

Economic Impacts of Introducing a Carbon Tax in South Africa: Provisional Results

CD:Modelling and Forecasting | 16 March 2011



national treasury

Department:
National Treasury
REPUBLIC OF SOUTH AFRICA

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Objectives of analysis

- Assess the impact of implementing a carbon tax in South Africa using five primary criteria. Namely *emissions*, *sector performance and competitiveness*, *employment and investment*, *income inequality* and *economic activity*.
- Assess how the different *uses of the carbon tax revenues* affect our results (recycling).
- Highlight the importance of *cheap and easily available technology* in the adjustment process to a greener economy.
- Illustrate the importance of mitigation by assessing the impact of *retaliatory measures* by the rest of the world against South Africa *or changes in consumer behaviour* in South Africa's major trade partners .
- Compare the outcomes *when imports are also subjected to carbon taxation*.
- Estimate the additional short and long run costs, if any, from *implementing* the tax *immediately* as opposed to *gradually*.

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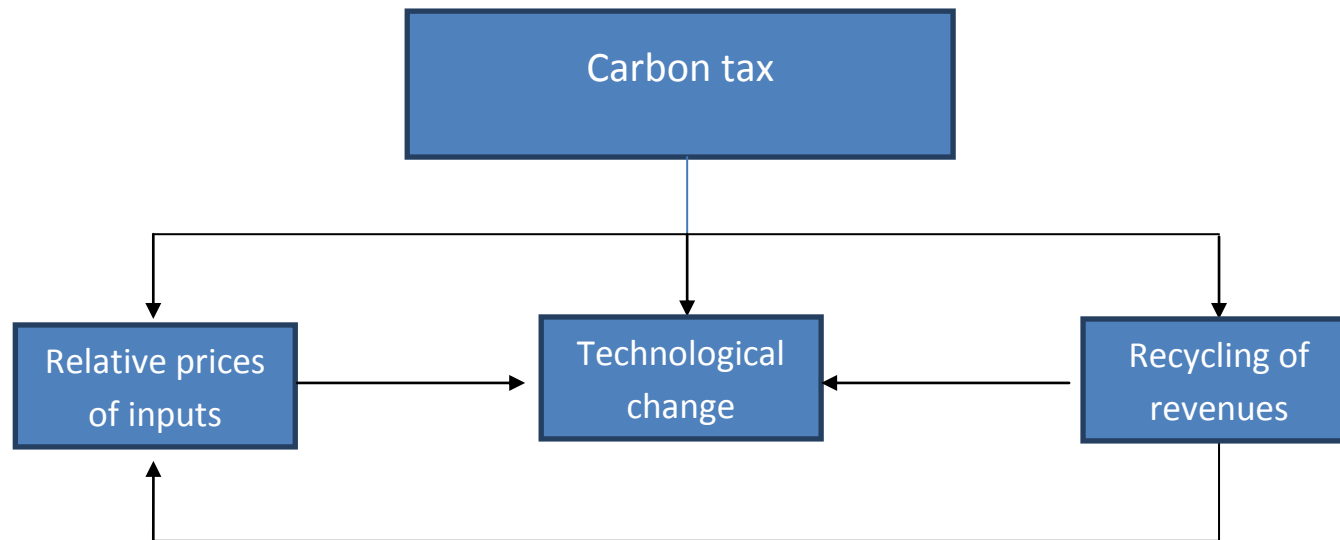
The model, the baseline and the level of taxation

- *South Africa General Equilibrium (SAGE) Model* - a recursive dynamic economy wide computable general equilibrium (CGE) model developed by UN-WIDER (Davies et al. 2011)
 - Based on 2005 SAM
 - 46 sectors, 4 types of labour
 - We use E-SAGE: disaggregated energy sector (tracks the flow of primary fuels to the transformation subsectors); firms can adapt to higher energy prices by investing in lower energy-intensive technologies.
- In the baseline:
 - *No carbon tax*
 - *No retaliatory tariffs or changes in consumer tastes*
 - *Electricity generation mixed bases IRP2 Revised Balanced Policy Scenario*
 - *South Africa is a climate change taker*- environmental benefits from emissions reductions are not taken into account
 - The *economy* is assumed to grow at an annual rate about 4.0%.
- We model two levels of carbon taxes: R100 and R200. The tax is imposed upstream on fossil fuels.

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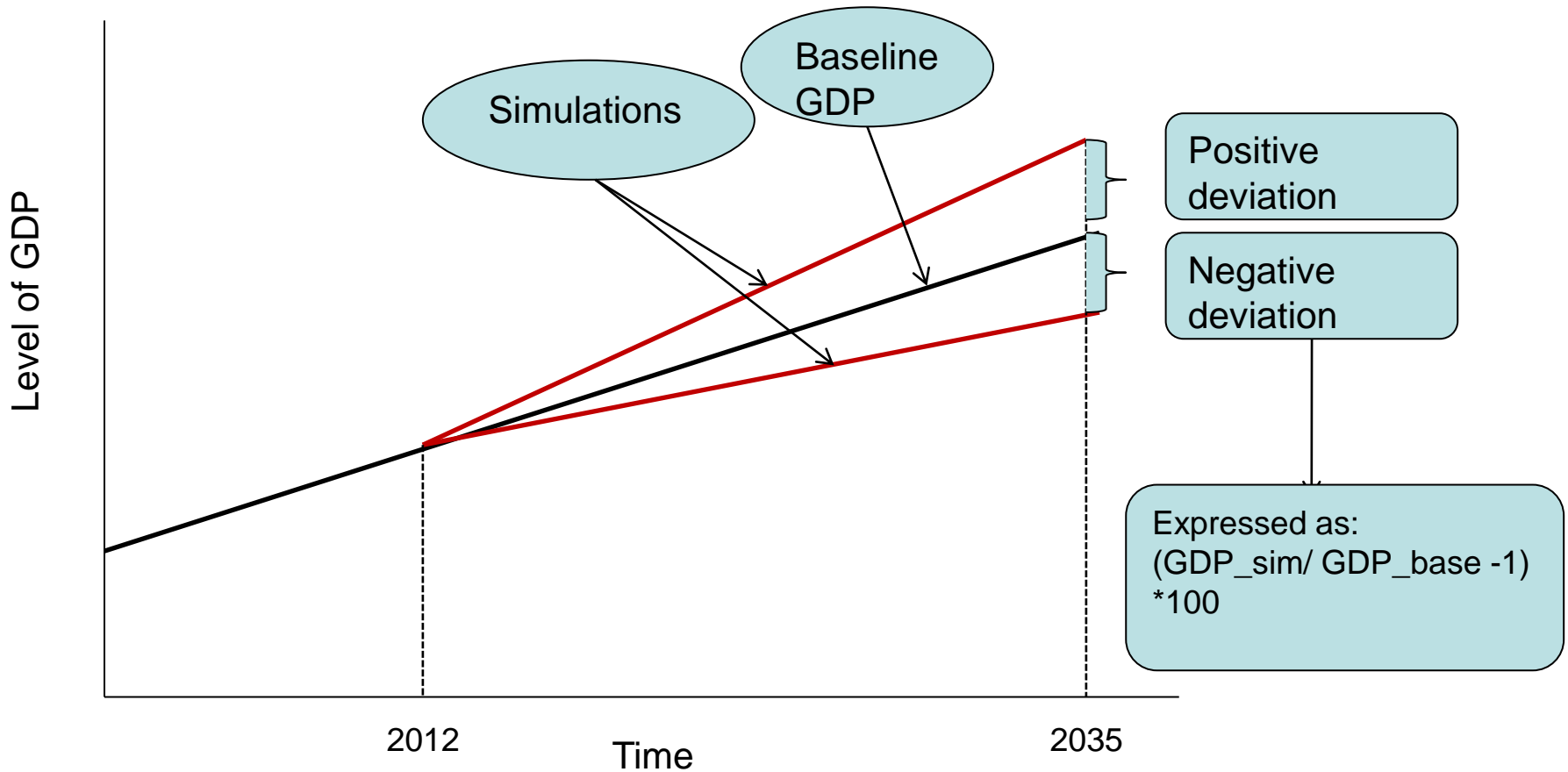
The carbon tax affects the economy through three main channels....



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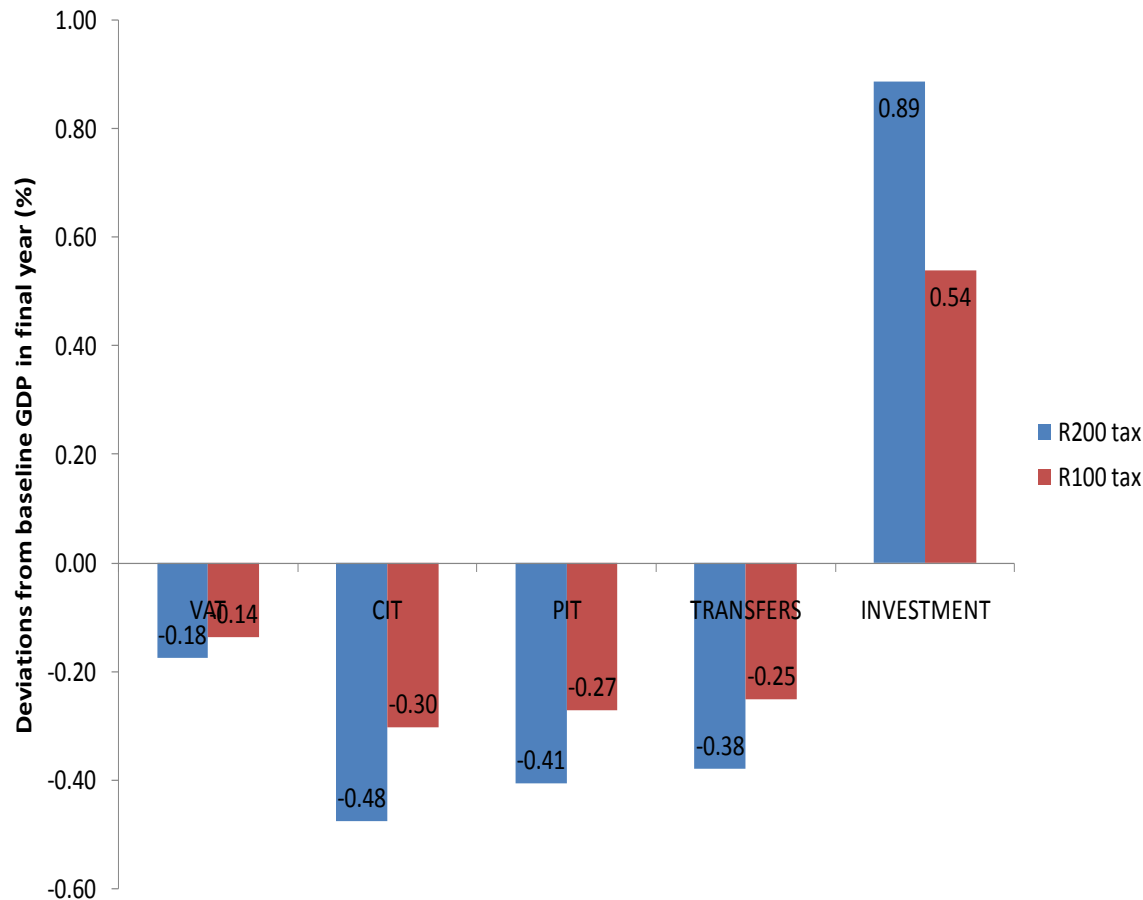
The results are presented as deviations from baseline GDP in 2035



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A carbon tax of R200 is enough to lower emissions by 34 per cent by 2020 and 45 per cent by 2025 and lead to small impacts on GDP



The small negative effect is explained by :

1. South Africa being a *climate change taker*
2. Significant past *misallocation of capital* due to low electricity prices, along with other industrial policies that favoured dirty industries and did not take into account environmental costs

Using government savings and investment to recycle the revenue offsets any negative impacts of the tax on output

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While carbon intensive sectors lose competitiveness others gain competitiveness

	Deviation from baseline GDP in final year (%)	
	R200 tax	R100 tax
TOTAL GDP	-0.18	-0.14
Primary	-2.20	-1.55
Agriculture	1.17	0.93
Mining	-3.19	-2.28
Manufacturing	-0.73	-0.57
Food	1.07	0.73
Textiles	2.36	1.84
Wood, paper & plastic	0.12	0.32
Petroleum	-19.93	-15.99
Chemical	-1.27	-1.12
Non-metal	0.17	0.07
Metal	2.74	2.50
Machinery	1.06	0.81
Vehicles	4.06	3.25
Other	2.73	2.27
Electricity	0.00	0.00
Water	-1.24	-0.59
Construction	-0.49	-0.57
Services	0.35	0.25
Wholesale and retail trade	0.77	0.59
Transport and communication	0.07	0.01
Financial and insurance	0.38	0.29
Business	0.38	0.23
Government	0.18	0.14
Other	0.38	0.25

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- The tax reduces the relative return of carbon intensive sectors.
- Economic resources shift from carbon intensive to greener sectors of the economy.
- This shift in the economic structure is part of the adjustment process towards a greener economy.
- Exempting carbon intensive sectors from the carbon tax defeats its purpose.
 - Emissions decline by only 15 per cent
 - Impact on GDP more negative

Neutral effect on employment and small reduction in inequality

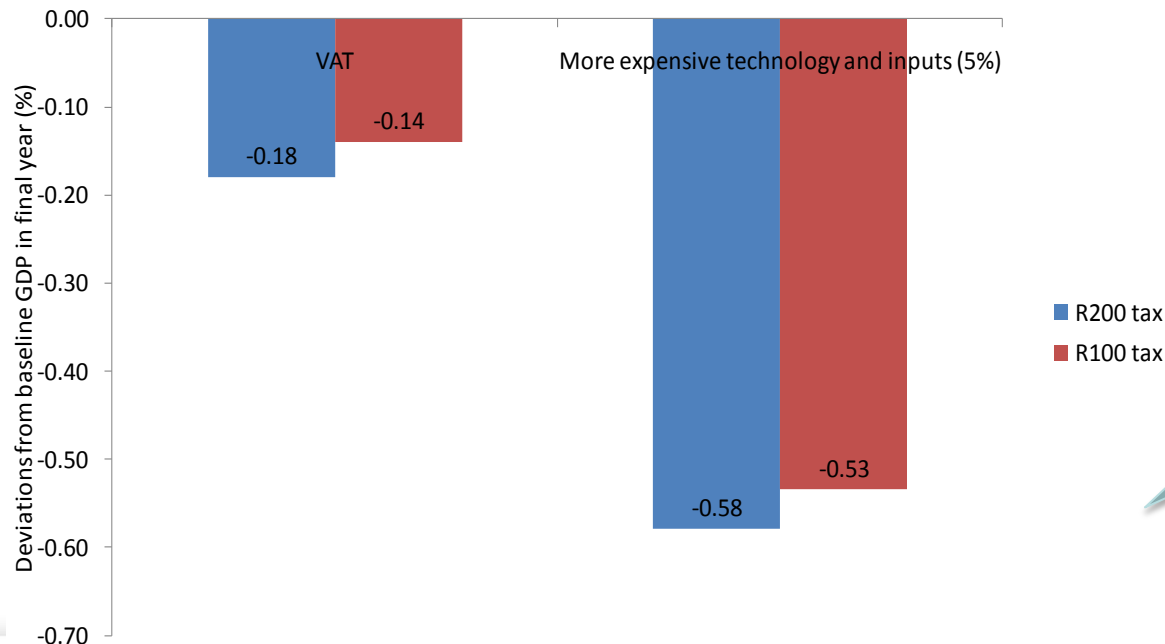
- Depending on the recycling option, the tax has almost neutral effect on employment.
- The *shortage of skilled labour* in South Africa continues to restrict the ability of the economy to expand output and employment.
- The tax affects the rents from capital the hardest. The rents from these sectors accrue to the top deciles of the income distribution.
- *Inequality declines marginally* and the effect is slightly stronger when revenues are recycled through increasing transfers to households.

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Availability and affordability of alternative technologies key to the adjustment process

- The introduction of the carbon tax encourages the use of greener technologies and the development of new technologies.
- Any policy which *raises the cost of greener technologies* or *limits its availability on the domestic market* will ultimately increase adjustment cost.
- Improving the availability and affordability of greener technologies can completely offset any negative impacts associated with the carbon tax



Increasing the cost of technology by only 5 per cent and still using VAT to recycle worsens the impact on GDP almost threefold

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The imposition of a carbon tax can help in avoiding retaliatory tariffs and adverse changes in consumer tastes.....

	Deviation from baseline GDP in final year (%)	
	R200 tax	R100 tax
VAT	-0.18	-0.14
Primary	-2.20	-1.55
Manufacturing	-0.73	-0.57
Services	0.35	0.25
Retaliatory tax on SA Exports (\$30)	0.80	0.95
Primary	-1.35	-0.73
Manufacturing	0.81	1.36
Services	1.15	1.09

If the carbon tax avoids retaliatory trade sanctions or adverse changes in consumer behaviour then the impact on output and employment is positive

- The global climate change debate indicates that trade measures might be used against those countries that do not mitigate and that free ride on the efforts of other countries.
- These measures could include a tax (a retaliatory tax) on the exports of non-mitigating countries or other sanctions or simple change in consumer's tastes towards less carbon intensive goods and services

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Border adjustment necessary to avoid carbon leakage

- Advantages
 - level the playing field by imposing similar costs on imports from countries without comparable carbon mitigation
 - prevent carbon leakage and create leverage on other countries to reduce emissions
- Disadvantages
 - difficult to determine the carbon content of each final consumer good or evaluate and assess the climate change actions of each country
 - violation of WTO rules against use of domestic taxes to discriminate against imports, especially if used for disguised protection
 - can motivate retaliatory actions from other countries, especially if used for disguised protection
- Complimenting a carbon tax of R200 with a border adjustment (recycled through VAT) offsets the small negative impact on GDP and leads to slightly higher output.

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Summary of results

- The overall impact of a carbon tax *depends largely on how government recycles the carbon revenues* as well as the *availability and affordability of greener technologies*.
- The *overall impact on output when revenues are recycled through decreasing other direct or indirect taxes is small negative*. Any environmental benefits from emissions reductions are not taken into account as SA is a climate taker. If carbon tax revenues are used to reduce the VAT rate, the carbon tax leads to a small negative impact on GDP equivalent to annual growth declines of 0.005 percentage points or 0.18% 2035.
- *Recycling revenue by increasing government savings and investment has large positive gains*. Using the revenues to increase transfers to households marginally reduces inequality but results in a small net reduction in GDP as most of the additional revenues are consumed.
- *Carbon taxes causes a marginal reduction in inequality*. It reduces the profits of carbon intensive sectors and hence the rents which accrue to the top deciles of the income distribution.

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Summary of results

- The carbon tax serves as an economic signal to shift resources away from carbon intensive sectors to greener sectors of the economy. These sectors are generally more labour intensive thus having a *positive impact on employment*.
- The *smooth transition to a greener economy depends on the affordability and availability of alternative technologies and production inputs*. Any policy that raises the cost of these technologies or decreases their availability in the domestic market will increase adjustment costs and retard the transition.
- Substantial *potential gains* from avoiding possible retaliatory tariffs and sanctions as well as lower demand for dirty SA products.
- In the long-run, incremental introduction of the carbon tax has similar impacts on output relative to the immediate introduction.

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