ANALYSING IMPACTS OF ALTERNATIVE POLICY RESPONSES TO HIGH OIL PRICES USING AN ENERGY-FOCUSED CGE MODEL FOR SOUTH AFRICA

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ABSTRACT

This study examines the effect on the economy and households of either subsidising or allowing fluctuation of domestic petroleum prices in response to exogenous oil price increases in South Africa. An energy focused CGE model is used for analysis. The model predicts that GDP would fall by between 0.8 and 3 percent under the two scenarios. The government deficit would worsen by between 9.6 and 33.5 percent. The real exchange rate depreciates more in the floatation scenario. Consumption increases by 0.5 percent when prices are subsidised and decreases by 1.1 percent when price fluctuation is allowed. Unemployment rates increase more among low skilled workers. Synthetic fuel, coal and to some extent electricity are the clear winners. All other industries experience a fall of their production but with different magnitudes. There is a significant increase in the wage gap between urban and rural high skilled workers when domestic oil prices are subsidised compared to when they are not. Household welfare falls and poverty increases when prices are floating but increase when they are subsidised. The increase of oil prices in the context of subsidized domestic petroleum prices is in favour of rural households, especially richer rural households.

Key words: Oil; Energy; Social Accounting Matrix; Computable General Equilibrium; Production; Distribution; Welfare

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1. INTRODUCTION

The recent oil price increase has created widespread concern about its impact on world economic growth and on poor people in many countries. During the last years, the oil market has witnessed substantial price volatility as well as historically high prices for crude oil and the major light products. On November 21st, 2007, Oil prices strike record high near 100 dollars when New York's main contract, light sweet crude for January delivery, hit an all time record high of 99.29 dollars US a barrel, five times higher than five years before when it was at $19.70 a barrel (December 2001). When adjusted by inflation to compare the oil prices in real terms, oil is now more expensive than at any time since 1980 (Annexure 1).

Analysts have pointed out that higher oil prices are inevitable and it is unlikely that prices will be reduced in the long term without major discoveries of sufficient sources of oil or alternative energy sources. Moreover, they are unanimous that government management of the higher oil prices will have significant repercussions on the economy of countries in terms of income distribution and poverty reduction. Because oil is such a basic component of production, flotation of oil prices will directly affect the whole economy, income distribution and poverty reduction. Removal of oil price subsidies will impact on oil-dependent businesses because their costs will increase substantially. Higher oil prices due to reduction and elimination of the use of subsidies will lower oil consumption in favour of other sources of energy such as coal, which are known to be more damaging for the environment. In contrast, if government subsidises oil prices, this distorts the real market signal. The market no longer reflects real costs and one consequence of this is that people no longer have an incentive to save on oil use. Subsidising oil products sends the wrong message to consumers who are in fact encouraged to consume more of these products, particularly in the production sector, and consequently, contribute more to the emission of green household gases (GHGs). In the long term, subsidising oil prices, even if it might be beneficial to competitiveness and the whole economy, raises the risk of increasing the trade deficit with increased oil imports. It may cause higher prices for domestic goods thereby lowering consumption. Consequently, higher inflation will ultimately pressure the government to increase interest rates, thereby reducing short-term investments and restricting predicted growth in the domestic economy.

This report examines the effects of alternative policy responses to the recent oil price changes in South Africa. It is a follow up to the report produced last year that focused on the impact of

oil price increases (Fofana *et al*. 2007). The report extends that work in terms of the range of policy scenarios tested and the complexity of the models used.

In Fofana *et al.* (2007), it was shown that the adverse impact of higher oil prices is much more diversified depending on the share of oil cost in national income and the energy efficiency and substitution possibilities of the industries in the economy. It was predicted that oil price increases would have negative effects on the economy and welfare. In this report, we explore the likely impacts of alternative government interventions in the face of such adverse impacts of oil price increases. Government policies can minimize or worsen the loss on income and welfare induced by higher oil prices. In order to understand the magnitude and distributional effects of oil price shocks and consequently to help formulating policies to ameliorate these effects, the following three levels of analysis are used to track the channels by which the South African economy and individuals are impacted.

- The macroeconomic level, looking at the impacts of oil price shocks and policy responses on the global economy, that is gross domestic product (GDP), the current account balance, government fiscal balance, inflation, private consumption, investment and unemployment.
- The mesoeconomic level, related to the distributional impacts of higher oil prices and policy interventions among industries and its translation into factors and commodities prices.
- The microeconomic level, looking at the distributional impacts on households' real income and welfare.

To understand as well as quantify these 3 levels of impacts for South Africa, this study uses a Computable General Equilibrium (CGE) Model specifically designed for South Africa. This is a major advance when compared to the accounting approach based on household survey dataset and an input output dataset used in Fofana *et al.* (2007). McDonald and van Schoor (2005) and Essama-Nssah *et al.* (2007) use a CGE macro-micro framework to understand the structural and distributional consequences of oil price increases for South Africa. These previous works have been predominantly focused on the impact of crude oil price increases. In this study, we extend these works to study the impacts of an increase of international (import and export) crude oil and oil products prices under alternative government policy responses. Specifically, we experiment with two scenarios. The first scenario assumes that the doubling of the prices of crude oil and petroleum products imported by South Africa is fully transmitted to end-users (consumers and producers) through an increase of the purchasing

prices of petroleum products while the second scenario supposes that the government fully compensates consumers for the increase through the price subsidy mechanism.

The CGE approach used in this Report is appropriate because there are likely to be significant indirect effects that will have strong impacts on allocation of scare resources following the interventions. The principal advantage of using CGE models in such policy analysis is that it permits taking into account interactions throughout the economy in a consistent manner. If something is changed in only one part of the economy, namely the oil sector, due to change in prices and government policy response, then there will be effects on the other parts of the economy, and these are automatically taken into account when one computes effects using a general equilibrium model. Hence this approach has both a sound theoretical structure as well as an exhaustive accounting strategy.

The next section provides the CGE model. The third section comprises details on the structure of the South African economy and relevant energy indicators obtained from the energy Social Accounting Matrix (SAM) used. Thereafter follows a detailed description and discussion of the policy simulations and results respectively. Section 5 then concludes the paper.

2. THE MODEL

The CGE model used in the study is based on the neoclassical-structuralist specification as presented in Decaluwé *et al.* (2001). The core of the constructed model for South Africa is based on the neoclassical general equilibrium theory and also builds on the energy CGE models that have just been reviewed. Producers maximize their profit under a given technology and independent prices. Industry-specific producers are modelled as representative producers that are assumed to have a nested CES production technology. Consumers maximize their utility under limited budgets and given market prices. Households are modelled as representative agents that are assumed to have Stone-Geary preferences. Perfect competition prevails in the sense that producers and consumers take as given the relative prices that simultaneously clear all markets, that is, equalizing the quantity produced for each commodity to the quantity demanded for that commodity. The model specifies a number of structural features designed to reflect the characteristics of the South African

economy as discussed below. The full details of the model and equations are provided in Fofana *et al.* (2008a).

- *Specificities of the model*

Empirical evidence and specificities appeal for a better specification of the South African labour market that the standard analysis fails to capture. There is a general consensus among analysts that the labour market in South Africa is segmented. Each segment corresponds to a specific skill-level and behaves differently in terms of earnings, job opportunity, unemployment and wage flexibility. The country faces at the same time a shortage of skilled workers and a high unemployment rate among unskilled workers. Therefore, workers and the labour market are distinguished into high-skilled and low-skilled categories. Each category in turn is separated according to their location (urban and rural areas). The model does not explicitly treat the rural-urban migration issue though.

The model presents a single aggregate capital distinguished by the sector of use, that is, agriculture, industry, private services and general government services. Capital demand is industry-specific. Consequently, there are as many returns to capital as there are capital using industries in the economy. Capital supply is exogenous and institutional units are endowed with the categories of capital mentioned above. Although the return to capital is industry-specific, institutions receive average returns from capital that has been installed in agriculture, industry and private services. There is no return for general government services capital. Instead the government supports the cost of using such capital.

The model explicitly treats the trade and transportation margins for commodities that enter the market sphere. A constant trade and transportation margins coefficient is added to each transaction and included in the purchasing price of commodities. Consequently, the generated revenues represent additional demands for trade, and transport services. There is a separation between production activities and commodities. A fixed proportional relationship between activity output and commodity domestic supply permits any activity to produce one or multiple commodities and any commodity to be produced by one or multiple activities.

- *Closure rule*

CGE models differ primarily in the choices of closure rules which equilibrate commodity, factor and foreign exchange markets. They also differ in rules specified to reconcile the government budget constraint and in the mechanism used to equilibrate savings and investment levels in the economy. In standard models, all commodity markets follow the neoclassical market-clearing price system, in which jointly determined producer and consumer prices vary only by given tax, subsidy and margins rates.

In our model, the labour market is assumed to be fully segmented. Workers are immobile between urban and rural areas. High-skilled workers do not compete for low-skilled jobs and low skilled workers similarly do not compete for high skilled jobs. As a result, high-skilled and low-skilled workers in both urban and rural areas participate in different labour markets. Each category of labour is assumed to be perfectly mobile across industries. A single wage index prevails for each market. High-skilled workers are fully employed in the economy although low rates of frictional unemployment[5] are observed in urban and rural areas for this category. The skilled labour market is assumed to be perfectly competitive so that the prevailing wage rates equalize exogenous supplies and endogenous demands for high-skilled workers in both urban and rural areas. In contrast, there is imperfect competition in the low-skilled labour markets where the total demand does not equal the total supply. There is an excess supply of labour which remains unemployed. The wage rate paid to low-skilled workers is fixed in real terms in both urban and rural areas.

According to the characteristics of the labour market in South Africa and the short term perspective of the study, we assume that the employment decisions in general public administration are exogenously determined as government hiring possibilities are limited. Therefore, fixed indexed-wage rates prevail in the general government services, while other industries take the market wage rates given by the market.

The supply of each category of labour is exogenous. Household labour supply specification takes into account the existence of unemployment for low skilled labour categories. We assume that for this category of low skilled workers employment is rationed on the demand side and the wage rate that equilibrates the labour market is compatible with a given rate of

[5] Frictional unemployment exists because both jobs and workers are heterogeneous. A mismatch related to skills, payment, worktime, location, attitude and tastes can result between the supply and the demand of labor.

unemployment. Workers have the same opportunity (probability) to be hired regardless of the household to which they belong to.

The foreign exchange market equilibrates via adjustments of the real exchange rate. The current account balance is therefore exogenous and pre-specified at the base year level. Hence, with fixed foreign borrowing and transfers from abroad, higher imports of some goods will require lower imports and/or higher exports of other goods in order to keep the current account balanced. Pressures to change export or import quantities (and hence, demand and supply of foreign currency) are therefore equilibrated by adjustments in the real exchange rate.

Government is passive in the sense that it does not optimize any objective function. Its role is limited to that of regulating economic activity. Its earnings comprise revenues raised from indirect taxes, direct taxes, trade taxes and net foreign borrowing. Its expenses consist of subsidies, current expenditures on the services provided by the public sector, investment and transfers to households and firms. Government transfers, current expenditures and investment expenditures are fixed. The government deficit is covered by borrowing on the domestic credit market.

Private savings are investment driven. Savings are generated by exogenous constant rates for households and by residual savings from firms. Private savings is equal to net savings available after government borrowing is covered. The model is homogenous of degree one in all prices and nominal values. The “numeraire” is the value added price index. All nominal values are thus measured in real terms relative to this price. Fixed wages in this context should be interpreted in terms of factor cost. Real incomes are computed with social group-specific consumer price indices which, unlike the value added price index, include the prices of imported goods, taxes, and subsidies. The model solves for one-period equilibrium and results have to be interpreted in comparative static terms.

- *Energy specification*

The model differs from standard CGE models in two aspects. These differences relate to energy supply and demand specification and the price setting method in the domestic oil

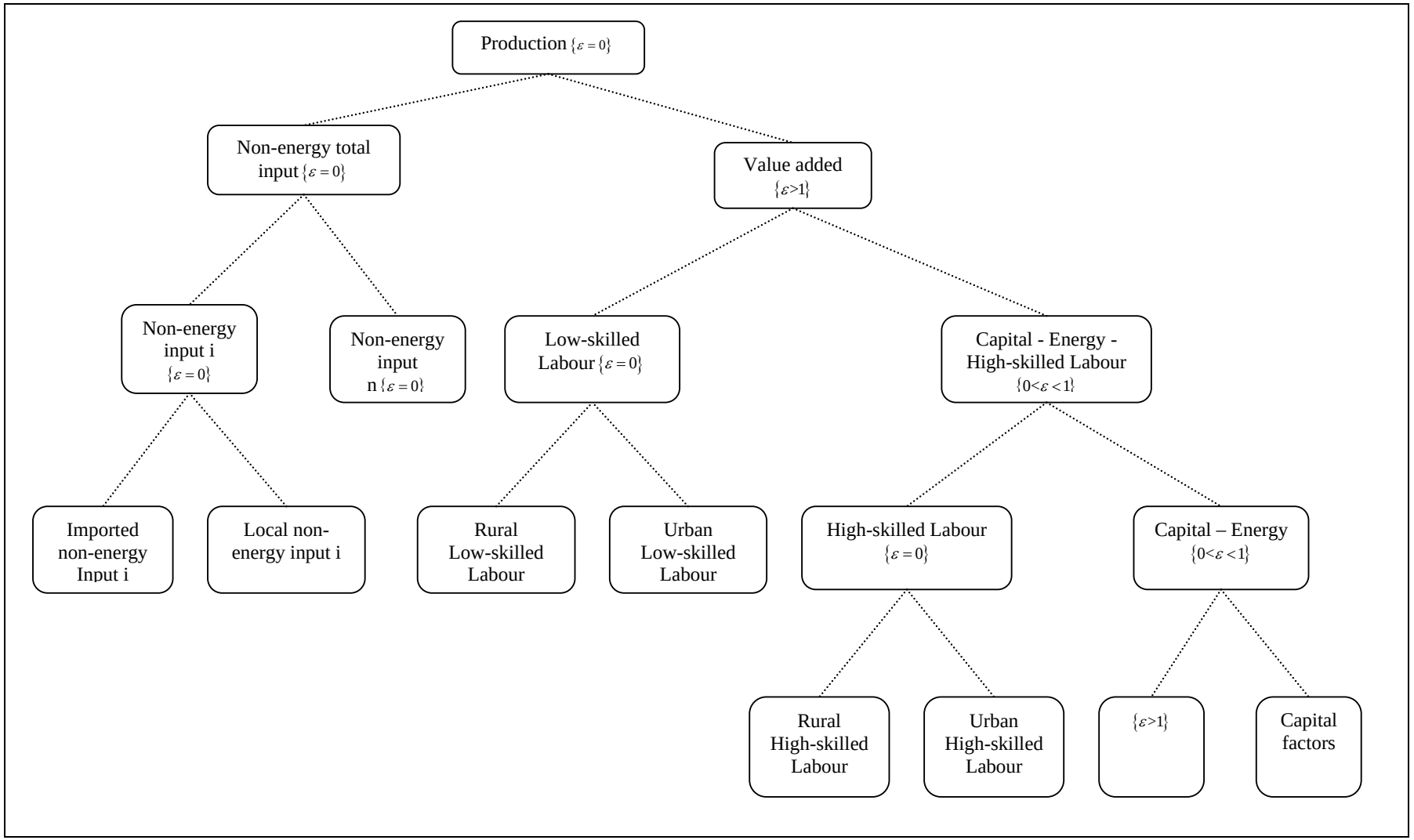
market. The model has the following four types of energy: crude oil, petroleum products, coal, and electricity (including gas and renewable energy).

An industry *j*'s technology is presented as a nested CES function (Figure 2). The gross output consists of a Leontief function of the composite value added-energy and the non-energy input consumption. Leontief technology also determines the demand for non-energy commodities in the total non-energy input consumption. A CES function aggregates low-skilled labour and the bundle of capital-energy and skilled labour in the value added-energy composite, with a high elasticity of substitution. The bundle of capital-energy and high skilled labour is also a CES aggregation of capital-energy and high skilled labour. However, the latter has a low elasticity of substitution. Each low-skilled and high-skilled labour category is a fixed proportional (Leontief) relationship between urban and rural labour categories. A CES function with a low elasticity demonstrates that capital and energy imperfectly substitute for each other or are quasi-complementary in the composite capital-energy.

Energy inputs are divided into four types which are imperfect substitutes of each other (Figure 3). Composite fuels and electricity are combined in a CES function with a relatively high elasticity of substitution. The former is defined as a CES-aggregate of coal and oil fuels with a relatively high elasticity of substitution between them. Finally, crude oil and refined oil products are assumed to be complements in the oil bundle. The demand for each energy commodity is shared between imports and domestically produced goods depending on their relative price and the degree of substitutability between them.

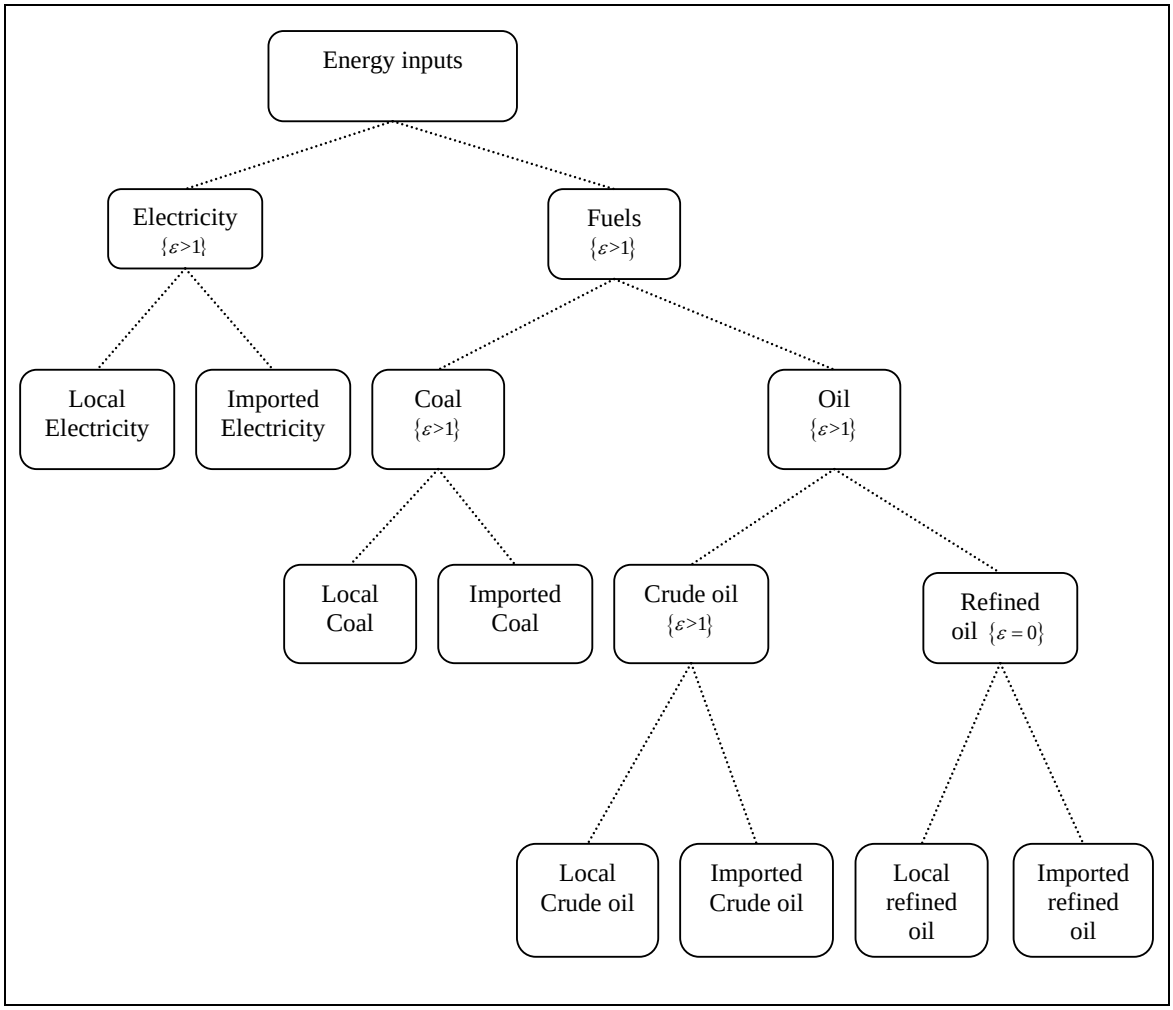
The goods and services consumed by households are grouped by purpose (food, personal care, housing, etc.). A single commodity category (e.g., petroleum product) enters into one or several groups of consumption by purpose (e.g. household fuel and transport). Representative urban and rural households maximize unitary utility functions over the group of consumption by purpose, subject to the constraint of their revenue. Thus, households' expenditure on commodities combine a Linear Expenditure System (LES) function over various groups of consumption by purpose, and a CD function over commodity categories for each group of consumption by purpose.

Figure 2: Structure of production by industry



To implement oil price support policy, the government guarantees a selling price to oil consumers. In a market-clearing situation, there is zero excess supply so that the equilibrium price adjusts supply and demand. Therefore, the government provides a price policy support to oil consumers but it is still willing to let the market adjust to the market-clearing price. In that case, the price paid to oil consumers may be exogenous whereas the level of subsidies paid to them is endogenously determined, depending on the fluctuation of the international oil prices[6]. The government will then have to arrange some method of financing the implied extra-expenses in the short to medium term.

Figure 3: Structure of sectoral energy input use



- *Microsimulation model*

[6] Alternatively, the level of the subsidy can be made exogenous and the consumer price then becomes endogenous instead. In that case, the government supports the difference between the market clearing price and the selling price through a subsidy scheme.

This paper uses a two-layered macro-micro model to analyse the income distribution and poverty impacts of the alternative policy responses to high oil prices in South Africa. The macro and micro modules are linked in a top-down fashion which does not account for the feed-back (second-order) effects from the micro component to the macro component of the model. Therefore, one should interprete the results as a first-round (prices and quantities) distributive impact analysis of the oil shocks.

Three procedures are identified in linking of the macro- and the micro- components of the model. The integrated approach is one way. The technique is equivalent to developing a CGE model in which the number of household categories equals the number of participants in the household surveys, eliminating the assumption of representative agents (Cogneau and Robillard, 2000; Cockburn, 2001). The method, also referred to as a multi-households CGE modelling, is appropriate in analyzing the price effects and the first-order approximation of welfare impacts attributed to macroeconomic shock. However, it seems to be technically limited to account for micro-econometric behaviour specifications of households in order to account for the reallocation and endowment effects after the shock.

This limitation is corrected in the layered methods, that is, the “top-down” and the “top-down/bottom-up” approaches, in which the macro- and micro components are solved sequentially. In the “top-down” approach the macro-model is solved first and provides prices and macro variables to the micro-model. The approach has the advantage of being able to perform micro-econometric behaviour modelling and also integrates more richness and heterogeneity in the distributional impact analysis. Its disadvantage lies on the lack of feed-back from the micro- to the macro- component; that is, a lack of heterogeneity in the determination of prices and quantities from the macro-module. Results from this model should be interpreted as a first-round (prices and quantities) distributive impact analysis.

The “top-down/bottom-up” approach (Savard, 2005; Essama-Nsaah 2007) corrects for the lack of feed-back from the micro-component. The macro- and micro- models are run sequentially until the two produce consistent results. The “top-down/bottom-up” method is a promising avenue for macro-micro modelling although the complexity of its procedure does not always insure a satisfactory convergence.

The micro-simulation model developed in this paper follows Ravallion and Lokshin (2004) and Ganuza et al. (2002) in accounting for both prices and reallocation effects of shocks. It takes CGE results on the employment and unemployment variables and on the return to factors as inputs.

Our model is based on the individuals' regular income data gathered from the 2000 income and expenditure survey (IES), and the 2000 September labor force survey (LFS) . First, the two surveys based on the same sample of surveyed households are merged in a single database. As we import changes in prices (factors and consumption) and macro-variables (employment and unemployment) from the CGE model, we do not attempt to reconcile the macro (or the SAM) and the household (or the survey) data. Then, the eighteen categories of individual regular revenues items encountered in the IES 2000 are grouped into three categories, i.e. wage, profit and transfer. The base year households' regular revenues and poverty indicators are computed as, the former are proxies for the household's welfare. First, the micro-simulation model proceeds by estimating the shadow wages of unemployed workers and non economically active individuals. Second, the CGE model changes in the labour market variables (employment and unemployment) are replicated into the micro-simulation model by randomly selecting current workers that remain employed when the employment falls or the current unemployed individuals becoming employed when the employment increases, that is, the unemployment decreases. Third, the changes in wage rates are then assigned to employed individuals and the labour earnings are aggregated at the household level. Fourth, changes in the return to capital and the economy-wide prices are input from the CGE model and used in estimating changes in the households' capital and transfer revenues respectively. Sixth, the total regular earnings are computed for the household as are the new poverty indicators.

3. THE ECONOMIC STRUCTURE OF SOUTH AFRICA

CGE models require the use of a SAM which is a consistent quantitative macroeconomic data framework presented in a square matrix and representing the flows between different sectors, agents and institutions within an economy during a given period. The procedure of building an energy focused SAM for South Africa (E-SAMSA) brings together the supply and use tables (SU-tables) and the integrated economic accounts (IEA), both for the year 2000 in a single framework. This is the standard SAM. An appropriate and coherent presentation of the SAM's factor payments and labour market required the use of additional information from the household surveys. The ones used were the Income and Expenditure Survey (IES) and the Labour Force Survey (LFS) for the year 2000. Details of the procedures followed are documented in Fofana *et al.* (2008b).

The resulting E-SAMSA for the year 2000 is a detailed database that brings together in a single framework information on the South African economy from various sources. The SAM's industries and commodities are kept as disaggregated as possible in order to better track the multiple channels by which the economy might be impacted by oil price shocks. The E-SAMSA presents 7 productive factors, 4 types of labour and 3 capital categories. Two criteria are used to distinguish the E-SAMSA's workers, namely, the residential area (urban and rural) and the skill category (high skilled and lower skilled). The capital factor is separated into agriculture capital, private non agriculture capital, and public non agriculture capital. Six institutional accounts are presented in the E-SAMSA consisting of 2 household categories (urban and rural), 2 firms (financial and non financial), government, and the rest of the world. There are 7 taxes and transfer accounts. The SAM accounts for 95 activities including 1 aggregate agriculture activity, 4 mining activities (including one crude oil represented by a domestic production of synthetic fuel), 80 industries (with one aggregate petroleum industry that combines synthetic fuel and refined oil industries) and 10 services (including one aggregate general government service). The commodity account presents the same decomposition. Finally, the 95 commodities are then clustered into 12 groups of consumption by purpose for each urban and rural household category.

The top thirty industries in terms of sectoral contribution derived from the 2000 SAM are listed in Table 1. It is seen that *General Government* is the biggest contributor. *Petroleum*

industry contributed 2.2% to sectoral output in 2000 while *crude oil* industry contributed 0.7%. These rank 14th and 30th respectively out of the 95 sectors in the 2000 SAM.

Table 1: Sectoral contribution and ranking (2000)

SAM industries	Value	Share	Rank	SAM industries	Value	Share	Rank
General Government	181030.000	11.1%	1	Health and social work	31250.327	1.9%	16
Trade	163168.739	10.0%	2	Gold	29913.240	1.8%	17
Insurance	133263.707	8.2%	3	Other construction	28509.017	1.8%	18
Transport services	91299.104	5.6%	4	Beverages and tobacco	28325.774	1.7%	19
Real estate	71249.138	4.4%	5	Accommodation	24140.163	1.5%	20
Communications	53470.829	3.3%	6	Non-ferrous metals	20577.918	1.3%	21
Agriculture	53402.377	3.3%	7	Coal	20176.321	1.2%	22
Other mining	52489.393	3.2%	8	Meat	18478.170	1.1%	23
Activities/ services	48612.630	3.0%	9	Publishing	13011.243	0.8%	24
Buildings	47346.940	2.9%	10	Motor vehicle parts	12827.201	0.8%	25
Motor vehicles	45069.576	2.8%	11	Fabricated metal	12772.062	0.8%	26
Business activities	42511.939	2.6%	12	Primary plastics	11818.868	0.7%	27
Iron and steel	37278.468	2.3%	13	Paper	11517.182	0.7%	28
Petroleum products	36038.373	2.2%	14	Plastic	11090.108	0.7%	29
Electricity	31257.301	1.9%	15	Crude oil	10907.804	0.7%	30

Imports of oil and oil products were estimated to be R 10,273 millions. This represented roughly 5.3 percent of total imports in South Africa for the year 2000 (Table 2). Despite a positive trade balance value, South Africa recorded a deficit of R 2,317 million on its balance of payments (BoP) in 2000[7]. The deficit on the BoP corresponded to 1.1 percent of exports and 0.3 percent of GDP. The coverage ratio (ratio of total exports to total imports) is estimated to be 1.13.

Table 2: Import value for selected products (year 2000)

SAM industries	Value (c.i.f.)	Share (%)	SAM industries	Value (c.i.f.)	Share (%)
Motor vehicles parts	18,277	9.5	Communications	3,458	1.8
Radio and television products	13,147	6.8	Other manufacturing	2,837	1.5
Motor vehicles	10,609	5.5	Pumps	2,618	1.4
Other mining products	**7,814**	**4.0**	Mining machinery	2,551	1.3
Office machinery	7,719	4.0	**Petroleum products**	**2,459**	**1.3**
Other transport products	7,703	4.0	Other fabricated metal products	2,437	1.3
Optical instruments	6,396	3.3	Iron and steel products	2,331	1.2
Transport services	6,157	3.2	Other services / activities	2,316	1.2
Other special machinery	6,015	3.1	Other business services	2,263	1.2
Basic chemical products	5,993	3.1	Plastic products	2,240	1.2

[7] Essentially, this is due to the capital (dividend, interest, etc.) payments to the rest of the world that surpass the capital revenue from the rest of the world in year 2000.

Pharmaceutical products	5,367	2.8	Paper products	2,213	1.1
Accommodation	4,372	2.3	Textile products	2,123	1.1
Non-ferrous metals	4,206	2.2	Insurance services	1,942	1.0
Primary plastic products	4,114	2.1	Electricity apparatus	1,925	1.0
Other chemical products	4,108	2.1	Machine-tools	1,905	1.0
Agricultural products	3,494	1.8	Other products	41,977	22
All				**193,084**	**100**

Source: Complied using the SU-tables; Final supply and use tables, 2000: an input-output framework/Statistics South Africa; Statistics South Africa, 2003.

South Africa has a well-developed synthetic fuels industry facilitated by the country's abundance of coal resources and offshore natural gas. These permit South Africa to meet 35 to 40 percent of its domestic liquid petroleum requirements while 14 percent is exported. Thus, the country presented a coverage ratio of oil and oil products of 0.8 in the year 2000 which is relatively high for a net oil-importing country. Petroleum was among the most export oriented industries in 2000 (Table 3). Results, discussed below, depend strongly on both import and export structures of oil and oil products in the economy.

Table 3: Export value for selected products (year 2000)

SAM industries	Value (c.i.f.)	Share (%)	SAM industries	Value (c.i.f.)	Share (%)
Other mining products	33234	15.3	Other transport products	2701	1.2
Gold and uranium ore products	25188	11.6	Furniture	2585	1.2
Iron and steel products	17948	8.2	Communications	2419	1.1
Transport services	12637	5.8	Wood products	1996	0.9
Motor vehicles	9262	4.3	Other manufacturing	1988	0.9
Non-ferrous metals	8661	4.0	Sugar products	1772	0.8
Coal and lignite products	8524	3.9	Other special machinery	1771	0.8
Petroleum products	**8341**	**3.8**	Radio and television products	1700	0.8
Basic chemical products	6798	3.1	Primary plastic products	1671	0.8
Insurance services	6517	3.0	Other chemical products	1594	0.7
Agricultural products	6388	2.9	Jewellery	1584	0.7
Accommodation	6269	2.9	Fruit and vegetables products	1574	0.7
Paper products	5527	2.5	Other business services	1394	0.6
Beverages and tobacco products	2968	1.4	Other services / activities	1365	0.6
Motor vehicles parts	2910	1.3	Fish products	1271	0.6
General machinery	2816	1.3	Other products	191373	12
All				**217,570**	**100**

Source: Complied using the SU-tables; Final supply and use tables, 2000: an input-output framework/Statistics South Africa; Statistics South Africa, 2003

Oil intensity of an industry can be measured as oil and oil products input cost per unit of value added. The oil intensity ratio is computed for the aggregate industries recorded in the Input-Output (IO) table for the year 2000[8] (Table 4). It shows that "*primary plastic*" is largely the most oil input intensive industry in South Africa. The industry's oil input cost per unit of

[8] Final supply and use tables, 2000: an input-output framework/Statistics South Africa; Statistics South Africa, 2003.

value added is estimated at 0.5. For simplicity, we focus on the top-ten and the bottom-ten oil input intensive industries after ranking them from the most to the least oil input intensity.

The top-ten group – referred to as *high intensive oil input industries* - have an oil input cost per unit of value added greater than 0.1, with an average of 0.2 for the entire group (Table 4). This group contributes 11 per cent of the total value added and accounts for half (50 per cent) of the total oil input cost. When we use the share of oil bill in total energy input – considering the principal sources of energy in South Africa (that is, coal, petroleum, and electricity) – as an indicator of inter-fuel substitution possibility, we found that most industries of this group have a very limited ability to substitute other fuels for oil. The average share of oil and oil products input cost in the total energy input cost is 77 per cent. *Primary plastics*, *Transport services*, and *Agriculture* are the most vulnerable industries to high oil prices as they have the highest shares of oil input cost in total energy input cost. In contrast, *Non-ferrous metal*, *Tyres*, and *Gears* industries are more amenable to inter-fuel substitution possibilities as their average oil shares in energy are relatively low.

The bottom-ten groups – or *low intensive oil input industries* – presents an oil input cost lower than 0.01 per unit of value added (Table 4). They contribute 17 per cent of the country's value added and account for 2 per cent of the total oil input cost. The average oil intensity is very low as well as the share of oil in total energy input for this group of industries.

Table 4: Industry Energy Profile of South Africa in year 2000

	Value added		**Oil**		**All energy**		**Oil intensity**	**Share of oil in total energy**
	Value	***Share***	**Value**	***Share***	**Value**	***Share***		
High intensive oil-input industries								
Primary plastics	3,401	*0.4*	1 600	*4.8*	1 720	*2.6*	0.471	93.0
Paints	1,316	*0.1*	279	*0.8*	359	*0.5*	0.212	77.7
Transport services	49,729	*5.6*	9 728	*29.3*	10 998	*16.4*	0.196	88.4
Tyres	1,555	*0.2*	241	*0.7*	485	*0.7*	0.155	49.7
Pumps	638	*0.1*	91	*0.3*	113	*0.2*	0.142	80.2
Fertilizers	1,805	*0.2*	248	*0.7*	303	*0.5*	0.138	81.9
Non-ferrous metals	8,180	*0.9*	1 105	*3.3*	3 678	*5.5*	0.135	30.0
Gears	307	*0.0*	38	*0.1*	66	*0.1*	0.124	57.7
Basic chemicals	3,215	*0.4*	385	*1.2*	473	*0.7*	0.12	81.4
Agriculture	26,953	*3.0*	2 765	*8.3*	3 206	*4.8*	0.103	86.3
All	**97,100**	***10.9***	**16 480**	***49.6***	**21 401**	***32.0***	**0.17**	**77.0**
Low intensive oil-input industries								
Sugar	1,639	*0.2*	10	*0.0*	60	*0.1*	0.006	17.2
Electricity	20,469	*2.3*	126	*0.4*	6 130	*9.2*	0.006	2.1
Other paper	1,599	*0.2*	8	*0.0*	14	*0.0*	0.005	58.2
Containers of paper	2,266	*0.3*	11	*0.0*	47	*0.1*	0.005	22.5

Insurance	85,759	*9.7*	388	*1.2*	933	*1.4*	0.005	41.6
Beverages and tobacco	21,461	*2.4*	90	*0.3*	231	*0.3*	0.004	38.8
Wearing apparel	4,965	*0.6*	20	*0.1*	59	*0.1*	0.004	34.2
Publishing	6,404	*0.7*	21	*0.1*	71	*0.1*	0.003	28.9
Wire and cable	1,455	*0.2*	2	*0.0*	3	*0.0*	0.001	53.7
Other food	2,545	*0.3*	2	*0.0*	6	*0.0*	0.001	35.3
All	**148,563**	***16.7***	**678**	***2.0***	**7 555**	***11.3***	**0.005**	**9.0**
Other industries	642,394	*72.4*	16 094	*48.4*	37 982	*56.7*	0.025	42.4
All South Africa	**888,057**	***100.0***	**33,252**	***100.0***	**66,938**	***100.0***	**0.037**	**49.7**

Source: Complied using the SU-tables; Final supply and use tables, 2000: an input-output framework/Statistics South Africa; Statistics South Africa, 2003.

The electricity sector is among the least oil input intense sectors in South Africa with a share of oil in the total energy input of 2 per cent and an oil intensity of 0.006 per cent (Table 4). It is highly intensive in coal which represents more than 70 per cent of the sectors' energy input cost. In contrast, transport sector is intensive in oil with an oil intensity of 0.2 ranking behind the primary plastics and, the paints industry (Table 4). With a high share of oil input cost in energy input cost, large-scale fuel substitution is less likely to occur in the transport sector without substantial financial support from the Government. Therefore, high petroleum-products prices are expected to impact more on the cost of transport services and primary plastics.

4. SIMULATION SCENARIO AND RESULTS

The study experiments with an increase of international (import and export) oil and oil products prices under alternative government policy responses. Concretely, it simulates a sustained increase of hundred percent of the prices of crude oil and petroleum oil imported by South Africa. The increase is equivalent to an additional US $20 cost to oil and oil products prices as compared to their values in the year 2000. The price of crude oil was set at US $21.70 in December 2000 and had more than doubled by October 2004 to US $44.31 (Energy Information Administration, 2007)[9]. It has been above this value since February 2005. Our analysis should be taken as giving a short term perspective of the impact of recent oil price shocks. Two scenarios are tested in the study. They are determined by the government response to the oil shock.

[9] http://tonto.eia.doe.gov/dnav/pet/pet_pri_wco_k_w.htm

The first scenario assumes that the doubling of the prices of crude oil and petroleum products imported by South Africa is fully transmitted to end-users (consumers and producers) through an increase of the purchasing prices of petroleum products. Therefore, the current intervention of the government in the oil market is maintained. The scenario is referred to as *the floating price scenario*.

The alternative scenario or *the fixed price scenario*, supposes that the government is willing to intervene and control for the increase of the purchasing prices of petroleum products in order to protect consumers and producers. Thus, it decides to fully compensate the increase through the price subsidy mechanism. The scenario is translated into a simulation in the model by fixing the purchaser prices of petroleum products and introducing a price subsidy mechanism that compensates for a doubling of import prices of crude and petroleum products. In this scenario, the price subsidy is applicable to all petroleum products regardless of final use.

In scenario 1, the increase of the international prices of imported oil and petroleum products increases the domestic prices and reduces the imports of oil and petroleum products. Assuming an inelastic substitution between imported and locally produced oil[10], imports of crude oil and petroleum products fall by 26.8 and 25.6 percent, respectively. The import bill increases as the fall in volumes is less significant than the increase in prices. Assuming that the South African economy faces a foreign reserve constraint in the sense that there are no spare reserves to spend or that it faces constraints on external borrowing (represented by a fixed current account balance in the model), the increase of the import bill puts downward pressure on the real exchange rate.

Under the hypothesis of a low export demand constraint from the rest of the world[11], the increase of export prices boosts the export of petroleum products by 19.3 percent. In a situation where the economy faces a shortage of foreign exchange reserves and external borrowing constraints, the increase in prices of petroleum products puts an upward pressure on the exchange rate. The increase in export value (50 percent increase in price and 19.3

[10] It is not easy to substitute imported crude oil by locally produced crude fuel (synthetic fuel) as well as it is not easy to substitute imported refined oil by locally produced refined oil as the country's production capacity is limited. The value of the elasticity of substitution is fixed at 0.7 for oil products and this is three times lower than that for non-oil products which is fixed at 2.1.

[11] As the international market faces a shortage of petroleum product supply with a sustained demand, we fixed the elasticity of export demand to 21, ten time higher than of non oil products at 2.1.

percent increase in volume) appears to largely compensate for the increase in the oil import bill (100 percent increase in prices and an average of 26 percent increase in volume). Consequently, the real exchange rate decreases in order to re-equilibrate the current account balance[12]. As the foreign average price is assumed exogenous and the nominal exchange rate is also fixed, domestic average price increases of 7.0 percent leads to a decline in the real exchange rate. The fall of the real exchange rate increases imports of non oil products while exports of non oil product drops. Overall, imports fall by 1.6 percent while exports fall by 2.5 percent respectively (Table 5).

The increase of domestic prices induced by high oil prices increases input costs and reduces business profits while leading to a deterioration in consumers' purchasing power (Table 5). Consequently, household consumption drops by 0.6 percent and investment by 5.5 percent. As a result, gross domestic production falls by 0.5 percent. The fall of investment is likely to exacerbate the drop in GDP in the medium and long term.

In the second scenario the consumption prices of petroleum products are fixed at their initial level. This implies that the increase of oil and oil products prices is compensated through a full subsidy by the government. The increase of prices for imported oil and oil products in a context of fixed domestic petroleum prices puts less pressure on the real exchange rate appreciation (depreciation of the national currency) as the fixed domestic prices for petroleum products reduces imports. On the other hand, the pressure for real exchange rate depreciation (appreciation of the national currency) induced by higher exports is also reduced in a context of fixed oil domestic prices. More importantly, the changes in economic variables under this scenario are mainly driven by the substantial fall in the economy's saving/investment capacity when compared to the price floatation scenario. The government's control for petroleum domestic prices exacerbates its deficit. This in turn feeds into aggregate savings which fall by 13.2 percent compared to 3.6 percent in the previous scenario (Table 5). As a consequence, investment drops by 15.5 percent (5.5 percent in the previous scenario) and GDP falls by 3.1 percent (0.5 percent in the previous scenario).

[12] The real exchange rate is defined as the ratio of foreign average price (converted in local currency by the exchange rate) to domestic average price.

Table 5: Comparison of change in macroeconomic variables (in percent)

	Scenario 1	Scenario 2
Price index	7.0	8.2
Imports	-1.6	-2.5
Exports	-2.6	-2.8
Unemployment rate*	1.4	2.1
Average wage	5.9	7.7
Return to capital	3.1	6.7
Consumer price index	5.4	4.6
Consumption	-0.6	1.3
Saving	-3.6	-13.2
Investment average price	2.2	1.0
Investment	-5.5	-15.5
Gross domestic production	-0.5	-3.1

Source: Compilation from oil price shock results (setting prices scenario)
Note: Variations computed as percent changes;
*Except for unemployment rate expressed as percentage point changes.

Imports drop more when compared to scenario 1 which depreciated more the real exchange rate (appreciate more the national currency). The factor prices increase (decrease less in real terms) compared to the previous scenario. This is particularly so for the return to capital. Consumer prices also increase less (decrease more in real term). Consequently, consumption increases by 1.3 percent while it decreased by 0.6 percent in the previous scenario (Table 5).

Tables 6 presents the output effects for the industries. In scenario 1, most of the industries with high oil input intensities relative to value added and a high share of oil in energy input cost witness a substantial fall in their output as compared to other industries. The incidence is most significant on the output of "*Petroleum products*". It is joined by Heavy manufacturing and Light manufacturing that account for a large share of the investment demand and the mining sector which faces a decline of its exports due to higher depreciation of the real exchange rate. Finally industries such as "*Agriculture*" and "*Food Manufacturing*" also show an important drop of their output. This is because of high income elasticities of household consumption for these products.

The output effects of the oil price shock in scenario 2 are driven by the impacts on investment. As demand for investment products decreases more because of lower savings (Table 5), industries whose products are used intensively in investment experience substantial reductions in their demand, and consequently, their output. Heavy manufacturing with the

highest share of its product in total investment demand experiences the highest decline in output, followed by the mining sector which faces a decline of its exports due to higher depreciation of the real exchange rate (Table 6). Light manufacturing, agriculture, and food manufacturing also face a reduction of their output.

Table 6: Comparison of changes in industrial output (in percent)

	Scenario 1	Scenario 2
Crude Fuel	-1.2	9.6
Electricity	4.6	-0.6
Coal	5.1	3.7
Services	-1.0	-0.4
Food Manufacturing	-1.3	-0.3
Agriculture	-1.8	-1.1
Light Manufacturing	-2.3	-2.3
Mining	-3.	-3.5
Heavy Manufacturing	-3.2	-6.7
Petroleum	-10.3	2.4

Synthetic fuel is the biggest winner from the oil price shock in this scenarios. Its output growth is 9.66.7 percent when the government subsidises the domestic fuel prices. The output of electricity, which is a petroleum substitute, increases in the first scenario but declines in the second scenario. One reason for the decline is that petroleum production has now become less expensive. Another reason why electricity output falls is because the demand for its product from manufacturing industries falls. However, coal, which is the other petroleum substitute, experiences positive growth in both scenarios. The reason for this is because it not only benefits by being a petroleum substitute but also because of increased demand from the synthetic fuel industry (scenario 2). The output of the petroleum industry increases in the second scenario because its demand falls less relative to the first scenario. Private services are largely in the group of industries that are least negatively impacted on by the oil price shock, irrespective of which scenario is run. Indeed, most of the private services have a high share of final consumption in the total demand with income inelastic demand for their services.

Value added prices increase for most of the industries except heavy manufacturing industries that observe a substantial fall in their output. Table 7 shows a significant increase in the wage gap between urban and rural high skilled workers in scenario 2 relative to the first scenario. Both urban and rural high skilled workers witness a relative increase in their wage rates, in particular for rural high skilled workers as they rely less on contracting manufacturing industries and more on less contracting agriculture and services. Unemployment rates

increase more among low skilled workers in urban areas (Table 7) as they are more intensively used in the contracting industries (i.e. heavy manufacturing and mining industries). The return to capital increases by 2.7 percent in the second scenario compared to the first scenario where it falls by 0.1 percent.

Table 7: Percentage change in wage and unemployment rates (scenarios 1 and 2)

	High skilled		Low skilled	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Urban				
Real wage rate	-3.8	-1.8	0.0	0.0
Unemployment rate	0.0	0.0	7.9	10.3
Rural				
Real wage rate	-4.1	-4.1	-4.1	-4.1
Unemployment rate	0.0	0.0	0.0	0.0

Table 8 shows that the increase of oil prices is in favour of rural households in both scenarios. This result is driven by the higher wage paid to rural skilled workers, and the lower reduction in the real return to agriculture capital (Table 8). Its distributional impacts among individual households is likely to be less pro-poor as it benefits more high skilled labour and capital factors. These are factors that are, in general, owned by the non-poor individuals.

Table 8: Welfare effects comparison (Scenarios 1 and 2)

	Disposal Income		Consumer Price Index		Welfare	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Urban households	4.4	5.8	5.3	4.6	-0.4	0.6
Rural households	5.0	7.3	5.5	4.6	-0.1	1.8
ALL	4.5	6.0	5.4	4.6	-0.3	0.8

Source: Compilation from oil price shock results (setting prices scenario)
Note: Equivalent variation of gross income

Government income increases by 4.3 percent in scenario 1. The increase in revenue is induced primarily by an increase of the two main sources of revenue (direct taxes and indirect taxes on local-commodities) although taxes on production and on imported goods also increase. Government revenue falls substantially by 6.2 percent in scenario 2 compared to an increase of 4.3 percent experienced in scenario 1. The fall in government revenue is essentially induced by the drop of taxes and levies on local commodities. Of lesser importance is the contribution of taxes on imported goods to this decline. As a consequence of the government revenue decline, the public deficit declines by 22.9 percent compared to 9.1 percent in the first scenario (Table 9).

Table 9: Fiscal effects (scenarios 1 and 2)

		Tax on imported goods	Tax on local goods	Tax on production	Tax on income	Capital revenues	Transfers	**ALL**	Public expenses	Transfer	Public deficit
Share in percent		7.4	23.4	7.8	46.7	8.6	6.1	**100**	64.2	63.9	-28.1
Change in real terms	Scenario 1	2.1	4.2	3.8	4.6	4.2	7	**4.3**	6.2	7.0	9.1
	Scenario 2	-11.2	-25.0	4.3	7.2	7.7	8.2	**-6.2**	7.1	8.2	22.9

Source: Compilation from the 2000 Energy-SAM and oil price shock results (setting prices scenario)

In addition to its income effects, the oil price shock influences household welfare by changing consumer prices. The prices of commodities purchased by households is a weighted average of domestic and import prices, where the weight is the share of domestic and import demands in the global demand. The changes in consumption prices follow a similar pattern for the two scenarios although there is a more pronounced reduction in scenario 2 (Table 10). The consumption price of petroleum goods is kept constant in the second scenario compared to the first scenario when it increases by 31.0 percent. While non-oil import prices are kept constant, domestic prices increase for most of the products. As a consequence, purchaser prices increase for most of the commodities. The increase is relatively significant for energy products for which domestic prices and import price for oil and petroleum record important increases, and for low oil import-substituting commodities which do not benefit from the relatively low import prices (Table 10). Heavy and light manufacturing sectors experience the lowest increase in purchaser prices. This is attributable to the observation that they have the highest import penetration rates. They are followed by manufactured food, private services, agriculture products and mining products.

Table 10: Comparison of changes in purchaser prices (in percent)

	Scenario 1	**Scenario 2**
Crude Oil	54.5	62.6
Electricity	13.4	6.6
Coal	10.4	9.6
Services	5.2	5.9
Food Manufacturing	4.1	5.0
Agriculture	4.7	5.2
Light Manufacturing	3.1	2.8
Mining	2.8	2.8
Heavy Manufacturing	2.3	1.3
Petroleum	31.0	0.0

Urban and rural households are affected differently by the price effects according to their consumption patterns. In this respect, we note that consumption prices increase for all households. In real terms, consumption prices decrease as the economy-wide price index increases by more in scenario 1. In contrast to the income effect which results in a fall of households' real income, the price effect of the oil price shock is beneficial to households. However, the price increases (reduction in real terms) are more important (less important) than the income increases (decrease in real terms) so that the welfare effect is negative for all households in this scenario (Table 11). If the income effect is in favour of rural households because of the low share of factor income in their revenue, the price effect is pro-urban as households in this area consume more manufactured goods which record the lowest price increase (or the highest real price decrease). Finally, urban and rural households witness similar welfare reductions as measured in terms of equivalent variation of their gross income.

Table 11: Welfare effects comparison (Scenarios 1 and 2)

	Disposal Income		Consumer Price Index		Welfare	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Urban households	0.8	1.7	2.3	1.4	-0.7	0.2
Rural households	1.2	2.7	2.6	1.5	-0.7	0.9
ALL	0.8	1.9	2.4	1.4	-0.7	0.3

Note: Equivalent variation of gross income

The welfare effects become positive when international oil prices increase while domestic prices for petroleum products are fixed (scenario 2) as shown in Table 11. Consumers in both urban and rural areas benefit from a higher income increase and a lower price decrease relative to the price floatation scenario. As in the scenario of floating petroleum prices, the price effects are slightly in favour of urban households while the income effects are in favour of rural households. As the changes in income effects dominate those in price effects, rural households are better off in this scenario (Table 11).

5. SENSITIVITY ANALYSIS: HIGHER PETROLEUM PRICE INCREASES

In this section we perform a sensitivity test to analyse how the increase of international price of petroleum products impacts the economy and households' welfare in South Africa. The previous scenarios performed a doubling of crude oil prices alongside an increase of 50 percent of petroleum prices (Test A) with and without price subsidisation. The new tests consists of doubling import and export prices of both crude oil and petroleum products (Test B). The performances of the economy deteriorates significantly when we allow export prices

to increase to match with the import prices for petroleum products. This is due to higher inflationary pressures on the economy (Table 12).

Table 12: Percentage change in macroeconomic variables

	Scenario 1		Scenario 2	
	Test A	**Test B**	**Test A**	**Test B**
Price index	7.0	10.2	8.2	12.5
Imports	-1.6	-0.4	-2.5	-1.7
Exports	-2.6	-3.2	-2.8	-3.7
Unemployment rate*	1.4	1.7	2.1	2.6
Average wage	5.9	8.8	7.7	11.9
Return to capital	3.1	5.9	6.7	11.6
Consumer price index	5.4	7.9	4.6	7.3
Consumption	-0.6	-0.4	1.3	2.3
Saving	-3.6	-1.8	-13.2	-15.3
Investment average price	2.2	3.6	1.0	2.0
Investment	-5.5	-5.0	-15.5	-19.0
Gross domestic production	-0.5	-0.4	-3.1	-4.2

Source: Compilation from oil price shock results (setting prices scenario)
Note: * Change in point of percentage;
Test A: 100 % increase of international (import and export) prices of crude oil, and 50% increase of international (import and export) prices of petroleum products
Test B: 100 % increase of international (import and export) prices of crude oil, and 100% increase of international (import and export) prices of petroleum products

Focusing on scenario 1 where prices are allowed to float, households are better off under this scenario in terms of gross income compared to the earlier one. This is especially so for rural households. When we look at the cost of living, however, households are now worse off as the consumer price index increase is higher. However, the increase in income is sufficient to outweigh the cost of living increase to leave households slightly better off under this scenario when compared to the previous shock (Table 13). In contrast, households are better off and the welfare gap between urban and rural households increases in favour of the latter when government subsidises prices (Table 13).

Table 13: Comparing welfare effects of higher increase of petroleum price (in percent)

	Scenario 1		Scenario 2	
	Test A	Test B	Test A	Test B
Urban households	-0.4	-0.2	0.6	1.1
Rural households	-0.1	0.2	1.8	2.9
ALL	-0.3	-0.2	0.8	1.4

Source: Compilation from oil price shock results (setting prices scenario)
Note: Equivalent variation of gross income

- *Poverty*

Using a poverty rate of two US Dollars per day we use the microsimulation model, adjusted by the CGE results to calculate FGT and Gini measures. Overall poverty and inequality increase due to the simulations as shown in Table 14. Urban poverty increases more than rural poverty in general. Scenario 1 increases poverty by more than scenario 2 on average although there are some differences when one looks at different racial groups.

Table 14: Differences between FGT and Gini indices (%)

	FGT0		FGT1		FGT2		Gini	
	Sc. 1	Sc. 2	Sc. 1	Sc. 2	Sc. 1	Sc. 2	Sc. 1	Sc. 2
South Africa	**0.4**	**0.1***	**0.6**	**0.4**	**0.6**	**0.6**	**0.2**	**0.3**
Urban	0.5	0.4*	0.8	0.9	0.8	1.1	0.3	0.4
Rural	0.2*	0.2*	0.3	-0.3	0.4	0.1*	0.1*	0.7
Black	0.3	0.0	0.6	0.3	0.6	0.5	0.3	0.2*
Coloured	1.1	0.9*	0.9	0.9	0.9	0.8	0.4	0.9
Asian	0.7*	1.2*	0.6*	1.6	0.4*	1.6	0.5*	0.5
White	0.1*	0.5	0.1*	0.2	0.1	0.5	0.1*	0.4

Note: Sc. = Scenario; * Non significant at 95% of statistical confident

6. CONCLUSION

Due to South Africa's dependence on imported oil, notably crude oil, recent oil price increases are likely to have serious negative consequences for government revenues, international trade, production, factor markets, household incomes and consumer price structure. This paper examines the effects of alternative policy responses that government may use to counter these impacts. Two scenarios are tested in the study. The first scenario, referred to as the *"Floating Price Scenario"* assumes that the doubling of the prices of crude oil and petroleum products imported is fully passed onto end-users through an increase of the purchasing prices of petroleum products. The second scenario assumes that government fully compensates the oil price increase through the price subsidy mechanism and is referred to as the "*Fixed Price Scenario*". To understand and quantify the impacts of these policy scenarios at the macro, meso and micro level, an Energy focused Computable General Equilibrium is used. The model specifies a number of structural features designed to reflect the characteristics of the South African economy. Distinguishing features of the model are its specification of energy supply and demand and the price setting method in the domestic oil market. Energy is disaggregated into crude oil, petroleum products, coal and electricity.

Our results suggest that GDP would fall by between 0.5 and 3.1 percent under the 2 scenarios. The impact on the government deficit varies widely between the two scenarios, ranging from a worsening of 9.1 to 22.9 percent. The real exchange rate depreciates more in the floatation

scenario. The mesoeconomic effects show important distributional impacts amongst industries. Coal, which is an alternative sources of energy, benefit under both scenarios while electricity, the other oil import substitute, only benefits under the *"Floating Price Scenario"* and synthetic fuels benefit under the *"Fixed Price Scenario"*. All other industries experience a fall of their production but with different magnitudes. Finally, the micro or household results vary widely. Factor prices decrease less in real terms under the "*Fixed Price Scenario*", especially for the return to capital. There is a significant increase in the wage gap between urban and rural high skilled workers under the "*Fixed Price Scenario*" when compared to the *"Floating Price Scenario"*. Both urban and rural high skilled workers witness a relative increase in their wage rates, in particular for rural high skilled workers as they rely less on contracting manufacturing industries and more on less contracting agriculture and services. In terms of household welfare, households experience reductions in standards of living when prices are allowed to float whereas they actually increase when oil prices are subsidised. This trend is also observed for poverty results. Further, urban poverty increases more than rural poverty.

The deterioration of the GDP in the short run is likely to be accentuated in the medium and long term as the saving/investment capacity of the economy declines. The positive welfare impacts, in particular in rural areas, noticed in the short run could hide anti-poor distributional impacts of the oil price shock. In fact, employment opportunities decline for low skilled workers while the wage rate for highly skilled labour and the return to capital increase. In the medium and long run, one would expect sectors with high return to capital to be less affected by the decline in investment so that income inequality and poverty would likely increase.

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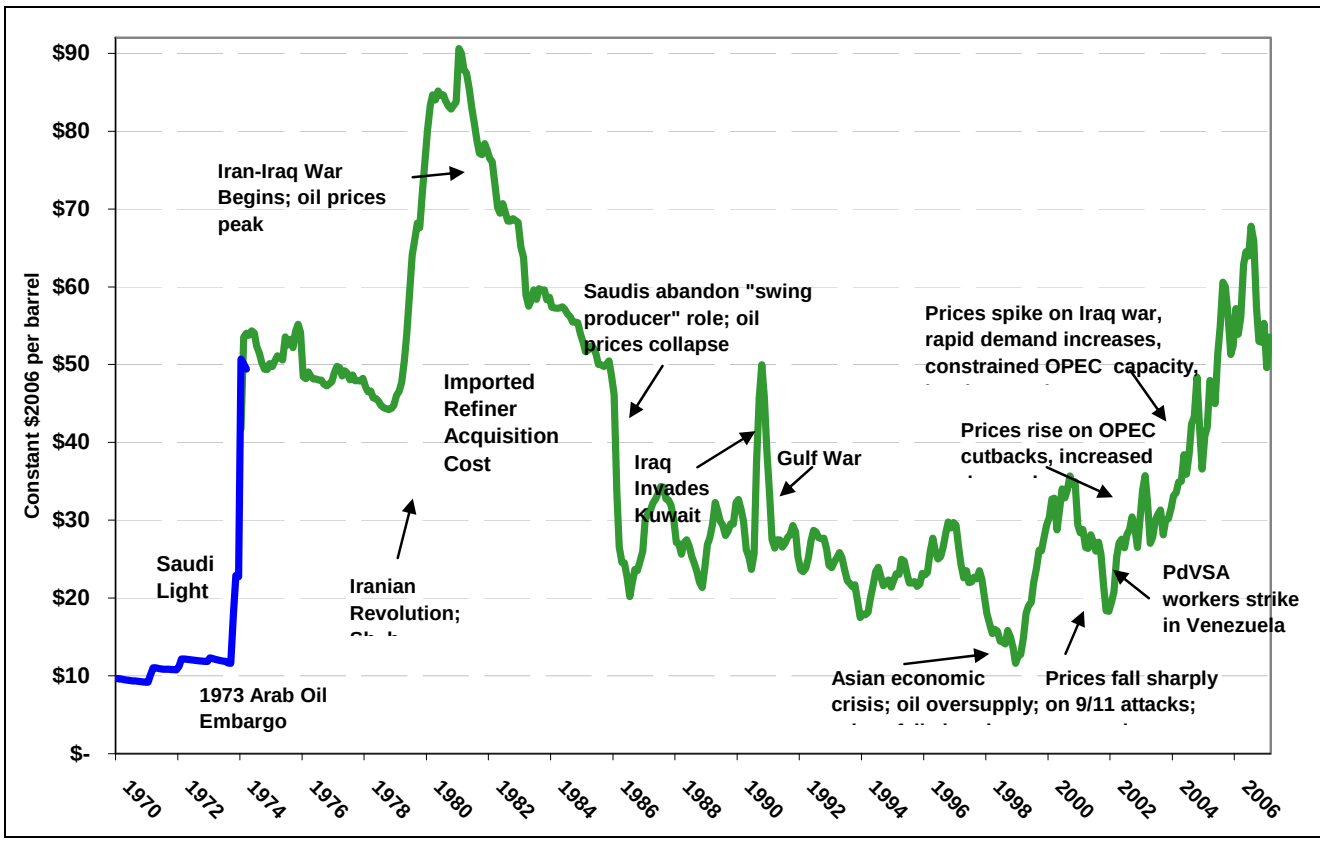
Annexure 1: Real World Oil prices 1970-2006 (US $2006 per barrel)



Annexure 2: Output effects in base year

Industry	Oil input intensity	Oil input share	DI/Q	C/Q	EX/Q	FCF/Q	STK/Q
Agriculture	4.7	38.4	71.1	28.3	10.2	0.0	-9.6
Coal	1.5	22.0	63.0	1.1	40.6	0.0	-4.7
Gold	0.5	3.9	0.0	0.0	86.0	0.0	14.0
Crude oil	12.0	6.4	100.0	0.0	0.0	0.0	0.0
other mining	1.3	16.2	42.6	0.0	64.1	0.0	-6.7
Meat	5.6	16.4	20.7	105.7	2.7	0.0	-29.2
Fish	1.6	16.3	9.9	90.9	36.8	0.0	-37.6
Fruit	1.1	14.9	11.0	99.3	20.3	0.0	-30.7
Oils	2.6	17.7	52.5	80.4	4.2	0.0	-37.0
Dairy	1.3	17.6	16.7	117.9	2.1	0.0	-36.7
Grain mills	1.2	15.0	24.3	105.4	2.6	0.0	-32.3
Animal feeds	1.9	19.8	99.8	10.2	0.6	0.0	-10.5
Bakeries	4.0	29.8	3.0	135.6	0.6	0.0	-39.1
Sugar	0.3	7.6	40.3	67.7	27.9	0.0	-35.9
Confectionery	0.8	14.6	6.1	115.5	8.7	0.0	-30.3
Other food	0.0	15.7	42.3	86.1	6.1	0.0	-34.5
Beverages and tobacco	0.4	17.3	12.3	114.1	6.1	0.0	-32.5

Textiles	0.8	19.6	86.3	6.9	11.8	0.0	-4.9
Textile articles	1.0	13.0	37.7	58.0	3.7	0.0	0.6
Carpets	4.2	27.0	62.0	36.0	8.7	0.0	-6.7
Other textiles	0.7	3.4	76.6	16.2	14.2	0.0	-7.1
Knitting mills	1.9	7.4	19.7	65.5	12.9	0.0	1.9
Wearing apparel	0.3	15.2	7.0	82.5	5.3	0.0	5.2
Leather	0.3	5.3	60.3	0.0	40.6	0.0	-0.9
Handbags	0.6	9.5	5.3	73.5	8.0	0.0	13.2
Footwear	0.5	22.0	10.6	85.6	1.5	0.0	2.3
Wood	0.4	15.8	78.7	1.4	17.2	0.2	2.5
Paper	0.7	16.6	75.8	0.0	35.8	0.0	-11.6
Containers of paper	0.2	10.0	80.1	0.0	2.1	0.0	17.8
Other paper	0.3	25.9	66.9	50.6	5.6	0.0	-23.2
Publishing	0.2	12.9	80.3	23.8	2.0	0.4	-6.5
Recorded media	4.6	39.2	32.9	49.5	10.1	0.0	7.5
Petroleum products	220.2	89.5	56.3	38.2	14.1	0.0	-8.7
Basic chemicals	5.7	36.2	70.7	0.6	35.2	0.0	**-6.5**
Fertilizers	6.8	36.4	79.1	0.6	14.9	0.0	5.4
Primary plastics	22.7	41.4	81.0	0.0	11.1	0.0	8.0
Pesticides	1.0	35.7	75.6	18.2	20.8	0.0	-14.6
Paints	10.8	34.6	85.0	0.0	3.8	0.0	11.2
Pharmaceuticals	2.0	9.4	53.7	46.9	4.1	0.0	-4.7
Soap	5.1	15.9	16.9	77.7	4.7	0.0	0.7
Other chemicals	4.6	20.9	69.5	12.0	13.6	0.0	**4.9**
Tyres	8.9	22.1	36.6	66.5	13.1	1.4	-17.6
Other rubber	1.0	17.5	86.5	2.5	10.6	0.0	0.4
Plastic	1.7	38.7	76.0	3.9	5.9	0.0	14.2
Glass	0.9	18.2	93.7	4.5	10.4	0.0	-8.6
Non-structural ceramics	1.4	24.5	71.4	10.6	2.7	0.0	15.3
Structural ceramics	2.2	19.3	92.9	0.0	3.4	0.4	3.3
Cement	1.0	12.3	86.9	0.0	3.4	0.0	9.7
Other non-metallic	1.1	15.8	83.8	0.0	10.3	0.0	**5.9**
Iron and steel	2.8	5.7	55.3	0.0	41.4	0.0	3.3

Note: DI = Input demand; Q = Absorption; C = Final consumption; X=Export, FCF= Fixed capital formation, STK=Change in stocks, Oil input intensity = Oil input value per unit of value added; Oil input share = Oil input value in total energy input value.

Annexure 2: Output effect in base year (continued)

Industry	Oil input intensity	Oil input share	DI/Q	C/Q	EX/Q	FCF/Q	STK/Q
Non-ferrous metals	6.1	13.4	59.0	0.0	34.6	0.0	6.4
Structural metal	0.4	20.5	65.3	0.0	12.8	24.6	-2.7
Treated metals	0.8	7.9	90.9	0.0	0.0	0.0	9.1
General hardware	1.4	3.7	64.5	23.2	18.1	1.7	-7.4
Fabricated metal	1.2	21.3	66.6	0.2	6.7	1.2	25.4
Engines	4.5	22.7	84.4	0.0	3.6	17.1	-5.1
Pumps	9.9	35.7	28.7	0.0	9.5	52.0	9.8
Gears	6.3	25.6	84.8	0.0	12.5	0.0	2.6
Lifting equipment	4.2	20.9	37.5	0.0	9.3	49.4	3.9
General machinery	1.3	20.0	39.3	0.0	51.7	19.2	-10.2
Agricultural machinery	5.3	40.4	37.8	0.0	6.1	60.6	**-4.4**
Machine-tools	0.6	7.6	26.8	0.0	8.6	65.3	-0.7
Mining machinery	1.2	30.1	43.5	0.0	13.0	44.7	-1.1
Food machinery	2.7	23.2	42.0	0.0	14.9	41.7	1.4
Special machinery	0.4	42.8	39.5	0.0	13.9	54.1	-7.5
Household appliances	1.8	30.1	14.5	79.9	4.4	15.9	-14.8
Office machinery	8.1	30.0	12.5	16.3	0.7	74.4	-3.9
Electric motors	4.7	34.9	13.8	0.0	12.1	76.0	-1.9
Electricity apparatus	0.7	22.4	62.2	3.0	7.5	24.1	3.2
Wire and cable	0.1	23.9	93.8	0.0	4.6	1.1	0.5
Accumulators	2.0	19.7	74.9	22.7	8.5	0.0	-6.2
Lighting equipment	0.9	19.4	79.4	22.3	6.0	2.6	-10.3
Electrical equipment	3.2	38.7	83.9	1.9	12.3	8.6	-6.8
Radio and television	0.7	23.7	30.4	11.4	7.8	45.0	5.4
Optical instruments	2.4	23.9	36.5	30.4	6.3	30.8	-3.9
Motor vehicles	1.4	43.9	25.6	27.5	15.2	23.6	8.1
Motor vehicle parts	0.5	24.1	74.1	7.3	7.5	0.0	11.1
Other Transport	0.8	17.3	46.7	5.2	20.3	25.9	1.9
Furniture	0.5	10.4	13.4	55.8	17.6	8.0	5.2
Jewellery	1.7	15.0	2.5	52.5	32.6	0.0	12.4
Other manufacturing	3.5	37.0	37.1	30.7	18.1	1.1	13.0
Electricity	0.3	0.9	65.6	35.7	2.9	0.0	-4.3
Water	0.6	3.0	81.1	22.7	0.0	0.0	-3.8
Buildings	2.8	40.4	31.3	0.0	0.1	59.3	9.2
Other construction	4.5	40.7	27.2	0.0	0.2	75.1	-2.5
Trade	0.9	25.7	64.2	26.2	1.2	0.0	8.4
Accommodation	0.3	7.1	21.2	59.0	25.1	0.0	-5.3
Transport services	**8.8**	**39.3**	**53.9**	**32.0**	**15.4**	**0.0**	**-1.2**
Communications	1.3	25.5	57.3	29.3	4.2	0.0	9.2
Insurance	0.2	18.5	53.2	32.5	5.1	0.0	9.2
Real estate	0.4	23.8	31.8	55.9	0.2	5.3	7.0
Business activities	1.2	41.2	77.2	4.3	2.6	0.8	15.1
General Government	0.5	32.9	5.8	92.3	0.0	0.0	1.9
Health and social work	1.8	30.1	6.0	79.8	1.0	0.0	13.2
Activities/ services	0.4	14.2	30.0	56.1	1.8	0.0	12.1
ALL	**4.3**	**39.0**	**46.2**	**34.7**	**14.5**	**13.2**	**-8.6**

Note: DI = Input demand; Q = Absorption; C = Final consumption; X=Export, FCF= Fixed capital formation, STK=Change in stocks, Oil input intensity = Oil input value per unit of value added; Oil input share = Oil input value in total energy input value.

Annexure 3: Factor effects

Industry	Value added price	Change in wage rates				Return to capital	Change in employment			
		Urban high skilled	Rural High skilled	Urban low skilled	Rural low skilled		Urban high skilled	Rural High skilled	Urban low skilled	Rural low skilled
Agriculture	-0.6	-0.6	-0.7	3.4	3.4	-2.6	-0.4	-0.4	-4.3	-4.3
Coal	**6.5**	**-0.6**	**-0.7**	**3.4**	**3.4**	**9**	**2**	**2**	**11.3**	**11.3**
Gold	1.1	-0.6	-0.7	3.4	3.4	-2.5	-0.4	0	-4.9	-4.9
Crude oil	**53.4**	**-0.6**	**-0.7**	**3.4**	**3.4**	**62.7**	**10.9**	**0**	**56.8**	**56.8**
other mining	-0.4	-0.6	-0.7	3.4	3.4	-2	-0.3	-0.3	-7.5	-7.5
Meat	-0.6	-0.6	-0.7	3.4	3.4	-4.6	-0.9	-0.9	-1.4	-1.4
Fish	0.2	-0.6	-0.7	3.4	3.4	-2.6	-0.4	-0.4	-6.4	-6.4
Fruit	1.1	-0.6	-0.7	3.4	3.4	-0.4	0.1	0.1	-4.6	-4.6
Oils	0.1	-0.6	-0.7	3.4	3.4	-2.9	-0.5	-0.5	-5	-5
Dairy	1.4	-0.6	-0.7	3.4	3.4	0.2	0.2	0.2	-3.7	-3.7
Grain mills	0.1	-0.6	-0.7	3.4	3.4	-0.8	0	0	-5.6	-5.6
Animal feeds	-1.3	-0.6	-0.7	3.4	3.4	-3.4	-0.6	-0.6	-8.2	-8.2
Bakeries	0.5	-0.6	-0.7	3.4	3.4	-2.6	-0.4	-0.4	-2.5	-2.5
Sugar	1.6	-0.6	-0.7	3.4	3.4	0.1	0.2	0.2	-5.3	-5.3
Confectionery	1.8	-0.6	-0.7	3.4	3.4	0.5	0.2	0.2	-3.6	-3.6
Other food	2.2	-0.6	-0.7	3.4	3.4	1.5	0.5	0.5	-4.2	-4.2
Beverages and tabacco	0.3	-0.6	-0.7	3.4	3.4	0.2	0.2	0.2	-6.1	-6.1
Textiles	1.9	-0.6	-0.7	3.4	3.4	-0.8	0	0	-5.1	-5.1
Textile articles	2	-0.6	-0.7	3.4	3.4	0.5	0.2	0.2	-2.9	-2.9
Carpets	0.6	-0.6	-0.7	3.4	3.4	-8.4	-1.7	-1.7	-3.3	-3.3
Other textiles	0.7	-0.6	-0.7	3.4	3.4	-7.8	-1.6	-1.6	-6.1	-6.1
Knitting mills	1.1	-0.6	-0.7	3.4	3.4	-7.4	0	0	-2.8	-2.8
Wearing apparel	2.5	-0.6	-0.7	3.4	3.4	3.5	0.9	0.9	-3.3	-3.3
Leather	0.6	-0.6	-0.7	3.4	3.4	-1.6	-0.2	0	-7.3	-7.3
Handbags	1.2	-0.6	-0.7	3.4	3.4	-0.2	0.1	0	-4.9	-4.9
Footwear	1.9	-0.6	-0.7	3.4	3.4	0.7	0.3	0	-4.1	-4.1
Wood	2	-0.6	-0.7	3.4	3.4	-0.1	0.1	0.1	-5.5	-5.5
Paper	0	-0.6	-0.7	3.4	3.4	-1.7	-0.2	0	-7.8	-7.8
Containers of paper	1.3	-0.6	-0.7	3.4	3.4	0.7	0.3	0	-5.3	-5.3
Other paper	1.4	-0.6	-0.7	3.4	3.4	0.8	0.3	0	-5.1	-5.1
Publishing	1.5	-0.6	-0.7	3.4	3.4	2.1	0.6	0.6	-5.1	-5.1
Recorded media	-0.7	-0.6	-0.7	3.4	3.4	-7.7	-1.5	-1.5	-6.2	-6.2
Petroleum products	-1.4	-0.6	-0.7	3.4	3.4	-1.8	-0.2	0	55.1	55.1
Basic chemicals	-2.5	-0.6	-0.7	3.4	3.4	-4.6	-0.8	-0.8	-6.3	-6.3
Fertilizers	-3.5	-0.6	-0.7	3.4	3.4	-6.3	-1.2	-1.2	-7.3	-7.3
Primary plastics	**-9**	**-0.6**	**-0.7**	**3.4**	**3.4**	**-15.2**	**-3.3**	**-3.3**	**-4**	**-4**
Pesticides	-0.3	-0.6	-0.7	3.4	3.4	-1.6	-0.2	0	-7.5	-7.5
Paints	-2.1	-0.6	-0.7	3.4	3.4	-7.1	-1.4	0	-1.2	-1.2
Pharmaceuticals	-1	-0.6	-0.7	3.4	3.4	-3.6	-0.6	0	-5.4	-5.4
Soap	-1.3	-0.6	-0.7	3.4	3.4	-4.6	-0.9	0	-3.1	-3.1
Other chemicals	-1.4	-0.6	-0.7	3.4	3.4	-4.9	-0.9	0	-4.6	-4.6
Tyres	**-1.9**	**-0.6**	**-0.7**	**3.4**	**3.4**	**-13.8**	**-2.9**	**0**	**-2.9**	**-2.9**
Other rubber	1.8	-0.6	-0.7	3.4	3.4	-1.1	-0.1	0	-4.5	-4.5
Plastic	1.7	-0.6	-0.7	3.4	3.4	-1.9	-0.3	-0.3	-4.1	-4.1
Glass	1.8	-0.6	-0.7	3.4	3.4	-1.1	-0.1	0	-5	-5
Non-structural ceramics	-1.2	-0.6	-0.7	3.4	3.4	-2.9	-0.5	-0.5	-9	-9
Structural ceramics	-4.5	-0.6	-0.7	3.4	3.4	-8.2	-1.6	-1.6	-14.9	-14.9
Cement	-2.9	-0.6	-0.7	3.4	3.4	-5.6	-1.1	-1.1	-12.8	-12.8
Other non-metallic	-3.9	-0.6	-0.7	3.4	3.4	-7.2	-1.4	-1.4	-15.4	-15.4
Iron and steel	-3.6	-0.6	-0.7	3.4	3.4	-6.8	-1.3	-1.3	-8	-8
Non-ferrous metals	-4.6	-0.6	-0.7	3.4	3.4	-8.3	-1.7	-1.7	-7	-7
Structural metal	1.4	-0.6	-0.7	3.4	3.4	-2.2	-0.3	-0.3	-8.7	-8.7
Treated metals	1.6	-0.6	-0.7	3.4	3.4	-1.6	-0.2	-0.2	-4.2	-4.2
General hardware	-2	-0.6	-0.7	3.4	3.4	-7.6	-1.5	-1.5	-7.1	-7.1
Fabricated metal	0.7	-0.6	-0.7	3.4	3.4	-0.2	0.1	0.1	-5.1	-5.1

Annexure 3: Factor effects (continued)

Industry	Value added price	Change in wage rates				Return to capital	Change in employment			
		Urban high skilled	Rural High skilled	Urban low skilled	Rural low skilled		Urban high skilled	Rural High skilled	Urban low skilled	Rural low skilled
Engines	**0.1**	**-0.6**	**-0.7**	**3.4**	**3.4**	**-10.7**	**-2.2**	**0**	**-5**	**-5**
Pumps	**-2.7**	**-0.6**	**-0.7**	**3.4**	**3.4**	**-28.1**	**-6.6**	**0**	**-8.8**	**-8.8**
Gears	**-0.9**	**-0.6**	**-0.7**	**3.4**	**3.4**	**-17**	**-3.7**	**0**	**-5.6**	**-5.6**
Lifting equipment	**-0.3**	**-0.6**	**-0.7**	**3.4**	**3.4**	**-12.7**	**-2.7**	**0**	**-5.8**	**-5.8**
General machinery	1.3	-0.6	-0.7	3.4	3.4	-2.8	-0.5	0	-5.6	-5.6
Agricultural machinery	**-2**	**-0.6**	**-0.7**	**3.4**	**3.4**	**-16**	**-3.5**	**0**	**-10.4**	**-10.4**
Machine-tools	0.3	-0.6	-0.7	3.4	3.4	-4.5	-0.8	0	-8.2	-8.2
Mining machinery	0.4	-0.6	-0.7	3.4	3.4	-3.9	-0.7	0	-7.9	-7.9
Food machinery	-0.4	-0.6	-0.7	3.4	3.4	-7.7	-1.5	0	-7.4	-7.4
Special machinery	0.9	-0.6	-0.7	3.4	3.4	-1.4	-0.2	0	-7.8	-7.8
Household appliances	0.3	-0.6	-0.7	3.4	3.4	-3.4	-0.6	-0.6	-6.7	-6.7
Office machinery	**-5.6**	**-0.6**	**-0.7**	**3.4**	**3.4**	**-18**	**-4**	**0**	**-11.6**	**-11.6**
Electric motors	**-2**	**-0.6**	**-0.7**	**3.4**	**3.4**	**-11.6**	**-2.4**	**0**	**-9.6**	**0**
Electricity apparatus	0.5	-0.6	-0.7	3.4	3.4	-1.6	-0.2	0	-8.1	0
Wire and cable	0.8	-0.6	-0.7	3.4	3.4	-0.6	0	0	-7.7	-7.7
Accumulators	1	-0.6	-0.7	3.4	3.4	-1.5	0	0	-3.9	0
Lighting equipment	0.9	-0.6	-0.7	3.4	3.4	-1.5	-0.2	0	-6.9	-6.9
Electrical equipment	-1.6	-0.6	-0.7	3.4	3.4	-4.8	-0.9	0	-8.2	-8.2
Radio and television	-1.2	-0.6	-0.7	3.4	3.4	-4	-0.7	0	-9.2	-9.2
Optical instruments	0.3	-0.6	-0.7	3.4	3.4	-3.8	-0.7	0	-5.9	-5.9
Motor vehicles	0.9	-0.6	-0.7	3.4	3.4	0.6	0.3	0.3	-4.4	-4.4
Motor vehicle parts	1.8	-0.6	-0.7	3.4	3.4	0.6	0.3	0.3	-5	-5
Other Transport	1	-0.6	-0.7	3.4	3.4	-0.2	0.1	0	-5.6	-5.6
Furniture	1.4	-0.6	-0.7	3.4	3.4	-0.1	0.1	0	-5.4	-5.4
Jewellery	0.8	-0.6	-0.7	3.4	3.4	-1.3	-0.1	-0.1	-4.3	-4.3
Other manufacturing	-0.2	-0.6	-0.7	3.4	3.4	-3.5	-0.6	-0.6	-5.7	-5.7
Electricity	**12.3**	**-0.6**	**-0.7**	**3.4**	**3.4**	**18.2**	**3.7**	**0**	**20.7**	**20.7**
Water	-0.1	-0.6	-0.7	3.4	3.4	-0.8	0	0	-4.3	-4.3
Buildings	0.3	-0.6	-0.7	3.4	3.4	-4.7	-0.9	-0.9	-7.3	-7.3
Other construction	-1.7	-0.6	-0.7	3.4	3.4	-8.7	-1.8	-1.8	-10.4	-10.4
Trade	1.5	-0.6	-0.7	3.4	3.4	0.6	0.3	0.3	-4.1	-4.1
Accommodation	0.7	-0.6	-0.7	3.4	3.4	0	0.1	0.1	-5.7	-5.7
Transport services	-1.2	-0.6	-0.7	3.4	3.4	-3.8	-0.7	-0.7	-0.8	-0.8
Communications	-0.5	-0.6	-0.7	3.4	3.4	-1.4	-0.2	-0.2	-7.1	-7.1
Insurance	0.2	-0.6	-0.7	3.4	3.4	-0.2	0.1	0.1	-7	-7
Real estate	-0.3	-0.6	-0.7	3.4	3.4	-0.3	0.1	0.1	-6.7	0
Business activities	0.9	-0.6	-0.7	3.4	3.4	1.6	0.5	0.5	-4.8	-4.8
General Government	3.2	3.4	3.4	3.4	3.4	2	-0.3	-0.3	0.3	0.3
Health and social work	0.1	-0.6	-0.7	3.4	3.4	-0.2	0.1	0.1	-5	-5
Activities/ services	0.8	-0.6	-0.7	3.4	3.4	1.6	0.5	0.5	-5.5	-5.5
ALL	**1.1**	**0.3**	**0**	**3.4**	**3.4**	**-0.1**	**0**	**0**	**-2.8**	**-3.2**

Annexure 4: Trade elasticities

Industry	Armington Elasticity	Export supply elasticity		Export demand elasticity		Industry	Armington Elasticity	Export supply elasticity		Export demand elasticity	
		Low bound	Upper bound	Low bound	Upper bound			Low bound	Upper bound	Low bound	Upper bound
Agriculture	1.273	0.7	1.3	3	6	Cement	0.655	0.7	1.3	3	6
Coal	2.771	0.7	1.3	3	6	Other non-metallic	0.655	0.7	1.3	3	6
Gold	2.771	0.7	1.3	3	6	Iron and steel	0.447	0.7	1.3	3	6
Crude oil	0.73	0.7	1.3	3	6	Non-ferrous metals	0.595	0.7	1.3	3	6
other mining	2.771	0.7	1.3	3	6	Structural metal	0.747	0.7	1.3	3	6
Meat	0.937	0.7	1.3	3	6	Treated metals	0.747	0.7	1.3	3	6
Fish	0.937	0.7	1.3	3	6	General hardware	0.747	0.7	1.3	3	6
Fruit	0.937	0.7	1.3	3	6	Fabricated metal	0.747	0.7	1.3	3	6
Oils	0.937	0.7	1.3	3	6	Engines	0.49	0.7	1.3	3	6
Dairy	0.937	0.7	1.3	3	6	Pumps	0.49	0.7	1.3	3	6
Grain mills	0.937	0.7	1.3	3	6	Gears	0.49	0.7	1.3	3	6
Animal feeds	0.937	0.7	1.3	3	6	Lifting equipment	0.49	0.7	1.3	3	6
Bakeries	0.937	0.7	1.3	3	6	General machinery	0.49	0.7	1.3	3	6
Sugar	0.937	0.7	1.3	3	6	Agricultural machinery	0.49	0.7	1.3	3	6
Confectionery	0.937	0.7	1.3	3	6	Machine-tools	0.49	0.7	1.3	3	6
Other food	0.937	0.7	1.3	3	6	Mining machinery	0.49	0.7	1.3	3	6
Beverages and tabacco	1.57	0.7	1.3	3	6	Food machinery	0.49	0.7	1.3	3	6
Textiles	1.262	0.7	1.3	3	6	Special machinery	0.49	0.7	1.3	3	6
Textile articles	1.262	0.7	1.3	3	6	Household appliances	0.49	0.7	1.3	3	6
Carpets	1.262	0.7	1.3	3	6	Office machinery	0.944	0.7	1.3	3	6
Other textiles	1.262	0.7	1.3	3	6	Electric motors	0.944	0.7	1.3	3	6
Knitting mills	1.262	0.7	1.3	3	6	Electricity apparatus	0.944	0.7	1.3	3	6
Wearing apparel	1.164	0.7	1.3	3	6	Wire and cable	0.944	0.7	1.3	3	6
Leather	1.474	0.7	1.3	3	6	Accumulators	0.944	0.7	1.3	3	6
Handbags	1.474	0.7	1.3	3	6	Lighting equipment	0.944	0.7	1.3	3	6
Footwear	2.04	0.7	1.3	3	6	Electrical equipment	0.944	0.7	1.3	3	6
Wood	1.205	0.7	1.3	3	6	Radio and television	0.441	0.7	1.3	3	6
Paper	0.789	0.7	1.3	3	6	Optical instruments	0.505	0.7	1.3	3	6
Containers of paper	0.789	0.7	1.3	3	6	Motor vehicles	0.786	0.7	1.3	3	6
Other paper	0.789	0.7	1.3	3	6	Motor vehicle parts	0.786	0.7	1.3	3	6
Publishing	0.083	0.7	1.3	3	6	Other Transport	0.932	0.7	1.3	3	6
Recorded media	0.083	0.7	1.3	3	6	Furniture	1.075	0.7	1.3	3	6
Petroleum products	0.73	0.7	1.3	3	6	Jewellery	0.417	0.7	1.3	3	6
Basic chemicals	0.677	0.7	1.3	3	6	Other manufacturing	0.417	0.7	1.3	3	6
Fertilizers	0.677	0.7	1.3	3	6	Electricity	1.437	0.7	1.3	3	6
Primary plastics	0.677	0.7	1.3	3	6	Water	1.437	0.7	1.3	3	6
Pesticides	0.677	0.7	1.3	3	6	Buildings	0.584	0.7	1.3	3	6
Paints	0.677	0.7	1.3	3	6	Other construction	1.28	0.7	1.3	3	6
Pharmaceuticals	0.677	0.7	1.3	3	6	Trade	0.603	0.7	1.3	3	6
Soap	0.677	0.7	1.3	3	6	Accommodation	0.42	0.7	1.3	3	6
Other chemicals	0.792	0.7	1.3	3	6	Transport services	0.861	0.7	1.3	3	6
Tyres	1.135	0.7	1.3	3	6	Communications	0.568	0.7	1.3	3	6
Other rubber	1.135	0.7	1.3	3	6	Insurance	0.616	0.7	1.3	3	6
Plastic	0.275	0.7	1.3	3	6	Real estate	1.066	0.7	1.3	3	6
Glass	0.942	0.7	1.3	3	6	Business activities	1.066	0.7	1.3	3	6
Non-structural ceramics	0.655	0.7	1.3	3	6	General Government	1.153	0.7	1.3	3	6
Structural ceramics	0.655	0.7	1.3	3	6	Health and social work	1.04	0.7	1.3	3	6
Cement	0.655	0.7	1.3	3	6	Activities/ services	1.065	0.7	1.3	3	6

Source: Gibson (2003) and Behar and Edwards (2004)