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Abstract

This paper aims to study the effects on poverty and income inequality of trade liberalisation in South Africa. This is achieved by using a micro-macro model. The main issue of interest is the effect of international trade on households (especially their income); some changes may contribute to reduce poverty while other changes could work against the poor. The approach presented in this paper relies on combining a macro-oriented computable general equilibrium (CGE) model and a microsimulation (MS) model. Combining these two models the microeconomic effects (on poverty and inequality) of a macroeconomic policy (trade liberalisation) can be analysed. The paper gives details about the MS model, the CGE model and the "top-down" approach used to link the two models. The main concern regarding poor households is whether the decrease in real (or nominal) earnings for formal low-skilled and skilled workers is offset by the upward trend in formal employment levels. This appears to be the case implying a decrease in poverty due to trade liberalisation. Although whites emerge as the main winners, the increase in inter-group inequality is more than compensated by the decrease in intra-group inequality.

1. Introduction

This paper aims to study the effects on poverty and income inequality of trade liberalisation in South Africa. This is achieved by using a micro-macro model.

The main issue of interest is the effect of international trade on households (especially their income); some changes may contribute to reduce poverty while other changes could work against the poor or the effect may be ambiguous by being beneficial for some groups of poor people but not for others. For instance, the removal of tariffs on footwear products is expected to affect the workers of this sector negatively while at the same time it is also expected to have a positive impact on other households by reducing the cost of their expenditure. Models and empirical evaluations are important to assess the real impact of complex changes on poor households. However, we are facing a problem since trade liberalisation is mainly a macroeconomic phenomenon while poverty and inequality are mainly microeconomic issues. In view of the fact that most of the available economic models have either a microeconomic or a macroeconomic focus,[1] the combination of a micro- and a macro-model appears to be the appropriate approach to address the question adequately, that is without missing the important micro-macro links.

The micro-macro model used in this paper was developed by Hérault (2005). It consists of a macro-oriented Computable General Equilibrium (CGE) model linked to a microsimulation (MS) model following the "top-down" approach introduced by Robilliard et al. (2001). However, this approach is extended by also taking into account the changes in capital returns[2] and transfers[3] at the household level. Combining these two models the microeconomic effects (on poverty and inequality) of a macroeconomic policy (trade liberalisation) can be predicted.

The second section gives brief details about the micro-data, the MS model, the CGE model and the links between the two models. The third section of the paper applies the methodology discussed in the previous section to assess the effects of trade liberalisation in South Africa, with a special focus on poverty and inequality. Finally, conclusions are provided in section 4.

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[1] These models include macro models, microsimulation models, multiplier models and computable general equilibrium models.

[2] This is similar to what has been done in some more complex CGE-MS models. For instance, see the integrated model by Cororaton and Cockburn (2005).

[3] Here by transfers we mean transfers from other households, transfers form abroad and transfers from the government.

2. Key characteristics of the model(s)

The aim of this section is to provide the reader with a basic background on the micro data, the functioning of the MS and the CGE model, and an overview of the "top-down" approach used to link both models.[4]

2.1. Overview of the microeconomic data

Table 1: Overview of employment (numbers in 1000's)

	Blacks	Coloureds	Asians	Whites	TOTAL
Inactive[(a)]	22,857	2,425	642	2,107	28,032
Unemployed	3,356	282	69	99	3,806
Subsistence agriculture	704	19	1	12	736
Informal workers[(b)]	2,935	268	32	122	3,357
(Average weekly hours of work)	*42.7*	*41.0*	*42.4*	*44.5*	*42.6*
Formal workers	4,327	1,019	359	1,602	7,307
(Average weekly hours of work)	*47.9*	*44.8*	*44.3*	*45.9*	*46.9*
TOTAL	34,180	4,013	1,104	3,941	43,238

Note: (a) Including 652,000 "unspecified" workers (b) Including 948,000 domestic workers. *Source: Author's calculations from IES 2000 and LFS 2000:2*

The South African MS model is based on two household surveys: the Income and Expenditure Survey (IES) of 2000 and the Labour Force Survey (LFS) of September 2000. The data are broadly in accordance with Casale et al. (2004) and reveal a national unemployment rate of about 30 per cent depending on the definition used. Table 1 includes the complete South African population and shows remarkable differences between racial groups. The 3.9 million whites account for less than 10 per cent of the total population but for more than 20% of the formal workers. On the contrary, blacks represent almost 80 per cent of the population but less than 60% of the formal workers. Indeed, blacks are overrepresented in all categories except formal workers, whereas coloureds, Asians and whites are underrepresented in all categories except formal workers. Table 1 also reveals that the level of hours worked is fairly high in South Africa averaging around 45 hours per week. It is somewhat lower in the informal sector[5] than in

[4] A more comprehensive description is provided in Hérault (2005).

[5] Following Statistics South Africa (questionnaire of the LFS of September 2000), "Formal sector employment is where the employer […] is registered to perform the activity. Informal sector employment is where the employer is not registered."

the formal sector. In this regard, it is interesting to note the distinct distribution of hours amongst racial groups in the formal and the informal sectors. Although whites work longer hours than blacks in the informal sector, the opposite is found in the formal sector. This can be explained by the different nature of jobs occupied by blacks and whites. Table 2 focuses on average incomes, poverty and income distribution.

Table 2: Overview of incomes, poverty and inequality[(a)]

	Blacks	Coloureds	Asians	Whites	TOTAL
Income per capita[(b)]	6,268	10,695	19,824	48,495	10,874
Headcount Index (P0)	35.6	10.3	1.1	0.2	29.2
Poverty Gap Index (P1)	14.0	3.2	0.6	0.07	11.4
Poverty Severity Index (P2)	7.3	1.4	0.4	0.03	5.9
Gini	0.59	0.51	0.47	0.47	0.67

Note: (a) The poverty line is the international $2/day poverty line (R174/month/capita in 2000 prices) (b) Average annual disposable income per capita in Rand. *Source: Author's calculations from IES 2000 and LFS 2000:2*

South Africa is well known for being one of the most unequal countries along with Brazil and this is confirmed by a Gini coefficient as high as 0.67.[6] The recent trend is towards a more unequal income distribution even if inter-group inequality has been declining. The explanation is that the gap between rich and poor within each group has increased substantially despite very high initial levels. For instance, a Gini coefficient of 0.47 for whites is a very high figure for a population with an education and occupation profile similar to those observed in rich countries.

Despite the end of the Apartheid regime in 1994 and the first democratic elections, the white average income per capita was still, in 2000, 8 times higher than the black per capita income. As a consequence, it is not surprising to observe that poverty concerns almost only blacks; they account for more than 95 per cent of all poor and more than 35% of all blacks are poor using the international $2/day poverty line. In contrast, poverty is virtually non-existent for Asians and whites despite the relatively high incidence of poverty at the national level of 29.2 per cent.[7]

[6] This Gini coefficient is computed on per capita disposable incomes. Using household incomes, the Gini coefficient is 0.59. Similar values are found in other studies. Simkins (2004) calculates a Gini coefficient on household incomes of 0.67 in 2000 and 0.69 in 2001. The Gini estimate by HRSC (2004) is 0.77 (using household incomes) for 2000. The World Bank (see http://iresearch.worldbank.org/PovcalNet), calculates a Gini coefficient, based on per capita incomes, of 0.58 in 2000 and the Gini index computed by Hoogeveen and Özler (2004) is also 0.58.

[7] Using the same poverty line, the World Bank (http://iresearch.worldbank.org/PovcalNet) produces an estimate of 34.1 per cent while Hoogeveen and Özler (2004) estimated a poverty incidence of 34%. Using a poverty line of R250

2.2. Key characteristics of the MS model

The South African MS model is a static MS model allowing for behavioural responses. The model simulates the new labour market choices after changes in individual characteristics, such as earnings (due to macroeconomic changes as estimated in a CGE model), or in the coefficients of the model. The simulation is carried out for all individuals aged between 15 and 65 years. Incomes are simulated for each of the 26,000 households surveyed in the 2000 IES and LFS.[8] The underlying selection model, which drives the behavioural responses, assigns each individual from the working-age population to one of the five labour market categories distinguished in the model: inactive, unemployed, subsistence agricultural worker, informal worker and formal worker. This model takes the potential earnings in these categories into account. A regression model is estimated to predict earnings in each category. Finally, the results of both the selection and the regression model are used to compute household real net incomes.

A multinomial logit specification is used for the selection model (see Maddala, 1983). The model assigns each individual to the sector with the highest associated probability. The probabilities are derived from the estimation of an implicit utility function. The underlying assumption is that each individual chooses the sector with the highest associated utility. The addition of a random utility term makes the model probabilistic. Following Creedy et al. (2002), this means that the model "does not identify a particular (…) [labour market choice] for each individual after the policy change, but generates a probability distribution over the (…) [labour market choices] used". This is achieved by drawing, for each individual, a set of error terms, representing the random utility, from the extreme value distribution (here 100 error terms are drawn). These error terms are drawn in such a way that only those which preserve the observed labour market choice as the optimal choice when adding the error term to the deterministic part of the utility function are selected. After a policy change, only the deterministic part of the utility

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per month per capita, our estimated poverty incidence of 41.7 per cent is close to the 38.6% found by Van der Berg and Louw (2003).

[8] A few workers aged below 15 years or over 65 years are fixed at the observed labour market category. Likewise, 652,000 "unspecified" workers, for whom there is no data on occupation and on the sector (formal or informal), are also excluded from the model. That these occupation and sector variables are missing is partly due to the fact that, for various reasons, some people were observed as workers in the IES but not in the LFS. These workers are also excluded from the simulation, and their labour market choices are fixed at the observed levels. Moreover, all recipients of the Old Age and War pension, as well as full-time students aged between 15 and 18 years, are also excluded from the simulation.

function is recomputed. Then, by adding the random error terms, previously drawn, to the recomputed deterministic utility components, a probability distribution over the labour market choices is generated for each individual. This implies that the model does not assign every individual from the sample to one particular labour market choice after the policy change. Instead, it gives the individual probabilities of choosing each of the five sectors. Combining this information with the sampling weights from the household survey allows us to generate the new distribution of the South African population over the labour market choices incorporated in the model.

A regression model is used to predict individual gross earnings in each of the five labour market categories. This variable influences the labour market choices made in the selection model. Furthermore, predicted earnings are used at the end of the microsimulation process when household real net incomes are calculated.

The regression model, like the selection model, is estimated separately for the four demographic groups.[9] Since formal and informal sectors are the only labour market segments where individuals receive earnings, the results of the regression model are used to assign predicted formal and informal earnings to all individuals in the model. However, for those individuals who were formal or informal workers at the time of the survey, the corresponding observed earnings are used rather than predicted earnings.

After running the selection and the regression models described above, individual earnings are added to other non-labour income to generate the updated household incomes. The majority of non-labour income consists of incomes from capital, and transfer incomes from other South African households, from abroad and from the government.

The sum of labour and non-labour incomes is the gross household income from which we subtract the income tax payable.[10] Then, household net income is deflated by a household-specific consumer price index CPI_h. Two sources of data are used to compute the household *CPI*: the budget shares of household *h* are observed in the micro-data while the price changes are

[9] Chow tests confirm that the coefficients are significantly different in the four demographic groups.

[10] Observed income taxes from micro- and macro-data are not used for various reasons. First and foremost because tax and income data do not refer to the same period. Moreover, there is no consistency between micro and macro tax data. Therefore, results, as well as base values, are computed using official tax rates rather than those derived from observed taxes. The results are reasonably robust to the use of observed tax rates instead of official tax rates. The differences are driven by the evident underestimation of tax rates and the absence of progressivity when using observed taxe rates. As a consequence, the use of observed taxes places a light downward pressure on poverty measures while inequality is always found to increase.

derived from the CGE model. This particular characteristic of the model is of interest when the focus is on poverty and inequality impacts of policy changes because expenditure patterns are significantly different for low-income and high-income households. Moreover, the price changes derived from the CGE model vary substantially amongst the 43 goods included in the model.

2.3. Key characteristics of the CGE model

The CGE model used in this paper was developed by Hérault (2004) based on the 2000 South African social accounting matrix (SAM). It is a static model similar in many aspects to the model presented in Thurlow and van Seventer (2002)[11] which can be classified as a neoclassical-structuralist model in the tradition originally introduced in Dervis et al. (1982). The main innovation introduced by CGE models is the explicit consideration of the general equilibrium effects. This built-in characteristic explains why CGE models have been so intensively used in the last decade, especially for the assessment of trade liberalisation policies in developing countries. As a matter of fact, trade liberalisation cannot be satisfactorily evaluated under a partial equilibrium framework. The liberalisation of trade in a given sector is more than likely to have some effects beyond this single sector. The most straightforward examples may occur if the output of this sector is used as an intermediate input in other sectors or if the sector of interest is one of the main buyers of any domestic product.

The South African CGE model shares some characteristics common to most of the CGE models. Producers maximise profits subject to their existing production technology and households maximise utility subject to a budget constraint, but the government does not have an objective function. The latter is one of the reasons why more constraints are necessary in order to "close" the model and define how the economic system operates. In practice, the aim is to have the same number of equations and endogenous variables in the model. The required additional constraints are often referred to as the closure rules or system constraints and are of particular interest because they determine, to a large extent, the way in which the model behaves. They ensure equilibrium is reached by answering such questions as: is the budget deficit fixed or

[11] The author is very grateful to James Thurlow and the International Food Policy Research Institute for their technical support during (and after) the advanced CGE workshop at the University of Cape Town in January 2004.

flexible? Is the exchange rate or the current account fixed? These closure rules also enforce the *ex post* equality of investments and savings.[12]

The South African CGE model is based on the 2000 SAM, which includes 43 sectors and 4 factors of production: high-skilled labour, skilled labour, low-skilled labour and one type of capital. The South African trade has been regionally disaggregated as in Thurlow (2003).[13] Following the Armington specification (Armington, 1969), imported and domestic products are imperfect substitutes which allow for intra-branch trade. There is no data available at the macro level regarding the informal sector, which is therefore not represented in the SAM. The results from the CGE model are available under three different sets of closures: two Keynesian closures and one neoclassical closure.[14] Each of these closures is based on a number of different assumptions regarding some key components of the economy.

These constraints determine to a large extent the functioning of the modelled economy. They affect the factor market, the savings-investment account, the current account and the government account.[15] In each closure, unemployment amongst low-skilled and skilled workers is allowed by assuming either nominal or real earnings to be fixed. All closures have a short term focus since capital is not mobile across sectors.

Most important when dealing with CGE models is how savings and investment adjust in each closure. In the Neoclassical closure, investment is savings-driven. That is, the investment level is the endogenous variable that adjusts *ex post* to the level of savings. In this specification, a crowding-out of investment follows any growing government deficit. The long-term empirical study by Nell (2003) supports this point of view in the case of South Africa.

The adjustment mechanism is less obvious in the Keynesian closures because both investment and savings are assumed to be fixed and both producer and consumer prices are flexible. In the first Keynesian closure, nominal earnings of skilled and low-skilled workers are fixed. If, after an exogenous shock, savings happen to be insufficient then a price increase is required to lower real wages. Consequently, this generates a boost in production and employment

[12] About CGE closures, see Sen (1963) and Robinson (2003).
[13] There are 10 trading partners in the model, namely: Southern African Development Community (SADC), Rest of Africa (ROA), United States of America (US), Southern Cone Common Market (Mercosur), European Union (EU), India, China, Japan, Rest of East Asia (ROEA), and Rest of World (ROW).
[14] These designations are only indicative. In the CGE literature, the differences between closures are usually more pronounced. Here, the main distinction concerns the savings-investment account whereas the closures of the other accounts are in concordance with empirical observations or the short-run focus of the model.
[15] More information on the closures of the South African CGE can be found in Hérault (2004, 2005), Thurlow and van Seventer (2002) and Thurlow (2003).

until savings reach the desired level of investment. The implicit assumption is that unions are too weak (for instance because of the high level of unemployment) to obtain any improvement in earnings when prices go up. The main concern with this closure is that it does not allow for any expansion of employment without a fall in real earnings, and that may not be consistent with the economic reality (see Robinson, 2003). Moreover, the empirical study over the period 1997-2001 by Muller et al. (2004) supports the view that real earnings are fixed in the South African formal sector.

The second Keynesian closure alleviates the latter concern by considering real rather than nominal earnings to be fixed. However, this is achieved at the expense of the current account closure where the nominal exchange rate now has to be fixed because of the need for a numeraire. As a result, foreign savings adjust to ensure the balance of the current account. In this specification, a shortfall in savings is basically offset by an increase in foreign savings. Indeed, the rise in earnings following any increase in prices implies a real appreciation and thus, a deterioration of the trade balance which can only be counterbalanced by an increase in foreign savings.

2.4. Linking the two models

The "top-down" approach used in this paper is an alternative to integrated models (see Cockburn 2002, Cororaton and Cockburn 2005, Cogneau and Robilliard 2000). It relies on using a CGE and a MS model in a sequential way: first the CGE model is run, followed by a second step in which the changes in some selected variables are passed on to the MS model (see Robilliard et al., 2001).[16] "Top-down" models have the advantage of avoiding the use of representative agent assumptions, while accounting for general equilibrium effects. Since both models are run separately, nothing prevents the use of fairly comprehensive models. This method also has the advantage of not formally requiring full reconciliation of micro and macro data.

The first step consists of running the CGE model to simulate the complete removal of import tariffs. The model returns the new macro-structure of the economy after the "shock". In the context of the "top-down" approach, three sets of variables are of particular interest: prices, returns from capital and labour, and employment levels. In a second step, the changes in these

[16] Our model borrows from Robilliard et al. (2001) with regard to the methodology being employed.

variables are passed on to the MS model. With regard to the prices, this procedure is relatively straightforward, because prices are exogenous to the MS model. The 43 price changes computed by the CGE model are simply passed on to the MS model.[17]

The procedure is more complex for the two other sets of variables. The changes from the CGE model cannot be directly transmitted to the MS model since the MS model is based on microeconomic data whereas the CGE model only returns macro numbers. The two sets of numbers are not automatically consistent with each other. In the "top-down" approach, the macro outcomes are imposed on the micro model. That is, coefficients of the MS model have to be modified in such a way that it reproduces the macro numbers obtained from the CGE model, while allowing for the price and factor return changes which may affect individuals' behaviours. This is achieved by applying micro-macro consistency equations, as explained below.

The CGE model provides us with the total earnings from wages and salaries, and total returns from capital after the policy change. Given that three types of labour are incorporated in the CGE model, it means that it returns three earnings; that is the earnings for high-skilled, semi-skilled and low-skilled workers. These earnings concern only the formal workers since the informal sector is not represented in the CGE model. In contrast, capital returns potentially concern all households.

The earnings changes are transmitted to the MS model by applying the resulting earnings changes per employee from the CGE model to the predicted earnings of each individual in the formal sector. Given that the structure of the labour force by skill level is very similar in both macro- and micro-data, the MS model is thus able to reproduce the changes in the aggregated figures from the CGE model concerning the formal earnings.

Regarding informal earnings, the assumption is that their change depends on the changes in formal employment levels and total formal earnings. The underlying assumption is that working in the informal sector is a survival strategy and that formal workers are the main consumers of informal goods. Consequently, when the formal sector is expanding one would expect fewer people to rely on the informal sector while at the same time there should be more demand for informal goods. As a result, individual informal earnings are expected to depend positively on

[17] The new prices are used to compute a household-specific consumer price index (see section 3.2).

total formal earnings and formal employment.[18] This might prove to be unrealistic but other better-informed choices are limited due to the lack of empirical studies.[19]

The change in capital returns is transmitted to the MS model at the household level since income from capital is a household level variable in the micro-data. The resulting percentage change in capital returns predicted in the CGE is applied to the total income from capital of each household.

In addition to capital income, other components of household non-labour income are also affected by the changes from the CGE model. Transfer incomes from other South African households are updated using changes in formal and informal earnings in accordance with the sectoral distribution of each racial group.[20] Transfer incomes from abroad are assumed to be fixed in the foreign currency and are consequently adjusted following changes in the exchange rate. Since real government expenditures are fixed in the CGE model, transfer incomes from the government are indexed to the CPI.

Although this was not explicitly mentioned in section 2.2, household income from capital and transfers is included in the selection model.[21] As a result, any change in capital income or in the transfer incomes of a given household can potentially affect the labour market choices of its members.

Even though the changes in the predicted earnings and the capital returns already imply that some people will switch from one sector to another, this is not sufficient to ensure full consistency between the two models as far as employment levels are concerned. Changes in the number of formal workers by skill level in the MS model must match those same changes in the CGE model. This can be done by modifying some specific coefficients of the selection model using so-called micro-macro consistency equations. These equations impose some constraints on the MS results such that the numbers of formal low-skilled, skilled and high-skilled workers

[18] The assumption is that the elasticity of individual informal earnings with respect to total formal earnings is equal to one. The elasticity of individual informal earnings with respect to total formal employment is assumed to be 0.5. This is derived from preliminary results of the MS model which have shown that the formal employment elasticity of informal employment is approximately 0.5.

[19] Another alternative was explored in which individual informal earnings vary in the same way as individual formal earnings by skill level. Although the direction of the results remained largely unaffected, all impacts were lower because of the implied cut in the growth of informal earnings. This was particularly true under the first Keynesian closure because of decreasing real earnings for low-skilled and skilled formal workers.

[20] The underlying assumption is that the majority of these transfers is generated by workers in the formal or informal sector, who live outside the household.

[21] Transfer incomes from South African households and from abroad are included in the predicted earnings while capital income and government transfers are considered as separate independent variables.

equal the corresponding numbers obtained from the CGE. The design of these constraints implies that the MS model is allowed to determine which individuals, amongst the entire population, will fill the need for more formal workers if their number is to increase according to the CGE model. Similarly, if the number of formal workers is found to decrease, then the MS model will freely choose the individuals with the highest probability to lose their job, amongst all formal workers.[22]

Regarding the informal workers, no constraint is imposed on the macro outcomes of the MS model since this segment of the labour market is not included in the CGE model. Indeed, only the macro outcomes concerning the formal sector, which accounts for 70 per cent of paid workers (see table 1), are imposed on the MS model. As a result, the number of people in the four other sectors (inactive, unemployed, subsistence agriculture and informal sector) is entirely determined by the MS model as a function of individual characteristics and as a function of the required changes in formal employment.

To conclude, the micro-macro consistency equations, along with the direct transmission of prices, ensure that changes in prices, in earnings from wages and salaries, in returns from capital, and in employment levels are fully transmitted from the CGE to the MS model. Given any change in the macroeconomic structure of the economy predicted by the CGE model, the MS model predicts how individual agents modify their behaviours and how their incomes are affected, while accounting for individual heterogeneity. Therefore, it provides us with an updated picture of the economy at the microeconomic level taking into account the simulated changes in macroeconomic policies. The following section uses this CGE-MS model to assess the effects of trade liberalisation in South Africa.

3. The removal of all tariffs

Since the early 1990s, South Africa has been involved in a trade liberalisation process. As a result, the decline in tariffs was uninterrupted throughout the 1990s and the weighted average tariff decreased by one third between 1993 and 2000. Moreover, the highly complex tariff regime was simplified. In particular, South Africa committed itself to eliminate, or convert into bound ad

[22] In fact, the process is slightly more complex. The MS model allows some people to find a formal job and others to lose their formal job independent of whether the CGE model predicts an increase or a decrease in the aggregate number. The consistency constraints concern only the aggregate results of the MS model since the CGE model only returns numbers at the macro level.

valorem rates, all quantitative restrictions by 1998. The process even went beyond the Uruguay Round commitments announced in 1994 (see Jonsson et al., 2001).[23]

South African trade policy relies on unilateral, bilateral and multilateral trade liberalisation in the context of the World Trade Organisation (WTO). The free trade area agreement with the European Union, by far the most important trading partner of South Africa, was signed in 1999 and due to be progressively implemented from 2000 onwards. Unilateral trade liberalisation is also on top of the South African political agenda, mainly because of its commitments under the WTO and the Growth, Employment and Redistribution Programme. This section uses the CGE-MS model described above to assess the short-run effects of the full elimination of tariffs. The first section presents the macroeconomic effects while the second section focuses on poverty and inequality impacts.

3.1 Macro-results from the CGE model

The ratio of import duties collected to the value of imports is only 3.6 per cent but there are some important disparities between the commodities.[24] For instance, petroleum products enter virtually duty free while the tariff on rubber is 24.2 per cent. The total amount of collected duties represents 8.2 billion rand, which is equivalent to 3.6 per cent of government income. Consequently, the removal of tariffs only implies a limited loss of revenue for the government. However, it also affects the economy through the reduced prices of imported commodities. Table 3 below summarises the results of the CGE model under three different closures.

The initial impact is due to the lowering of import prices, which causes a shift towards imported goods and away from domestic production. As the value of imports rises and the trade balance deteriorates, the exchange rate depreciates which promotes exports and contributes to maintain the current account balance. Regarding the government account, the loss of import duties implies an increase in the government deficit between 0.58 and 0.73 percentage point of GDP. Finally, the mechanisms invoked to bring back the balance between savings and investment depend on the closure.

[23] South Africa is a member of the WTO.
[24] All estimates presented refer to the year 2000. The CGE model uses the value of the collected duties rather than the official tariff rates in order to account for the numerous rebates (see Thurlow and van Seventer, 2002).

Table 3: Simulation results from the elimination of import tariffs

	BASE	Keynes 1	Keynes 2	Neoclassical
	Values[(a)]	Percentage change from base year[(b)]		
Real GDP	R888	0.59	0.37	0.30
CPI	-	1.15	-0.57	-0.24
Real exchange rate	-	0.74	0.22	0.57
Nominal exchange rate	-	2.16	-	0.59
Exports (volume)	R249	1.81	0.95	1.41
Imports (volume)	R225	2.01	1.98	1.56
Trade balance	5%	-0.72	-0.48	-0.73
Private savings	R154	3.54	1.15	1.35
Government deficit	-2%	-0.58	-0.69	-0.73
Foreign savings	R4	2.16	57.05	0.59
Investment	15%	-0.21	-0.19	-0.45
Total real household consumption	R556	0.94	0.97	0.86
Factor real returns				
Capital	-	2.59	1.89	1.76
Low-skilled labour	-	-1.32	-	-
Skilled labour	-	-1.13	-	-
High-skilled labour	-	0.55	0.57	0.48
Factor demand				
Low-skilled labour	3,596	1.42	0.65	0.50
Skilled labour	2,718	1.34	0.74	0.64
High-skilled labour	1,118	0.27	0.29	0.24

Note: (a) Values in billions of rand, percentage of GDP and thousands of workers (b) Changes for base values expressed as a percentage of GDP are expressed in percentage points of GDP. *Source: author's calculations*

In the first Keynesian closure, money illusion amongst low-skilled and skilled workers[25] implies that the increase in the consumer price index causes their real earnings to decrease. The lower cost of these two production factors, along with the diminished price of imported intermediate goods and the stimulation of exports through the real exchange rate depreciation, is at the root of real GDP growth. This GDP growth, together with the induced job creation, supports the rise in aggregate income. In turn, this allows for an increase in private savings which finances the widening government deficit. A growing economy also means more demand for capital and high-skilled labour. Given the limited supply of these factors, their real returns are found to increase significantly. There is a boost in total real household consumption as the decline in real earnings for low-skilled and skilled workers is more than offset by the expansion in employment and by the increased real returns of capital and high-skilled labour.

Under the second Keynesian closure, there is no money illusion amongst low-skilled and skilled workers and the nominal exchange rate is fixed. Consequently, the deteriorating trade

[25] Since nominal earnings are fixed for these workers.

balance is funded by an increase in foreign savings. The expansion in exports is halved because the real depreciation is much less important than in the previous closure. The drop in the consumer price index, resulting from falling import prices, causes nominal earnings of skilled and low-skilled workers to go down. Therefore, their relative competitiveness improves, which results in a downward pressure on unemployment. The induced economic growth, which is also boosted by the decline in imported intermediate inputs, calls for more use of the two scarce production factors. As a result, real returns of capital and high-skilled labour rise substantially. Given that in this closure there is no contraction in real earnings of low-skilled and skilled workers, and since inflation has now turned into deflation, the increase in total real household consumption is found to be slightly higher than in the previous closure, despite a lower real GDP growth.

The Neoclassical closure implies both fixed real earnings and a flexible exchange rate but the level of investment is now free to adjust to the changes in savings. As in the previous closures, two phenomena are at the origin of real GDP growth: the boost in exports generated by the exchange rate depreciation and the lower prices of imported inputs. However, the expansion of the government deficit is not balanced with an increase in foreign or private savings. Instead, there is a crowding-out of investment, which explains why the recorded real GDP growth is less than what is observed under the Keynesian closures. Once more, trade liberalisation implies a decrease in the consumer price index, which translates into more demand for low-skilled and skilled workers since their real earnings are fixed. The increase in total real household consumption stems from a combination of the lower level of unemployment and the growth in real returns of capital and high-skilled labour.

To summarise, the strongest effects are found when there is money illusion, like in the first Keynesian closure, while the smallest effects occur when allowing for the crowding-out of investment, like in the Neoclassical closure. More generally, the effects are greater under the Keynesian closures because savings and investment adjust through the new incomes generated by the fall in unemployment and because there is no crowding-out effect.

More disaggregated data (not shown in Table 3), regarding the level of activity in the 43 sectors of the model, show that there are both losers and winners from trade liberalisation. The sectors benefiting most from trade liberalisation are those orientated towards exports or

household final consumption and with a low initial level of protection like transport, communication, trade and catering services. The sectors with the highest initial levels of protection are the systematic losers. They include the following sectors: footwear, rubber, glass, non-metal minerals, metal products and electrical machinery. Depending on the closure, this list can be extended to leather and textile industries. Finally, trade liberalisation seems to be more favourable to services than to manufacturing sectors. This explains why the boost in demand for skilled labour is found to be systematically higher than the surge in demand for low-skilled labour, because manufacturing is more intensive in low-skilled labour than the rest of the economy.

Regarding household incomes, all results converge towards a gain. Nevertheless, given the contrast between the changes in real returns from capital and high-skilled labour on the one hand, and real earnings from low-skilled and skilled labour on the other hand, a worsening of the inter-group income distribution can be expected.[26] Moreover, regarding low-income households, the MS model will have to determine whether the decrease in real (or nominal) earnings for formal low-skilled and skilled workers is offset by the upward trend in formal employment levels.

3.2 Micro-results from the microsimulation model

Table 4 presents the effects of trade liberalisation at the household level for the entire South African population, as well as for each racial group.[27] The effects prove to be substantially different depending on the racial group, especially regarding the changes in labour market status. The impacts amongst racial groups are mainly driven by the differences in the subpopulation distribution by skill level and labour market sector. Given that the expansion in formal sector employment is stronger for low-skilled and skilled workers (see table 5), blacks (and, to a lesser extent, coloureds) are found to benefit the most from formal job creations. Indeed, there is a substantial stock of unemployed and inactive low-skilled black workers while Asians and whites have higher skill levels and higher levels of employment. Accordingly, in both closures, more

[26] High-skilled labour and capital are the most important sources of income for rich (mainly white) households whereas (black and coloured) poor households' incomes depend essentially on the earnings of low-skilled and skilled workers.

[27] In order to present a table of a reasonable size, results from the second Keynesian closure have been omitted because they are similar in many respects to the results obtained with the Neoclassical closure. However, the decreases in poverty indicators are slightly more important under the Keynesian closure because the presence of the Keynesian multiplier effect implies more job creations.

than half of the new formal workers are blacks who were formerly unemployed or inactive. The trend is thus toward a rather significant decrease in poverty incidence.[28] The increase in formal employment is the main force driving poverty alleviation, largely offsetting the negative impact of decreasing formal real earnings under the first Keynesian closure.

Table 4: Simulation Results from the MS model (percentage change from the base values as presented in tables 1 and 2)

	Keynes 1					Neoclassical				
	All	Blacks	Coloureds	Asians	Whites	All	Blacks	Coloureds	Asians	Whites
Inactive[(a)]	-0.16	-0.12	-0.28	-0.46	-0.36	-0.07	-0.04	-0.11	-0.19	-0.20
Unemployed	-0.91	-0.86	-1.39	-1.13	-1.35	-0.36	-0.33	-0.55	-0.62	-0.67
Subsistence agriculture	-0.23	-0.23	-0.18	-0.58	-0.26	-0.10	-0.10	-0.06	-0.58	-0.11
Informal workers	-0.25	-0.34	-0.70	0.30	2.64	-0.14	-0.14	-0.29	-0.02	0.36
Formal workers	1.21	1.54	1.23	1.02	0.36	0.51	0.61	0.49	0.46	0.28
Informal earnings[(b)]	3.94	2.36	2.61	2.24	7.34	0.97	0.69	0.74	0.58	1.64
Formal earnings[(b)]	-1.43	-1.71	-1.48	-0.97	-0.65	-0.13	-0.19	-0.11	0.01	0.08
Real income per capita[(c)]	0.69	0.61	0.21	0.43	0.91	0.65	0.63	0.49	0.57	0.72
P0[(d)]	-1.55	-1.54	-1.75	0.00	0.00	-0.95	-0.96	-0.71	0.00	0.00
P1[(d)]	-3.18	-3.05	-7.42	-12.26	-13.20	-1.57	-1.51	-3.49	-4.60	-4.59
P2[(d)]	-4.25	-4.08	-9.58	-28.08	-21.59	-2.03	-1.96	-4.64	-10.66	-9.73
Gini	-0.14	-0.42	-0.41	-0.19	0.36	-0.04	-0.11	-0.11	-0.08	0.12

Note: (a) Including 652,000 "unspecified" workers (b) Average real per capita earnings (c) Average real disposable income per capita in Rand (d) The poverty line is the international $2/day poverty line (R174/month/capita in 2000 prices).

The larger growth in formal employment under this closure explains the larger poverty reduction despite a lower increase in real income per capita. The dampening effect is even stronger on the poverty gap index and the poverty severity index than on the poverty incidence. This is due to the fact that the poor households moving out of poverty, because one (or more) members find a formal job, were more deeply in poverty than the very few new households moving into poverty because of lower formal earnings. Poor households with one (or more) members in formal employment tend not to be the poorest households. Another interesting result is that, despite a minor increase in real income, coloureds experience a more important decrease in poverty than blacks. This can be attributed to the much higher share of formal workers amongst coloureds than amongst blacks: despite a smaller percentage increase in the number of formal workers (starting from a larger base value), the percentage decreases in the other labour market categories are stronger for coloureds than for blacks. This explanation also holds for Asians and whites when compared to blacks.

[28] When interpreting poverty changes at the national level, it should be borne in mind that blacks account for more than 95 per cent of all poor.

Another result that becomes evident from the table is that the number of informal workers amongst whites and Asians exhibits an upward trend, especially for whites. Whites and Asians are less in demand than blacks (and coloureds) to fill the new formal jobs. This is due to their higher skill levels and the fact that they are already more likely to work in formal employment. Thus, the number of individuals entering the informal sector because of higher earnings is greater than the number of informal workers moving in the direction of the formal sector. Moreover, following the tightening gap between formal and informal earnings, there is a significant flow of white high-skilled workers moving from the formal to the informal sector, where earnings are not taxed. This phenomenon is the main contributor to the vigorous growth of informal white earnings. It also strengthens the rise in average informal earnings. However, at the country level, the latter increase is mainly caused by the trickle down effect of the formal sector development on informal earnings. Indeed, the growth in formal employment and total formal earnings is indirectly responsible for the increase in informal per capita earnings.[29]

Under the Neoclassical closure, the labour market changes are relatively similar albeit smaller than with the first Keynesian closure. This is not surprising given the smaller changes observed at the macro level (see table 3). Here, the decrease in formal per capita earnings is less important because real formal earnings are fixed at the macro level for low-skilled and skilled workers (whereas they were flexible and decreasing under the first Keynesian closure). The only downward pressure on formal per capita earnings now arises from the fact that the new formal workers tend to have a lower skill level, and thus lower earnings, than the former formal workers. At the macro level, the expansion of the formal sector is smaller in terms of employment and total earnings, which is why informal per capita earnings progress to a lesser extent. However, combined with deflation and formal job creations, this is enough to generate a reduction in poverty incidence. That is the decrease in nominal formal earnings of low-skilled and skilled workers is not sufficient to offset the positive impacts of the formal employment growth and the falling consumer price index.

Regarding inequality, the results using either closure converge towards a small decline at the country level despite a visible worsening of the inter-group income distribution. The growth in real income per capita is systematically higher for whites (the richest racial group) than for the

[29] A secondary reason is that most of the workers leaving the informal sector are low-skilled or skilled workers (who are moving to the formal sector), which pushes up the average skill level and thus average earnings.

poorest groups (blacks and coloureds). However, the apparent increase in inter-group inequality is more than offset by the reductions in intra-group inequalities for blacks, coloureds and Asians due to the labour market changes.

The upward trend in inter-group inequality is mostly caused by the surge in real capital returns and to a lesser extent by the differential rates of growth in formal earnings by skill level. The distribution of capital income is extremely unequal, with a Gini coefficient of more than 0.95. Moreover, it is highly concentrated amongst whites, which explains the increase in inequality amongst this racial group. For whites, price effects are more important than labour market changes: the increase in inequality is driven by the fact that high-income households gain from trade liberalisation because of the increase in real capital returns and real earnings from high-skilled labour. In contrast, labour market changes are more important than price changes for blacks and coloureds (and to a lesser extent for Asians) since capital income and high-skilled workers' earnings account for a much smaller share of their incomes. The decrease in intra-group and total inequality is due to the fact that the poorest households are the main winners from the expansion in formal job creation because the latter is biased towards inactive and unemployed people with a low skill level.

4. Conclusion

In this paper, a CGE model and a MS model are combined in a sequential approach in order to assess the effects of trade liberalisation on South African households. Since there is no strong consensus emerging from the CGE literature regarding the most relevant closure to adopt when assessing trade liberalisation, three different closures with a short-run focus are used in this paper. The aim was to choose some closures either based upon economic theory, the CGE literature or empirical evidence. One Neoclassical and two Keynesian macroeconomic closures of the CGE model are considered. Although the magnitude of the results can vary depending on the closure, a clear pattern emerges regarding the direction of the effects. Trade liberalisation appears to be pro-poor and to have a limited dampening effect on inequality. No matter the closure, the positive impact of formal job creations is always the main force leading to a decrease in poverty. Regarding inequality, the Gini coefficient shows a decreasing trend, independent of the closure used in the CGE model. There is an apparent increase in inter-group inequality, which is due to

the fact that the two production factors showing the highest growth in their returns are skilled labour and capital. These two factors are the two main income sources of high-income (mainly white) households. However, the decrease in intra-group inequalities driven by the labour market changes more than offsets the more unequal income distribution due to increasing inter-group inequality. The results show that labour market changes are the most important factor placing a downward pressure on inequality and poverty while the increase in capital earnings tends to increase income inequality.

In conclusion, the combination of a micro- and a macro-model allows the assessment of macro-policies beyond their economy-wide effects. Even though some micro-impacts can be inferred from the macro-results, the use of a micro-model has proved useful to evaluate more precisely these impacts as well as to carry out some disaggregated analyses. In this paper, the microeconomic effects of trade liberalisation are found to be quite diverse depending on the racial groups.

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