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The Carbon Intensity of South Africa's Economy

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Introduction

- Other presenters in this session are looking in detail at measures to reduce emissions in South Africa
- I try to provide a background and broad analysis of key elements
- Focus on “CO₂ from fossil fuel use”
 - 60% global GHGs : 80% RSA GHGs

South Africa's CC Dilemma

- South Africa faces enormous development challenges
 - Unemployment +/-25%
 - Poverty 23% (head count)
 - Gini 0.7 (income from work, self employment and capital)
- ... but is a 'dirty' energy user
 - 13th largest CO₂ emitter in absolute terms
 - 1.4% of global emissions from 0.7% of global population
- Government has committed to a 42% reduction in emissions against baseline projection by 2025
- But difficult to manage technically ...
 - Can it be done without adding to development problems?
- ... and politically
 - Concern from business about global competitiveness and exports
 - Concern from labour about reduced employment
 - Concern with impact on poor households

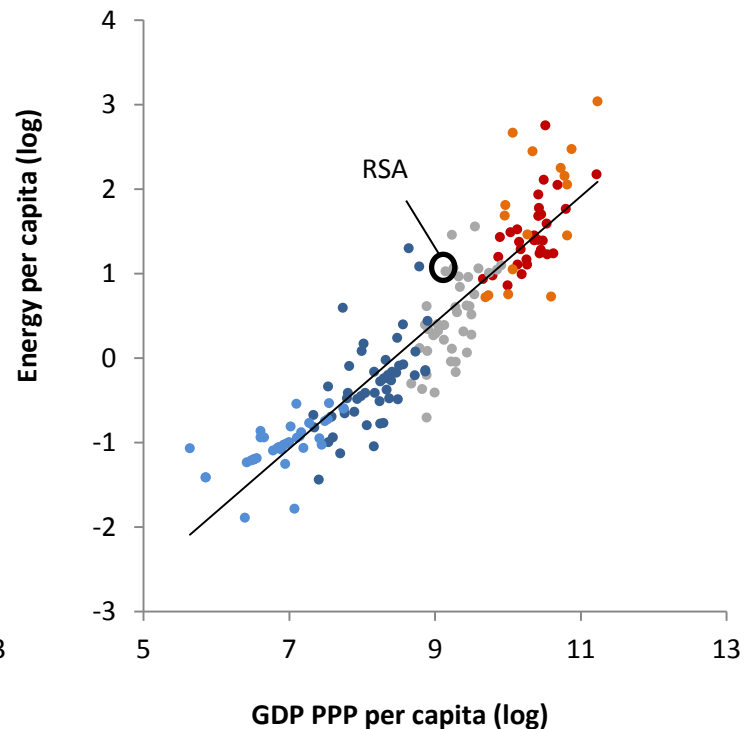
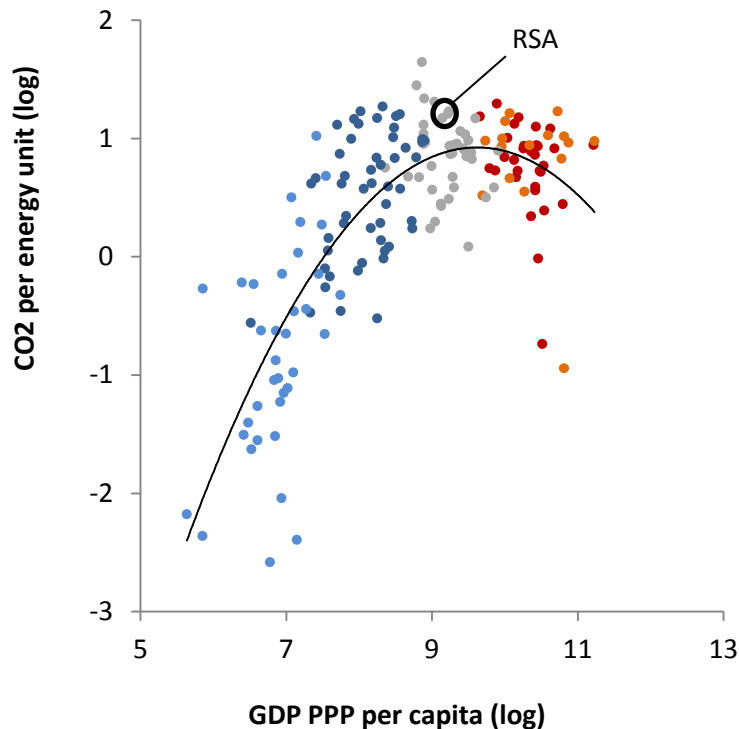
Decomposing Aggregate Emissions

$$\frac{CO_2}{Pop} = \frac{CO_2}{E} \cdot \frac{E}{GDP} \cdot \frac{GDP}{Pop}$$

2007	Emissions per capita (CO ₂ /Pop)	CO ₂ Intensity (CO ₂ /E)	Energy Intensity (E/GDP * 1000)	Income level (GDP/Pop)
World	4.7	2.5	184	9,506
South Africa	9.0	3.1	307	9,374
USA	18.5	2.4	177	43,710
Finland	12.1	1.7	208	33,501
Japan	9.8	2.4	127	31,660
European Union	8.0	2.3	125	28,413
China	5.2	3.5	284	5,239
Developing SSA	0.9	1.5	315	1,909

Low Carbon Development

- As income per head rises
 - Energy use rises
 - Energy emissions rise and then fall



Decomposition Again

$$\frac{CO_2}{Pop} = \frac{CO_2}{E} \cdot \frac{E}{GDP} \cdot \frac{GDP}{Pop}$$

- Development target entails raising GDP per head
- Therefore emissions per head must be reduced by
 - Reducing energy intensity of production and/or
 - Making energy cleaner
- This requires
 - technical changes and/or
 - change in composition of production
- To examine potential of the latter option need disaggregated analysis of carbon content of production
- This also helps understanding possible impacts of carbon taxes

Measuring Carbon Intensity

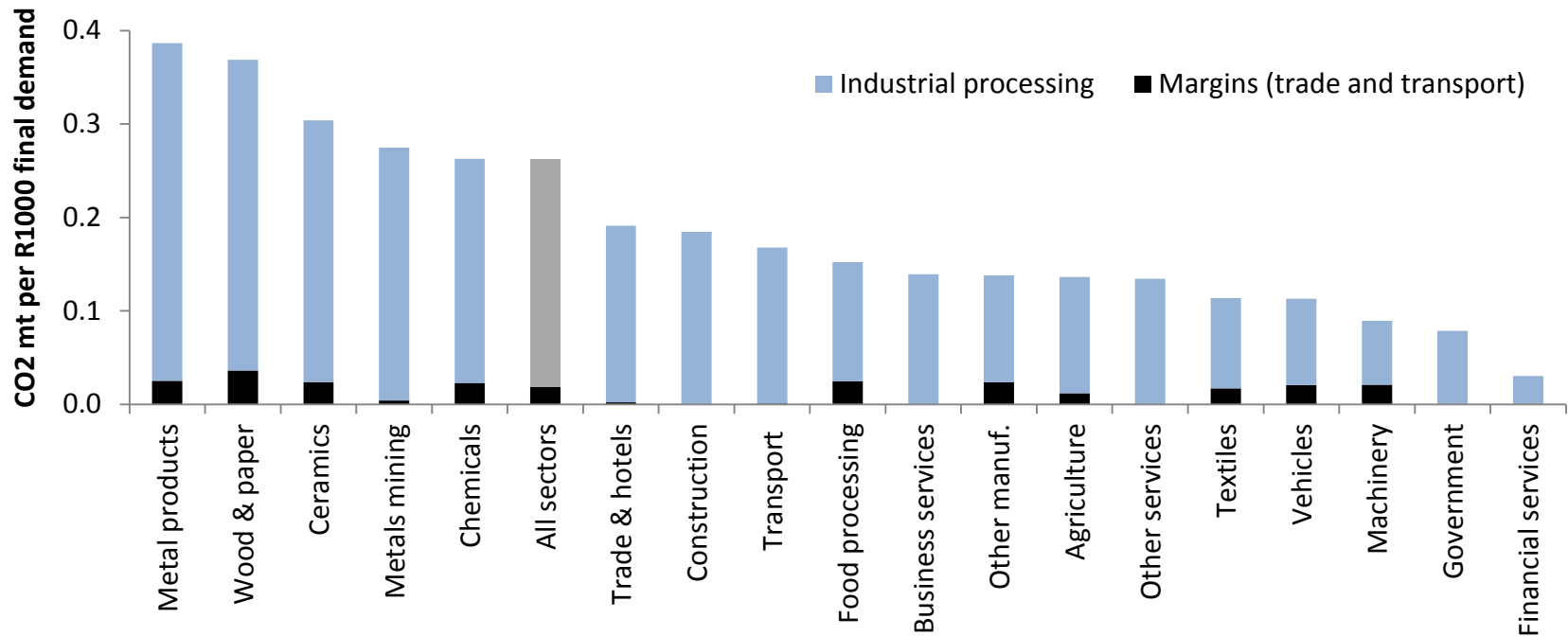
- Look at carbon use within the RSA economy
 - Carbon content of products
 - Carbon intensity of sectors
 - Relationship between carbon, exports and employment
 - Carbon consumption patterns across households
 - Basis for border tax adjustments (BTA)
- Full paper:
 - Arndt, Davies, Makrelov, Thurlow (2012) Measuring the Carbon Intensity of the South African Economy. *South African Journal of Economics*.

Methods and Data

- Capture direct and indirect carbon use
 - Direct use of fuels (i.e., crude oil, natural gas and coal) and transformed energy (e.g., electricity and petroleum)
 - Indirect use of carbon embodied in other inputs (e.g., plastics)
- Multiplier analysis using supply-use tables
 - Carbon enters the system as fossil fuels
 - Track all upstream and downstream product flows to determine total (net) carbon use per unit of output or final demand
- 2005 supply-use and energy balance tables
 - 172 industries, 105 products and 6 household income groups

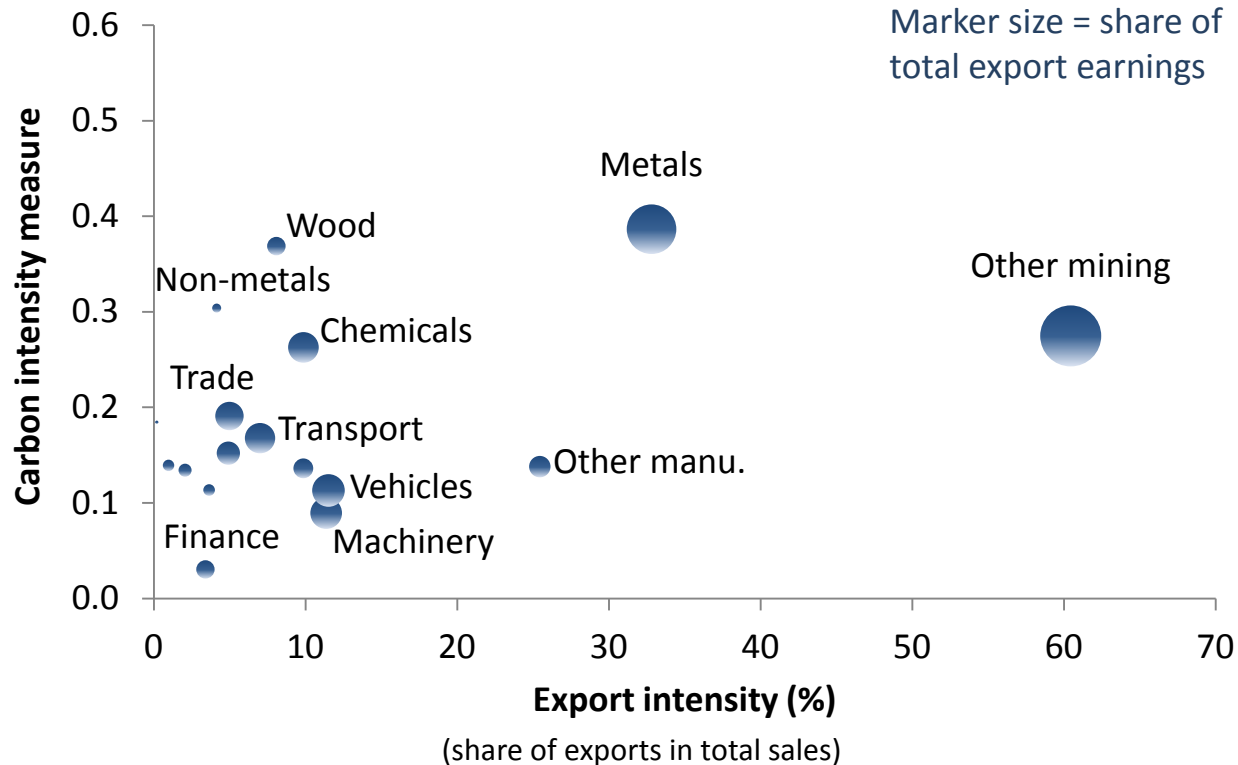
Results: Carbon Within Products

- Energy products are the most carbon intensive:
 - Primary fuels : Coal (12.3), Gas (2.1) and Crude oil (1.0)
 - Transformed energy : Electricity (3.2) and petroleum (0.67)
- Margins account for 7% of carbon within products



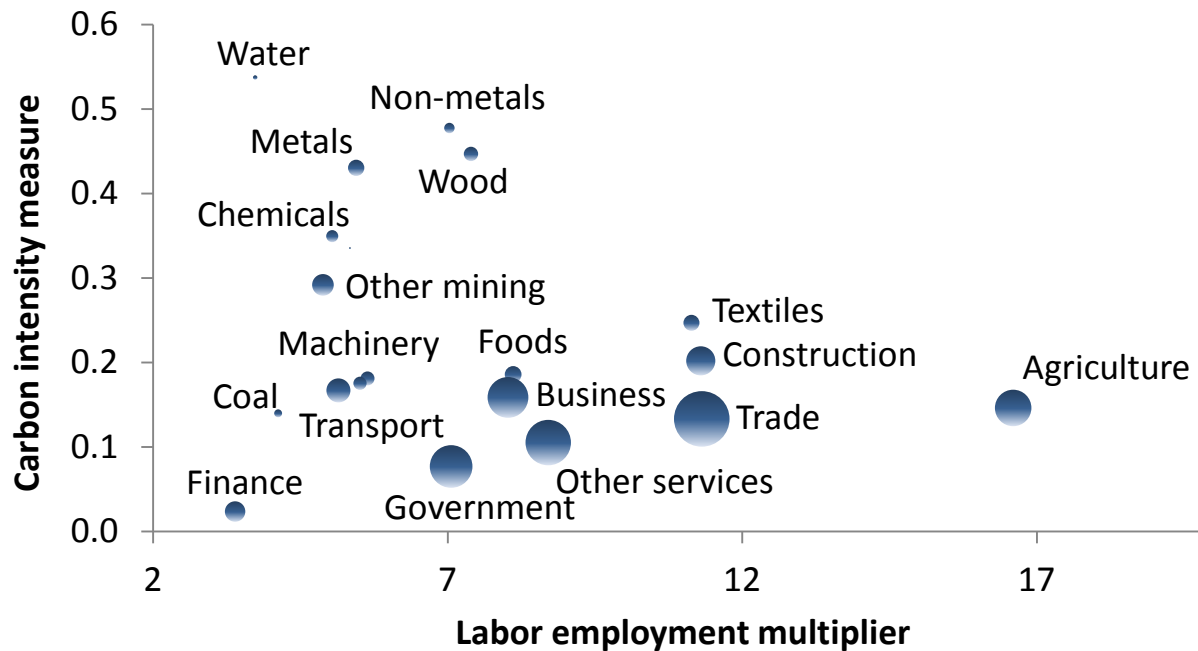
Results: Exports

- RSA is a large net exporter of carbon (2.5x imports)
 - Large export intensive sectors are typically carbon-intensive



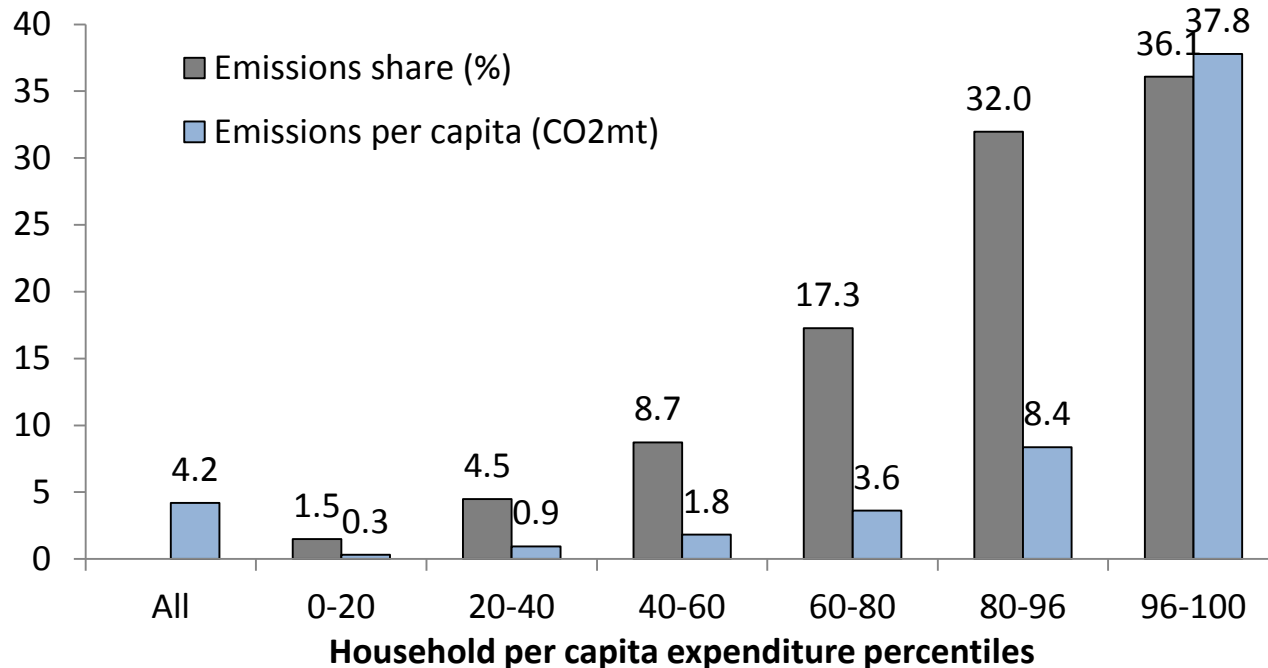
Results: Employment

- Carbon-intensive products tend to be:
 - Less labor-intensive
 - Less important for overall employment



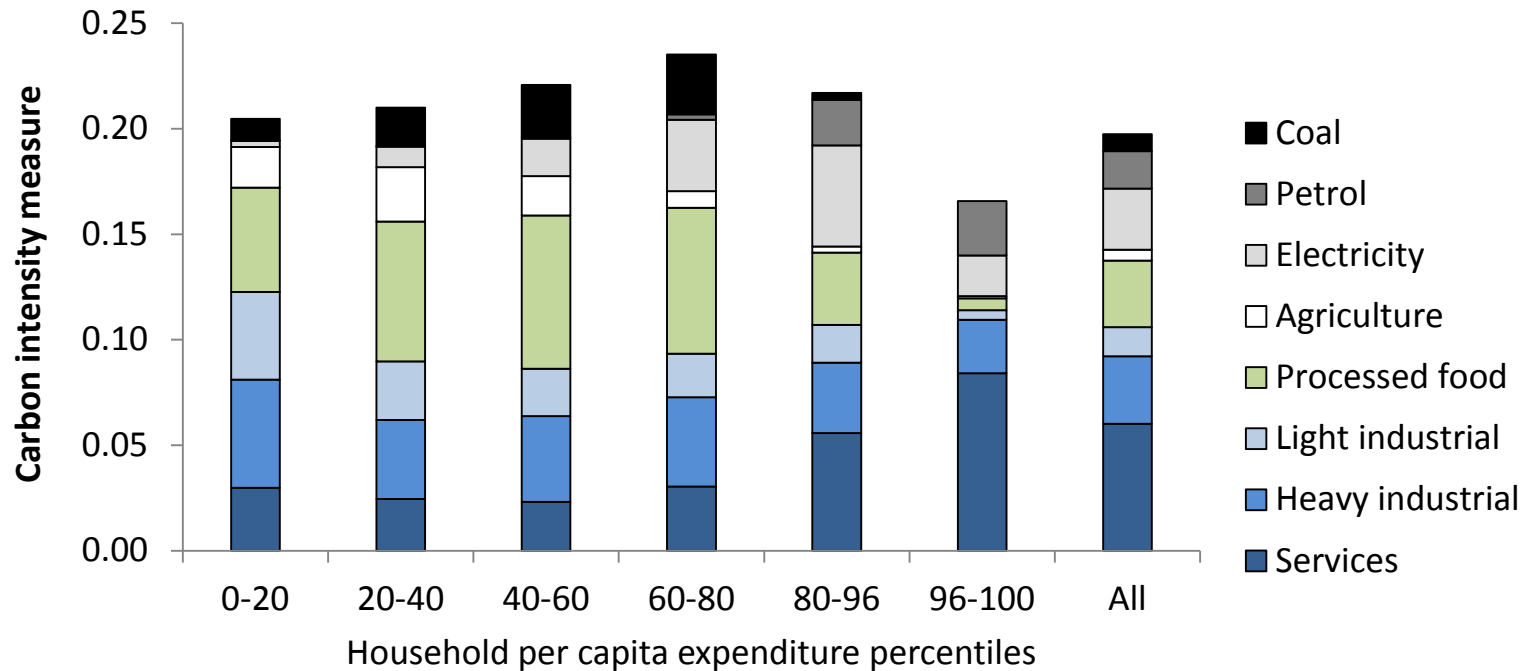
Results: Consumers or Households (1)

- Household emissions < national average, but unevenly distributed
 - Poorest 20% = 0.3 tons of CO₂ pc (≈ Benin)
 - Richest 4% = 37.8 tons of CO₂ pc (≈ Kuwait)



Results: Consumers or Households (2)

- Middle-income households are most carbon-intensive
 - Based on 2005 Income and Expenditure Survey and SUT
 - Higher income: mainly services and electricity
 - Lower income: foods and fuels (chemicals and coal)



Conclusions

- Wide variation in carbon intensity across sectors/products
- Major exports do have high carbon contents
 - Might justify border tax adjustments to maintain competitiveness
- Key employment sectors tend to be less carbon intensive
- Middle-income households are more carbon-intensive
 - But high income households consume far more carbon