
Fertilizers	7,936.04	351.47	4.43%	9

	SAM column total (total payments)	Expenditure on petroleum (a)	(a)/(b)	Rank
Rubber plastic	18,158.28	594.77	3.28%	16
Iron and steel	114,535.19	3,072.12	2.68%	17
Electrical	17,855.67	290.49	1.63%	22
Non-metallic	19,091.65	237.57	1.24%	27
Audiovisual	8,370.92	82.02	0.98%	32
Special purpose machinery	15,536.52	130.19	0.84%	36
Pesticides	2,653.23	15.17	0.57%	39
Other Chemicals	66,081.90	4,199.98	6.36%	4
Textiles	34,335.75	193.90	0.56%	40
Transport equipment	78,401.14	407.99	0.52%	42
Wood paper media	60,280.71	206.90	0.34%	44
Other manufacturing	13,594.40	167.82	1.23%	28
Services				
Transport services	100,563.86	13,444.72	13.37%	1
Construction	88,451.33	2,089.05	2.36%	18
Communication	63,648.07	1,245.59	1.96%	20
Trade and accommodation	221,746.74	2,904.60	1.31%	25
Activities and services	29,068.45	300.79	1.03%	30
Government health social	233,497.50	2,364.24	1.01%	31
Business services	279,716.38	2,398.84	0.86%	35
Electricity water	45,935.77	274.25	0.60%	38
Domestic services	13,244.08	0.00	0.00%	46

Source: SAM

9.2. Appendix B: SAM accounts

Commodities: Agriculture

1 Summer Cereals
2 Winter Cereals
3 Other Field Crops
4 Potatoes and Vegetables
5 Wine grapes
6 Citrus
7 Subtropical
8 Deciduous
9 Other Horticulture
10 Livestock Sales
11 Other agriculture
12 Poultry
13 Other Animals
14 Forestry and fishing

Commodities: Other

15 Coal and lignite products
16 Gold and uranium ore products
17 Crude oil products
18 Other mining products
19 Meat products
20 Fish products
21 Fruit and vegetables products
22 Oils and fats products
23 Dairy products
24 Grain mill products
25 Confectionary products
26 Other food products
27 Beverages and tobacco products
28 Textile products
29 Wood paper media products
30 Petroleum products
31 Fertilizers
32 Pesticides
33 Other chemical products
34 Rubber plastic products
35 Non-metallic products
36 Iron and steel products
37 Agricultural machinery
38 Special purpose machinery
39 Electrical products
40 Audiovisual products
41 Transport products
42 Other manufacturing
43 Electricity water
44 Construction
45 Trade and accommodation
46 Transport services
47 Communications
48 Business services
49 Government health social
50 Other services and activities
51 Domestic services

Activities: Agriculture

52 Western Cape: Cape Town
53 Western Cape: Boland
54 Western Cape: Overberg
55 Western Cape: South Coast
56 Western Cape: Little Karoo
57 Western Cape: Breede River
58 Western Cape: Swartland
59 Western Cape: Olifantsriver
60 Western Cape: Great Karoo
61 Northern Cape Agriculture
62 North West Agriculture
63 Free State Agriculture
64 Eastern Cape Agriculture
65 KwaZulu Natal Agriculture
66 Mpumalanga Agriculture
67 Limpopo Agriculture
68 Gauteng Agriculture

Activities: Other

69 Forestry fishing
70 Coal
71 Gold
72 Other mining
73 Meat
74 Fish
75 Fruit
76 Oils
77 Dairy
78 Grain mills
79 Confectionery
80 Other food
81 Beverages and tobacco
82 Textiles
83 Wood paper media
84 Petroleum
85 Other Chemicals
86 Fertilizers
87 Pesticides
88 Rubber plastic
89 Non-metallic
90 Iron and steel
91 Agricultural machinery
92 Special purpose machinery
93 Electrical
94 Audiovisual

95 Transport equipment
96 Other manufacturing
97 Electricity water
98 Construction
99 Trade and accommodation
100 Transport services
101 Communication
102 Business services
103 Government health social
104 Activities and services
105 Domestic services

Factors: Capital

106 Gross operating surplus mixed income

Factors: Land

107 Western Cape Land
108 Northern Cape Land
109 North West Land
110 Free State Land
111 Eastern Cape Land
112 KwaZulu-Natal Land
113 Mpumalanga Land
114 Limpopo Land
115 Gauteng Land

Factors: Labour

116 Western Cape African High-skilled and Skilled
117 Western Cape African Semi- and unskilled
118 Western Cape Coloured and Asian Skilled
119 Western Cape Coloured and Asian Semi- and unskilled
120 Western Cape White High-skilled and skilled
121 Western Cape White Semi- and Unskilled
122 Eastern Cape African High-skilled and skilled
123 Eastern Cape African Semi- and unskilled
124 Eastern Cape Coloured and Asian High-skilled and Skilled
125 Eastern Cape Coloured and Asian Semi- and Unskilled
126 Eastern Cape White High-skilled and skilled
127 Eastern Cape White Semi- and Unskilled
128 Northern Cape African High-skilled and Skilled
129 Northern Cape African Semi- and Unskilled
130 Northern Cape Coloured and Asian High-skilled and Skilled
131 Northern Cape Coloured and Asian Semi- and Unskilled
132 Northern Cape White High-skilled and Skilled
133 Northern Cape White Semi- and Unskilled
134 Free State African High-skilled and Skilled
135 Free State African Semi- and unskilled
136 Free State Coloured and Asian High-skilled and Skilled
137 Free State Coloured and Asian Semi- and Unskilled
138 Free State White High-skilled and Skilled
139 Free State White Semi- and Unskilled
140 Kwazulu-Natal African High-skilled and skilled
141 Kwazulu-Natal African Semi- and Unskilled
142 Kwazulu-Natal Coloured High-skilled and Skilled
143 Kwazulu-Natal Coloured Semi- and Unskilled
144 Kwazulu-Natal Asian High-skilled and Skilled
145 Kwazulu-Natal Asian Semi- and Unskilled
146 Kwazulu-Natal White High-skilled and Skilled
147 Kwazulu-Natal White Semi- and Unskilled
148 North West African High-skilled and Skilled
149 North West African Semi- and unskilled
150 North West Coloured and Asian High-skilled and Skilled
151 North West Coloured and Asian Semi- and Unskilled
152 North West White High-skilled and Skilled
153 North West White Semi- and Unskilled
154 Gauteng African High-skilled and skilled
155 Gauteng African Semi- and Unskilled
156 Gauteng Coloured High-skilled and Skilled
157 Gauteng Coloured Semi- and Unskilled
158 Gauteng Asian High-skilled and Skilled
159 Gauteng Asian Semi- and Unskilled
160 Gauteng White High-skilled and skilled

161 Gauteng White Semi- and Unskilled
162 Mpumalanga African High-skilled and skilled
163 Mpumalanga African Semi-skilled
164 Mpumalanga African Unskilled
165 Mpumalanga Coloured and Asian High-skilled and Skilled
166 Mpumalanga Coloured and Asian Semi- and Unskilled
167 Mpumalanga White High-skilled and Skilled
168 Mpumalanga White Semi- and Unskilled
169 Limpopo African High-skilled and skilled
170 Limpopo African Semi-unskilled
171 Limpopo Coloured and Asian High-skilled and Skilled
172 Limpopo Coloured and Asian Semi- and Unskilled
173 Limpopo White High-skilled and Skilled
174 Limpopo White Semi- and Unskilled

Households

175 African Lower Secondary and lower
176 Western Cape African Upper Secondary and higher
177 Western Cape Asian and Coloured Lower Secondary and lower
178 Western Cape Asian and Coloured Upper Secondary and higher
179 Western Cape White Lower Secondary and lower
180 Western Cape White Upper Secondary
181 Western Cape White Tertiary
182 Eastern Cape African Agricultural
183 Eastern Cape African Homeland Lower Secondary and lower
184 Eastern Cape African Homeland Upper Secondary and higher
185 Eastern Cape African Non-Homeland Lower Secondary and lower
186 Eastern Cape African Non-Homeland Male Upper Secondary and higher
187 Eastern Cape Asian and Coloured Lower Secondary and lower
188 Eastern Cape Asian and Coloured Upper Secondary and higher
189 Eastern Cape White Lower Secondary and lower
190 Eastern Cape White Upper Secondary
191 Eastern Cape White Tertiary
192 Northern Cape African Primary and lower
193 Northern Cape African Lower Secondary and higher
194 Northern Cape Coloured and Asian Lower Secondary and lower
195 Northern Cape Coloured and Asian Upper Secondary and higher
196 Northern Cape White
197 Free State African Agricultural
198 Free State African Lower Secondary and lower
199 Free State African Upper Secondary and higher
200 Free State Asian and Coloured
201 Free State White Lower Secondary and lower
202 Free State White Upper Secondary
203 Free State White Tertiary
204 Kwazulu-Natal African Agricultural
205 Kwazulu-Natal African Lower Secondary and lower
206 Kwazulu-Natal African Upper Secondary and higher
207 Kwazulu-Natal Asian Lower Secondary and lower
208 Kwazulu-Natal Asian Upper Secondary and higher
209 Kwazulu-Natal Coloured
210 Kwazulu-Natal White Lower Secondary and lower
211 Kwazulu-Natal White Upper Secondary
212 Kwazulu-Natal White Tertiary
213 North West African Agricultural
214 North West African Lower Secondary and lower
215 North West African Upper Secondary and higher and higher
216 North West Asian and Coloured
217 North West White Lower Secondary and lower
218 North West White Upper Secondary and higher
219 Gauteng African Agricultural
220 Gauteng African Lower Secondary and lower

221 Gauteng African Upper Secondary and higher
222 Gauteng Coloured Lower Secondary and lower
223 Gauteng Coloured Upper Secondary and higher
224 Gauteng Asian Lower Secondary and lower
225 Gauteng Asian Upper Secondary and higher
226 Gauteng White Lower Secondary and lower
227 Gauteng White Upper Secondary
228 Gauteng White Tertiary
229 Mpumalanga African Agricultural
230 Mpumalanga African Lower Secondary and lower
231 Mpumalanga African Upper Secondary and higher
232 Mpumalanga Asian and Coloured
233 Mpumalanga White
234 Limpopo African Agricultural
235 Limpopo African Lower Secondary and lower
236 Limpopo African Upper Secondary and higher
237 Limpopo Asian and Coloured
238 Limpopo White

Trade and transport margins

239 Trade margin
240 Transport margin

Tax accounts

241 Import duties
242 Export tax
243 Value added tax on imports
244 Value added tax on domestic go
245 Excise duty
246 Sales Tax
247 Sales subsidies
248 Production taxes
249 Production refunds or VAT
250 Production subsidies
251 Factor Tax
252 Direct income taxes

Other accounts

253 Government
254 Business Enterprises
255 Savings
256 Stock Changes
257 Rest of the World
258 Account totals

9.3. Appendix C: Classification of occupation into skill level categories

Factor code	Description	Skill classification
0	Not applicable/not working	Not applicable
1	Legislators, senior officials and managers	High skilled
2	Professionals	High skilled
3	Technical and associate professionals	High skilled
4	Clerks	Skilled
5	Service workers and shop and market sales workers	Skilled
6	Skilled agricultural and fishery workers	Semi-skilled
7	Craft and related trades workers	Semi-skilled
8	Plant and machine operators and assemblers	Semi-skilled
9	Elementary Occupation	Unskilled
10	Domestic workers	Unskilled
11*	Not adequately or elsewhere defined, unspecified	Unskilled

*Code 11 may include semi-skilled, skilled and/or high skilled workers as well, but it is almost impossible to determine.

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