

INFRASTRUCTURE-LED POLICY SCENARIOS FOR SOUTH AFRICA

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Asghar Adelzadeh

INTRODUCTION

The Development Bank of South Africa (DBSA) brought together a group of experts from government, academic and research institutions to engage in a process of scenario-based strategic thinking and scenario formulation. The process enabled participants to examine the future of South Africa and provide diverse perspectives that went beyond the assumptions and views held by any one individual, group or organization. The group began by identifying an overarching focus question for the period between 2008 and 2014: *What are the prospects for increased infrastructure spending to help achieve faster growth, and radically reduce poverty and inequality?*

In response to the focus question, the group constructed a series of plausible scenarios and development trajectories. By grappling with uncertain aspects of the future, and a range of seemingly distant forces that may evolve and affect the overall environment, they generated scenarios to describe diverse possible futures. Economic modelling techniques have been used to examine the plausibility of the future scenarios and to specifically provide feasible answers to the focus question. The combination of scenario planning and economic modelling illustrates the relationship between different future scenarios and relevant policy choices. Importantly, a better understanding of the risks and uncertainties that emerge for the future shed light on the strategic decisions needed in the present to move the country into its most desirable outcome.

THE DRIVING FORCES OF THE SOUTH AFRICAN ECONOMY

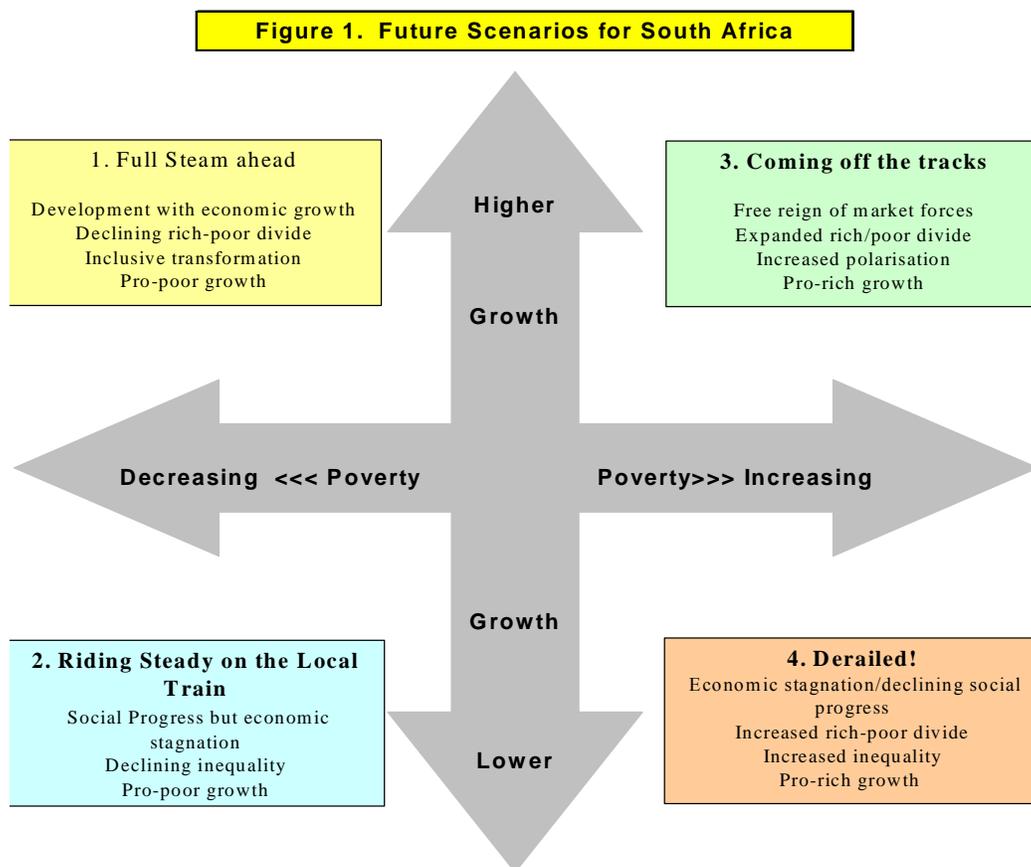
In order to examine this critical question of infrastructure and development, the participants of the group that met in October 2007 engaged in a process of analysis to isolate trends and key forces that drive the economy. They identified 25 key factors that combined known facts about the future, (e.g. demographics, mineral reserves) and critical uncertainties that are plausible yet unpredictable (Column 1 of Box 1.)

Box 1. Drivers of South African Growth and Development

	Impact	Uncertainty
Commodity prices	34	32
Infrastructure Investment	32	18
Consumer spending	29	21
Balance of Payments	24	27
HIV&Aids	19	20
Political will	33	32
Interest rates/Monetary policy	32	19
Fiscal policy	33	16
Governance and democracy	27	25
Capacity – human	33	28
Capacity – Industrial	34	23
Inclusively and exclusiveness/ Unlocking potential	32	29
Climate change	26	24
Use of Fossil fuels	19	21
Infrastructure spend	26	18
Spatial /disparity	27	22
Income and wealth distribution	33	30
Economic growth	34	30
Regional economy	26	27
Global economy –	30	29
International financial market	28	28
Competition and regulation	25	23
Water scarcity	23	20
Energy security	32	23
Technology and innovation	27	24

There are many trends, events and drivers that shape the future, but some are more important and evident than others. The factors identified by participants were ranked according to their *strongest impact* on the economy and those most unlikely to occur (Box 1). Factors that are certain to occur were removed from the discussion. By so doing, participants were able to prioritise aspects of the economy that augment or hamper the goal of infrastructure development and its link to poverty eradication. Additionally, by capturing unpredictable drivers, they were able to identify possibilities, as remote or unlikely, that could enhance or impede the country's success in the long run. Ranking the identified driving forces of the economy enabled participants to achieve consensus on the two most important drivers of South African economy, namely growth and poverty.

The two key drivers are mapped along vertical and horizontal axes in order to construct four quadrants upon which future development paths are depicted. The vertical axis captures the continuum between high and low growth. The horizontal axis reflects the range between worsening and declining rates of poverty. By mapping growth and poverty on an x-y diagram, four distinct quadrants emerge. Each quadrant has a story to tell. The two right-hand quadrants depict diverse development paths that produce higher or lower economic growth with small or substantial decline in the poverty rate. The two quadrants on the left side of the diagram portray possible growth paths that are accompanied by small or large reductions in poverty. Looking at the diagram from a top-bottom angle, the top two quadrants depict the important distinction between two types of high growth paths. Those that fall within the left side quadrant include increased polarisation and worsening of poverty. The growth paths that fall within the top right hand side quadrant lead to gradual or accelerated declines in poverty. The bottom two quadrants



capture similar qualitative differences between development paths with low growth rates.

2014: IDENTIFYING FUTURE SCENARIOS

The participants in the scenario-planning workshop used the key drivers of the economy to identify more specifically the particular conditions under which a mix of domestic and international factors may steer the country towards one of the four quadrants over the next six years. Looking at each scenario from the perspective of the year 2014 – the target set by government for the halving of poverty and unemployment in South Africa – they identified four possible development paths.

Development path 1: Full steam ahead (high economic growth with poverty reduction)

The 'Full steam ahead' path describes a future South Africa in which the desire for improved growth performance has been tempered by simultaneously meeting the country's development goals. Overall, the country's economic path is characterised by high growth rates and declining poverty rates.

It is 2014. Looking back, the factors that helped bring the country to its current situation had both domestic and international dimensions. Domestically, South Africa benefited from high political commitment and coordination aimed at realising the twin objectives of halving poverty and unemployment rates. To achieve this, government policies focused increasingly on achieving a 'pro-poor' growth outcome.¹ The substantial decline in the unemployment rate and significant reduction of poverty and income inequality was the direct result of the inclusive restructuring of an economy that put people to work in meaningful ways.

The implementation of planned investment in infrastructure was successfully carried out, with an uncompromising focus on employment creation. The government successfully designed and implemented a large public employment programme to create millions of work opportunities for the unemployed. Thus, public infrastructure investment has led to the process of pro-poor transformation and improved economic efficiency. As a result, contrary to the earlier trend, the new growth path is characterised by much higher rates of employment creation. This has significantly contributed to the flow of resources to households, enabling many to feel the benefits

of an inclusive growth process and helping them move out of poverty. In turn, the increased household incomes boosted local markets and economic growth.

The high rates of growth were also supported by government's heavy investments in education, health care, housing, water and other social and economic services. A number of international factors also contributed to the outcome of this scenario. For example, the country benefited from the quick recovery of the world economy from the economic crisis of 2008, the stabilisation of oil prices and a continuing robust commodity market.

Development path 2: Riding steady on the local train (low growth with declining poverty)

'Riding steady on the local train' describes a future South Africa where the economy has been successfully restructured to respond to the chronic problems of unemployment, poverty and inequality. The country's economic path embodies reductions in poverty despite its moderate to low growth performance.

From the vantage point of 2014, South Africa's modest growth performance has become increasingly job creating. The government has been steadfast in its commitment to use policy and resources to reduce unemployment, poverty and inequality. Despite lower rates of economic growth, government paced its public infrastructure investment in such a way as to ensure that the growth process embodied significant employment creation and reductions in poverty and income inequality. As a result, infrastructure investment and industrial policy were coordinated to help the expansion of domestic industry, reduce reliance on imports and increase the employment generation potential of public investment.

Moreover, government effectively implemented public employment programmes for the unemployed. It invested heavily in economic services (e.g. housing, education, health care) and expanded financial and in-kind support to poor individuals and households. Critical attention to the building of skills has resulted in workplace applications that have led to greater productive efficiencies within the formal sector, and engendered dynamic efficiencies overall.

Internationally, the prolonged economic slowdown in the OECD countries had a significant impact on South Africa's growth trajectory, as did the decline in the economic growth in sub Saharan countries. As with most of the global economy, the

persistent rise in oil prices has had a significant bearing on the current and future outlook.

Development path 3: Coming off the tracks (high growth with worsening of poverty)

The 'Coming off the tracks' path describes a future South Africa that is able to attain high levels of growth but is unable simultaneously to stave off poverty and inequality. Generally, economic activity remains skewed against the poor, and increasingly against working people, as the social and economic disparities between income groups widen.

It is 2014. The economy is experiencing high levels of growth. However, inequality and poverty levels remain extremely high, in part due to the persistence of the high unemployment rates and insufficient spending on social and economic services (e.g., healthcare, education, water, housing). Public infrastructure investment has had mainly supply side effects, increasing exports and raising the international competitiveness of industries, but it has been unable to increase the employment-generating capability of the economy. Consequently, the benefits of growth are shared by the white and black elites only; redistribution to the population at large remains fleeting and the income gap between the wealthiest and the poorest within society continues to grow.

In this scenario, the desire for economic development has not accompanied the good economic growth performance that has been supported by AsgiSA-related investments. The emphasis on economic growth as the overriding solution to the country's developmental imperatives has led to large segments of society being excluded from the benefits of high growth. The lively discussions that took place at the dawn of democracy about a pro-active development-driven state that would reorient the economy toward pro-poor outcomes were largely pushed to the margins. Wealthy groups, with an interest in retaining the current economic status quo, argued that any growth is good for the poor since 'a rising tide will raise all boats'. Anxious to further maintain and attract global business, the government followed this advice as it implemented its investment in the country's infrastructure. However, the high rate of capital goods imports and low rate of employment creation has negatively affected the livelihoods of many. Rising prices have affected most. The society is even more

polarised than before, with poor communities increasingly marginalised from the country's rising wealth.

The role of domestic factors – such as industrial policy, improvements in health and education outcomes, the public investment in part time employment for the poor, increased investment in economic services – has been downplayed. In contrast, concerns about adherence to inflation targets, the avoidance of budget deficits, increased international competitiveness and deregulation have, among other things, enjoyed singular importance.

Internationally, the good to moderate growth patterns in the OECD countries and robust commodity prices have contributed to the improvement in the country's growth performance.

Development path 4: Derailed! (low growth with worsening poverty)

The 'Derailed!' path reflects the general sentiment that the government promise of inclusive economic development has been largely unfulfilled.

It is 2014. The low rates of growth and rising poverty are partly the outcome of the failure of public and private investment to absorb labour at sufficient levels. Similarly, industrial downturn, particularly in sectors hard hit by inadequate power supply, and a shortage of critical skills have negatively impacted on the economy's performance.

The failure to nurture a broad skills base has prevented upward mobility in the workplace. Government employment creation programmes have failed to materialise or have, in some cases, been inadequate. Persisting high rates of unemployment and underemployment have ultimately diminished the productive potential of the economy. Household incomes have suffered as a consequence of these factors.

The domestic and international causes that have lead to the 2014 situation are diverse. Domestically, the inadequate power supply (first signalled nearly ten years ago) has not been adequately responded to. The government also experienced poor management of public investment. The high import content of public investment undermined the opportunity for developmental industries to benefits from increased public infrastructure investment. Apart from World Cup related investment projects, other infrastructure investment has been curtailed or removed from the government planning processes.

Internationally, rising oil prices, prolonged economic slowdown in OECD countries and other factors have left the international demand for South African goods and

services weak and dampened the country's growth prospects. Box 2 provides a comparison of important features of the four scenarios.

QUANTIFICATION OF SOUTH AFRICA'S FUTURE PATHS

The main distinction emerging from the four possible development paths relates to the magnitude of growth and the inter-relationship between growth, inequality and poverty. As the first step, this section reviews the channels through which growth and poverty interact. It also reviews the criteria that can be used to judge the variations to and extent of their interaction, and an overall assessment of the main beneficiaries of a growth path. Next, modelling techniques are used to develop and quantify policy scenarios with a view to providing feasible answers to the focus question and translating, as far as possible, the above future trajectories into model scenarios.

Growth and poverty

The first question we need to ask is: what is the relationship between economic growth and poverty? To answer this, we need to identify the channels through which growth influences poverty, develop a measure of the contribution of each channel to changes in poverty and provide an aggregate measure of their overall effect on poverty. It is also desirable to go one step further and use the findings to define the conditions for determining whether a growth path is or is not 'pro-poor'.²

In the theoretical and empirical literature, poverty reductions, especially rapid reductions in poverty, depend on two important factors. The first factor is the size of the economic growth rate: that is, the higher (lower) the growth rate, the larger (smaller) the poverty reduction will be. The second factor concerns changes in inequality that generally accompany economic growth: that is, a rise (fall) in inequality decreases (increases) the impact of growth on poverty reduction. Kakwani *et al*³ derive a measure of 'total elasticity of poverty' that captures the net effect of the above two factors on the overall poverty index, and use it to define the formal conditions for different types of growth path. This chapter adopts a different formal approach to derive a similar measure of total elasticity of poverty.⁴ The approach is informed by the need to include explicitly the links between poverty and both the labour market and government's poverty related expenditures. Osmani⁵ defines these channels as the personal income channel and the social provisioning channel. The former refers to the growth of the economy which, through employment, translates

into higher personal income amongst the poor. The latter refers to the resources generated by growth (e.g. taxes) that can potentially be used by a society to provide services to the poor.

Measuring relationships and change

Appendix A provides the formal presentation of the system of inter-relationship between growth, poverty, income distribution, provision of social services and employment.⁶ Assuming that the poverty line is kept constant in real terms, one central expression captures the channels through which changes in the real growth rate of the economy impact on the poverty:

$$\rho = \psi + \phi + \kappa\gamma \quad [1]$$

Where:

ρ represents total elasticity of poverty as a measure of the overall rate of decline in the poverty index, due to a 1 per cent real increase in GDP.

ψ represents a combination of elasticities related to the employment nexus between growth and poverty. It is a measure of how much a small increase in GDP reduces poverty through employment. It captures both the income and the inequality effects. In the rest of this chapter, we refer to ψ as the poverty elasticity of employment.

ϕ represents a combination of elasticities related to the social provisioning nexus between growth and poverty. It is a measure of how much a small increase in GDP reduces the poverty rate through the social provisioning channel. It captures both the income and the inequality effects. In the rest of this paper, we refer to ϕ as the poverty elasticity of social provisioning.

κ measures the direct effect of 1 per cent increase in GDP on inequality (Gini index).

γ measures the increase in the poverty index as a result of a small increase in the inequality index.

Equation 1 captures the way a 1 per cent increase in GDP is channelled through employment and social provisioning to influence mean household income and inequality, which in turn influences the total poverty rate. Thus, the answer to how much a 1 per cent increase in GDP affects poverty depends on the extent to which change in the GDP affects employment and social provisioning, and has overall effects on average household income and inequality. The aggregation of these channels expresses how much, in the end, poverty is affected by a small change in the GDP.⁷

The channels through which changes in inequality impact on poverty can be expressed differently to derive the following equation⁸:

$$\rho = \mu + \sigma \quad [2]$$

Where:

μ represents the growth elasticity of poverty,⁹ which is the percentage change in poverty due to a 1 per cent increase in economic growth, provided that the growth process does not change inequality (i.e. the benefits of growth are distributed equally among everyone in the country).

σ represents the inequality elasticity of poverty. It is an aggregate measure of all the channels through which a 1 per cent increase in GDP impacts on poverty through its impact on inequality. In other words, it is a measure of how much the changes in the total poverty index relate to changes in inequality, given a 1 per cent increase in GDP.

Equation 2 shows that the total poverty index is equal to the sum of two combinations of elasticities. The first (μ) is an extension of Kakwani's concept of growth elasticity of poverty.¹⁰ It measures percentage change in the poverty index that result from the impact of a 1 per cent increase in GDP on employment and social provisioning, provided that the growth process does not change inequality.

The second combination of elasticities (σ) – a measure of the inequality elasticity of poverty – is the sum of different channels through which a 1 per cent increase in GDP impacts on poverty through its net effects on inequality. σ captures three channels

through which growth impacts on inequality. The first and second measures capture the impact of growth on inequality through the employment and social provisioning channels. The third measures the direct effect of growth on inequality.

Kakwani, Khandher and Son¹¹ show that economic growth is pro-poor (pro-rich) if the change in inequality that accompanies growth reduces (increases) total poverty. This implies that growth is pro-poor if both total elasticity of poverty (ρ) and the growth elasticity of poverty (μ) are negative and $|\rho| > |\mu|$. These two criteria for pro-poor growth are satisfied under certain conditions.¹²

For our purpose, a key criterion to distinguishing different development paths is the magnitude and sign of the total elasticity of poverty, ρ . A negative (positive) ρ reflects the overall rate of decline (increase) in the poverty index, due to a 1 per cent real increase in GDP.

ECONOMIC MODELLING AND POLICY SCENARIOS

In this section, we use a linked macro-micro economic model of South Africa to simulate the growth and development impacts of various policy scenarios to answer the core question – what are the prospects for increased infrastructure spending to help achieve faster growth, and radically reduce poverty and inequality? Appendix B provides a brief overview of the structure and characteristics of the economic model that has been used (i.e., Dynamically Integrated Macro-Microeconomic Model of South Africa – DIMMSIM). This section focuses on the specification of policy scenarios and analyses of their simulation results.

Policy scenarios

What, with a different mix of policies, are the alternative paths that the economy is likely to take? The criteria that are used to judge the quality of different economic paths follow from this core question. A desirable economic path would possess the following characteristics:

- positive economic growth – the higher the better
- declining unemployment rate – the faster the better
- decreasing poverty – the faster the better
- decreasing income inequality – the faster the better
- improved access by the poor to public services – the more the better

In addition, results for a given economic path are evaluated for sustainability using a number of criteria, including:

- stable, low to moderate inflation
- sustainable external balance – the less the deficit the better
- stable fiscal position – low to moderate deficit.

Overall, the model was used to simulate a ‘base’ scenario and three groups of alternative scenarios. The base scenario is a construct of the future of South African economy with which to compare all other scenarios. It is designed to capture the economic growth and development trends that do not include ASGISA-related investments after 2007.

The first group of alternative scenarios (Group A) includes three scenarios that focus on the macroeconomic and development impact of different levels of public infrastructure investment during 2008-2014. The Group B scenarios are experiments designed to test the impact of combining the surge in public infrastructure investment (Group A scenarios) with initiatives aimed at gradually increasing the employment intensity of growth. The Group C scenarios are designed to test further the possibility of accentuating the developmental outcome of Group B scenarios by including a guaranteed national public employment programme.

GROUP A POLICY SCENARIOS: MACROECONOMIC AND DEVELOPMENT IMPACTS OF PUBLIC INFRASTRUCTURE INVESTMENT

The multi-year expansion of public infrastructure investment is expected to have diverse direct and indirect effects on the economy. It is, among other things, expected to increase output, potentially increase private sector investment and raise employment. Through the channels that link growth to poverty, poverty and income inequality are also expected to be affected by the rise in public investment. The model used for this chapter captures and quantifies the complex interactions between macroeconomic, microeconomic and policy variables. It quantifies the growth, employment, poverty and inequality impacts of alternative public investment scenarios.

This section presents details and results of three policy scenarios that form Group A scenarios. The aim is to examine the macroeconomic and developmental effects of carrying out different levels of public investment between 2008 and 2014. The

scenarios differ based on assumptions of the level of public investment during the next seven years. Generally, they can be distinguished as follows:

Scenario A1 (100% AsgiSA Scenario)

The focus of this scenario is on simulating the impact of fully implementing the government's infrastructure investment plan within the stated timeframe, as outlined in 2008 Budget Review. Moreover, since there is no specific government investment plan for the period 2011 to 2014, the scenario assumes that the public sector continues to invest substantially in social and economic infrastructure after 2010. Table 1 reflects the planned public investment during the next three years. It also shows the hypothetical level of public investment for the period 2011 to 2014, with the annual nominal growth rate of 13 percent.

	2008	2009	2010	2011	2012	2013	2014
Building and construction works	55,282	55,614	59,662	67,418	76,182	86,086	97,277
Transportation Equipment	12,325	9,519	10,469	11,830	13,368	15,106	17,070
Machinery and Other Equipments	58,602	96,114	95,751	108,199	122,264	138,159	156,119
TOTAL	126,209	161,247	165,882	187,447	211,815	239,351	270,466
General Government GFCF	54,966	62,001	65,599	74,126	83,762	94,651	106,956
Non Financial Public Corporations GFCF	71,243	99,246	100,284	113,321	128,053	144,699	163,510

Note: Values for 2008-2010 are based on Treasury Department, 2008 Budget, various tables from Chapter 3, items related to the gross fixed capital formation (GFCF), and the General Government and Non Financial Public Corporations. The data for 2011 to 2014 is based on the assumption that public investment in the economy will continue at a similar rate as the period 2007-2010. Specifically, it allows annual investment in the three types of investment to be equal to the average of corresponding investment during 2007-2010.

Scenario A2 (50% AsgiSA Scenario)

Scenario A2 examines what will happen if the public sector is unable, for various institutional, social, economic or political reasons, to implement fully its planned infrastructure investment. Or alternatively, what are the implications if both government and public enterprises adopt slower implementation plans for their infrastructure investment in order to allow for the gradual expansion of domestic industries? Specifically, the scenario examines the impact of public infrastructure investment that is 50 per cent lower than the amount in Scenario A1.

Scenario A3 (150% AsgiSA Scenario)

Scenario A3 examines the impact of hypothetical public investment expenditure that is 50 per cent greater than that in Scenario A1. This scenario is designed to capture

possible additions to current planned infrastructure investment to include larger investment in social infrastructure (e.g., building schools, hospitals, irrigation systems, etc.) that goes beyond the current economic infrastructure investment.

While the three scenarios share many similar assumptions, the following points are noteworthy:¹³

- Employment intensity of economic growth: The three scenarios are run without any external positive or negative shocks to employment. The employment intensity that emerges for each economic growth path is endogenously generated in the economy.
- Current expenditure of the government 2008 to 2014: The three scenarios use government's planned current expenditure for the period 2008 to 2010, as outlined in the latest budget document. The model uses the average annual growth of expenditure items for 2007 to 2010 to project amounts for the period 2011 to 2014.
- Monetary policy rule: The scenarios are run using the current inflation-targeting rule for monetary policy. The rule allows the interest rate to adjust gradually to close the gap between the annual inflation rate and the target inflation rate.
- Social security: The social security programme that underlies the three scenarios reflects current policy and includes the gradual extension of the old age pension benefit to males above 60 years old over the next three years. However, the amount of all social grants and the means tests are fully adjusted to the inflation rate every year within the model.¹⁴
- Poverty line: All scenarios in this chapter use the adult equivalent definition of a poverty line, set at R577 per month for 2008. The poverty line is also annually adjusted to the inflation rate.

Other common assumptions for the scenarios in this group relate to:

- Trend in oil price
- OECD average annual growth rate
- Sub-Saharan average annual growth rate

Analysis of scenario results

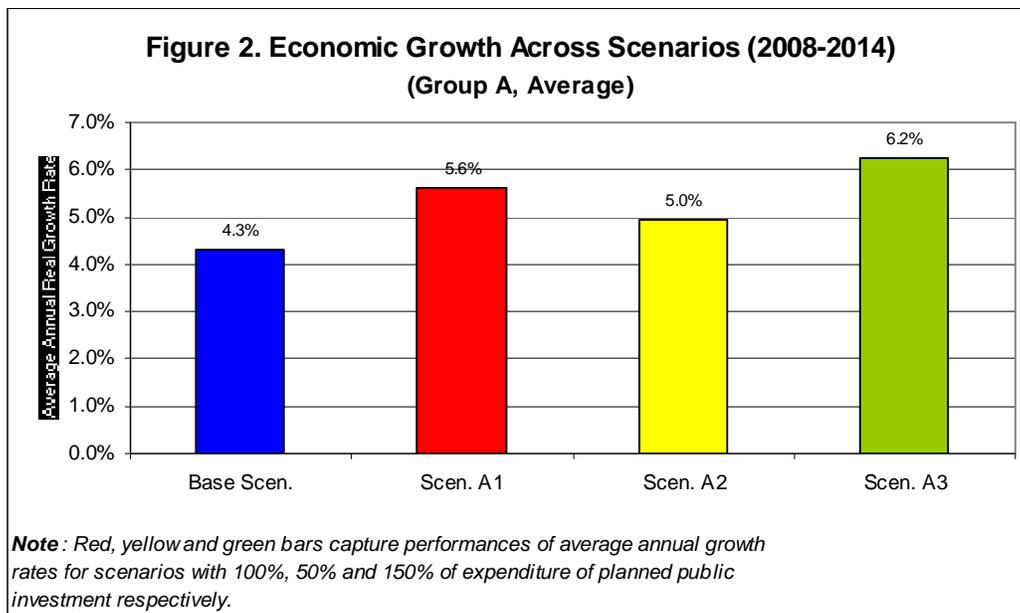
The model generates extensive results for a wide range of variables related to the macro economy, industrial sectors and household's poverty and inequality.¹⁵ Given

the space limitation, this section presents simulation results for only four key growth and development indicators and several sustainability indicators for the period 2008-2014.

The four important macroeconomic and developmental indicators are: the real rate of economic growth, the unemployment rate, the poverty rate and the Gini-coefficient as a measure of inequality.¹⁶

Growth Rates

The base scenario, that assumes no AsgiSA related public investment beyond 2007, produces an average real annual growth rate of 4.3 per cent for the period 2008 to 2014. On the other hand, the full implementation of the current public investment plan, as described in Scenario A1 (100% AsgiSA scenario) helps raise the average rate of growth to 5.6 percent. The average annual growth will decline to 5.0 per cent with Scenario A2 (50% AsgiSA scenario) and will increase to 6.2 per cent with Scenario A3 (150% AsgiSA scenario). Comparing this to the base scenario results, it is clear that the magnitude of public investment makes a significant difference to growth performance and thus the size of the economy (Figure 2).¹⁷



The above overall results for the growth of the economy are distributed differently among sectors of the economy. AsgiSA-related public investment particularly helps raise the level of output of the following sectors: transport, storage and communications; building construction and engineering; financial services, business

intermediation, insurance and real estate; basic iron and steel; electricity, gas and water; coal mining; other mining; machinery and equipment; furniture; and community, social and personal services.

Unemployment rate

Using the Statistics South Africa population forecast up to 2015, and assuming that labour force participation remains at its 2007 level (56.5 percent), the South African labour force is estimated to reach 18.6 million by 2014. The objective of halving, by 2014, the official 2004 unemployment rate implies that the level of employment needs to reach 16.2 million. Based on the latest available Labour Force Survey¹⁸, this implies creating about 3 million jobs between 2007 and 2014.

The model's estimates of the level of employment and the unemployment rate for 2007 are 11.9 million and 30.2 per cent respectively. These results are different from the Statistics South Africa's 13.2 million and 23 per cent for September 2007 (Statistics South Africa 2008). The discrepancy is mainly due to the classification of more than 2 million informal sector jobs as employed in the StatsSA report. The model's projections of sector employment are mainly based on formal sector employment and include employment in the agriculture and household sectors.

Under the base scenario conditions, the model predicts that the unemployment rate will not change between 2008 and 2014, even though the economy is projected to generate almost 900 000 new jobs. On the other hand, over the next seven years, the model predicts that the growth path that underlies Scenario A1 (100% AsgiSA scenario) will result in the additional employment of 1.2 million, which is 300 000 more than the base scenario. Scenario A2 (50% AsgiSA scenario) results in a lower average annual growth rate and is also projected to generate fewer new jobs (about 1 million). On the other hand, under scenario A3 (150% AsgiSA scenario), total employment is projected to increase by about 1.4 million.

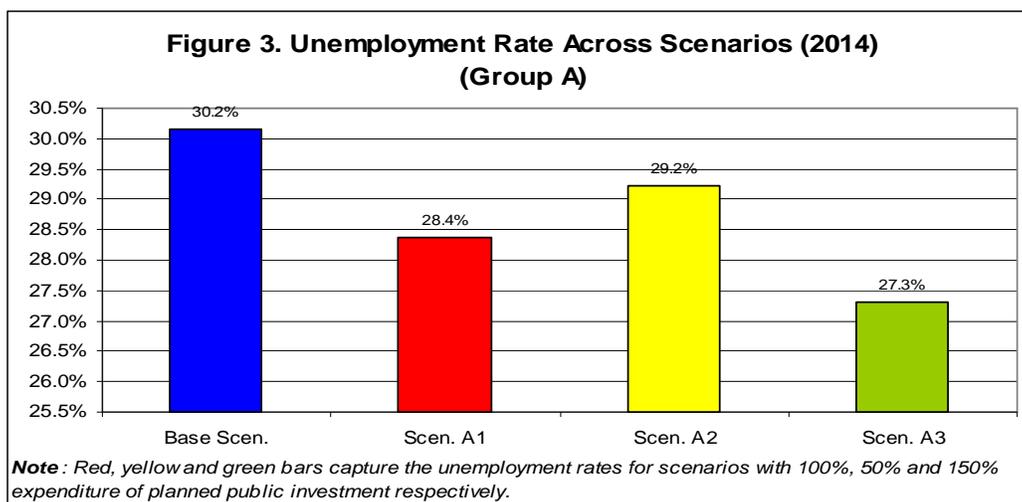


Figure 3 compares the base scenario unemployment rate with the projected unemployment rates for the Group A scenarios. These results show that, even though the economy is projected to grow at moderate to high levels, the unemployment rate will be only few percentages lower than in 2007. This mainly reflects a structural problem with the South African economy, where investment (including public investment) that engenders economic growth embodies low employment creation. Consequently, the average employment elasticity of growth is relatively low (between an average annual value of 0.327 to 0.363) for the base scenario and the Group A scenarios for the period 2008 to 2014.

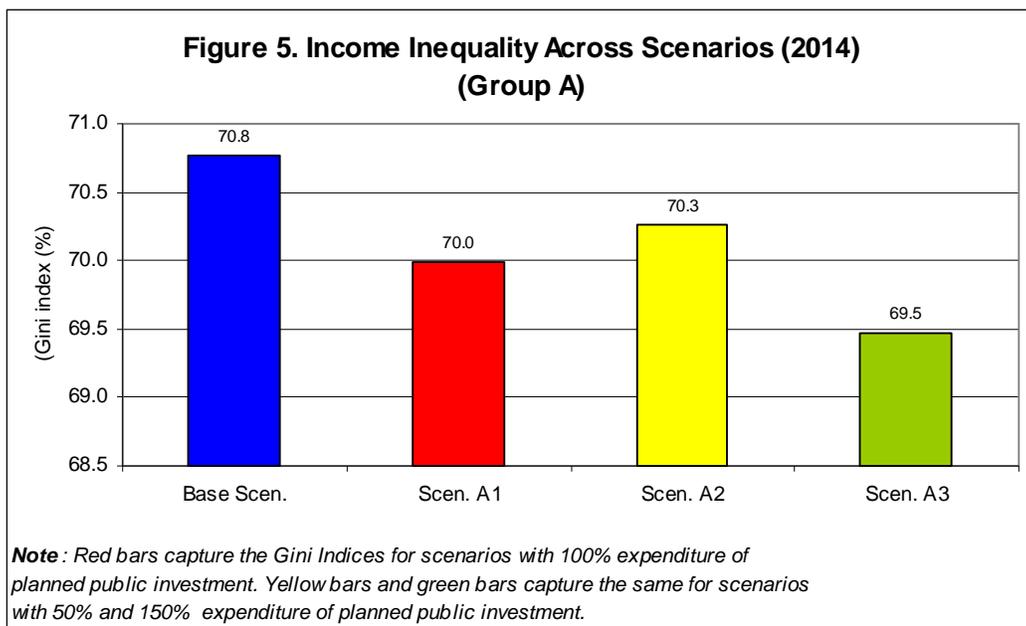
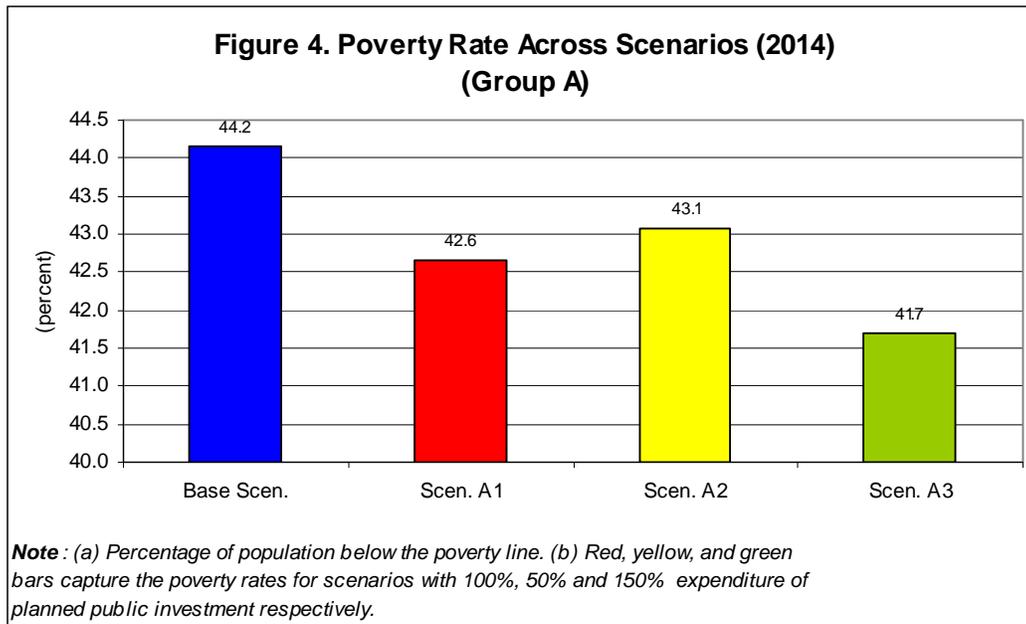
In terms of the distribution of employment between the economic sectors, manufacturing sector employment is the main beneficiary of the rise in the level of public infrastructure investment under Group A scenarios. Its share of total employment increases from the estimated 12.87 per cent for 2007 to 14.7 per cent (Scenario A1), 14.3 per cent (Scenario A2) and 15.0 per cent (Scenario A3) for 2014.

Poverty and inequality

Without AsgiSA-related public investment, the poverty rate (which is estimated at 39.9 per cent for 2008) is expected to deteriorate and drop to 44.2 per cent by 2014. Income inequality, measured by the Gini-index,¹⁹ is expected to improve slightly from the estimated 71 per cent in 2008 to 70.8 per cent by 2014. These weak results are due to the narrowness of the economic channels that link the base scenario's growth path to poverty. Overall, the economic path represented by the base scenario is not pro-poor: that is, the non-poor portion of the population will be relatively better off under this growth path. This observation is captured by the positive sign of the total elasticity of poverty ($\rho = 1.86$), which is an overall measure of the nexus between growth and poverty (Figure 4).²⁰

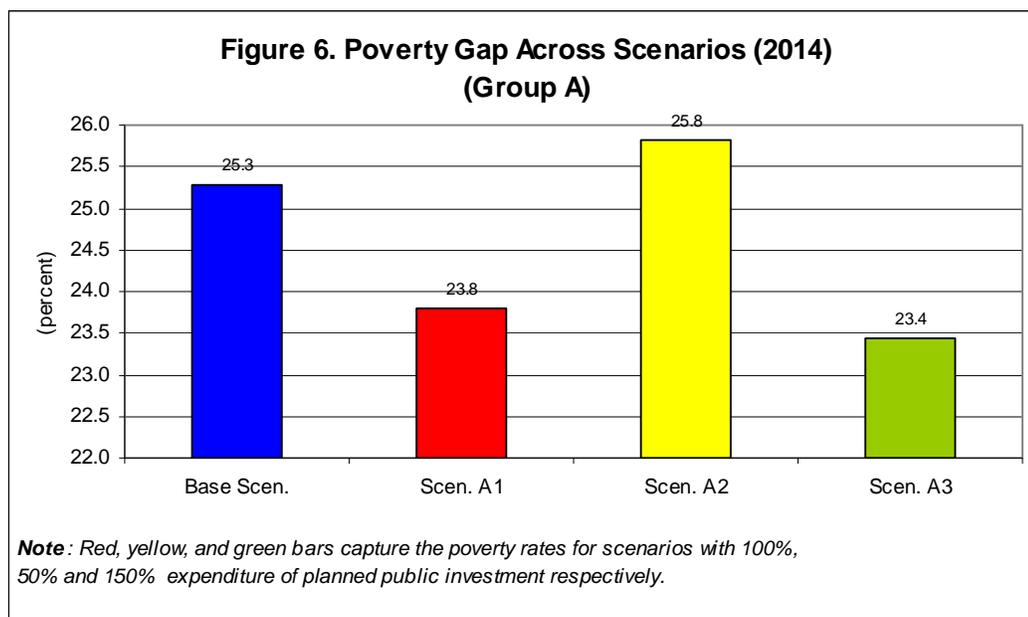
The relatively higher growth performance of Group A's three public investment scenarios does not change the overall developmental characteristics of the related growth paths. None of the three scenarios generates pro-poor outcomes. The total elasticity of poverty remains positive for the three scenarios. This implies that, under the current economic structure, AsgiSA-related public investments will continue to benefit the non-poor more than the poor, as in the case of the base scenario. The only difference is that, relative to base scenario results, the Group A scenarios are expected

to result in smaller increases in the poverty rate and larger reductions in inequality (Figure 5).



Figures 4 and 5 compare the poverty rate and inequality results for the Group A scenarios with the base scenario results. The findings show that even with the scenario with the best results (Scenario A3), the poverty rate will be 41.7 per cent in 2014, and income inequality will be only slightly less severe in 2014 than the corresponding

values for 2008. The depth of poverty, measured by the poverty gap,²¹ also declines only slightly under the Group A Scenarios (Figure 6).



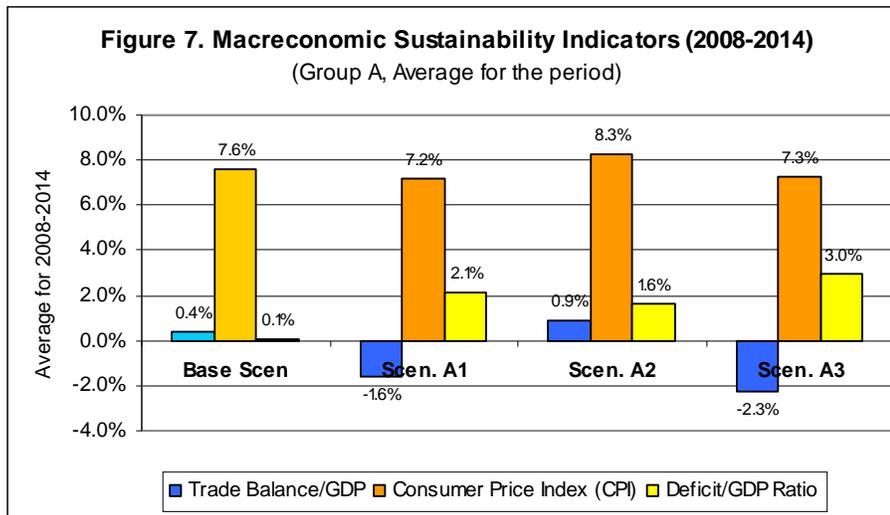
Sustainability of scenario results

The results for Group A's public investment scenarios show that public infrastructure investment has the potential to propel the economy to medium to high growth paths, albeit with poor developmental outcomes. Results for a number of additional indicators, furthermore, highlight the characteristics of the scenarios in this group. Figure 7 provides an overview of indicators related to the macroeconomic and sector specific results. It shows that the three scenarios produce a consistent and stable set of results for key economic sustainability indicators. Of important interest for the next sets of scenarios are the fiscal results for the three scenarios, which include budget surpluses ranging from 1.5 per cent of GDP for scenario A2 to 4 per cent for Scenario A3.

GROUP B POLICY SCENARIOS: IMPACT OF CHANGES IN EMPLOYMENT INTENSITY OF GROWTH

The simulation of the public infrastructure investment scenarios of Group A did not include additional measures to enhance the employment intensity of the growth process in South Africa. Consequently, despite AsgiSA's large investment injection into the economy, and given the inherited economic structure, the employment

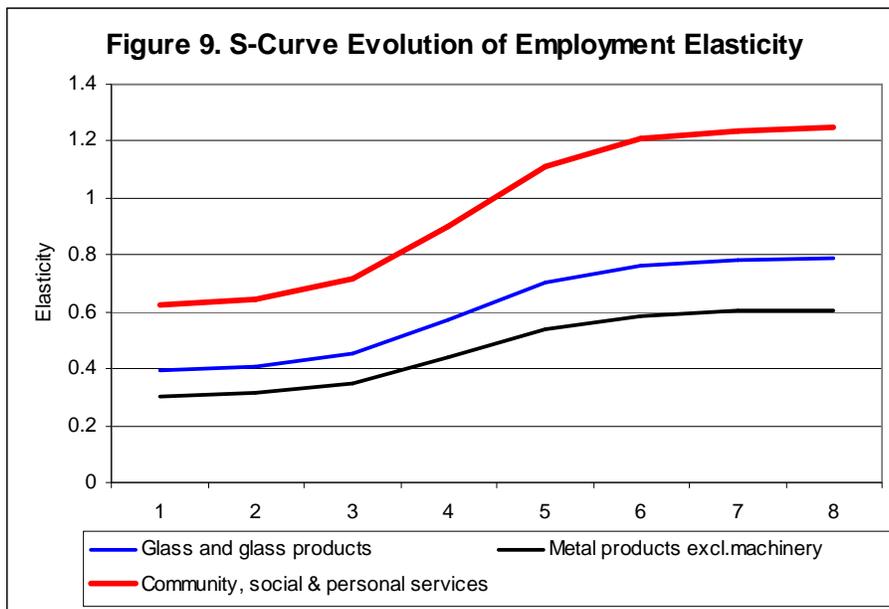
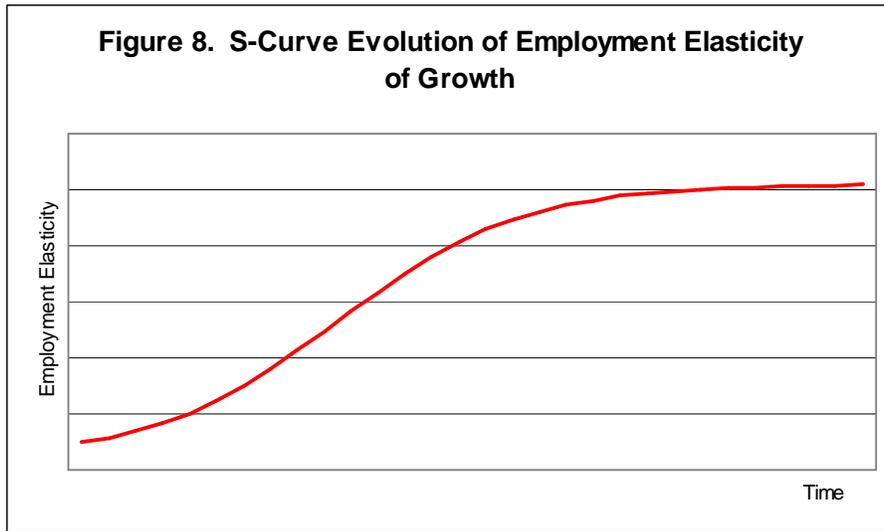
projections for the three Group A scenarios were weak, resulting in a small decline in the unemployment rate. This outcome further undermined the potential of public investment to reduce poverty and inequality significantly.



The next group of scenarios considers what might happen if the infrastructure investment measures of Group A scenarios are accompanied by public and private sector decisions to use production technologies that help increase the economy's rate of employment creation.²² What will be the impact on poverty and inequality? How will macroeconomic balance be affected?

The Group B scenarios seek to answer these questions by postulating gradual increases in the employment intensity of economic growth in South Africa. More specifically, the three scenarios in Group B (scenarios B1, B2, and B3) use a diffusion model of technology to allow the doubling of the sector specific employment elasticity of growth during the next six years.²³

In the literature, the technology diffusion time path most typically takes the form of S-shaped curve (Figure 8). In order to carry out the plan to double the labour intensity of growth, the S-curve process envisions a slow early stage (two years) of adopting important changes in how both public and private sectors use domestic and imported technologies in the production process. This process is then expected to begin to accelerate, diffusing to all industries and firms. But then it begins to tail off as sectors' employment intensity of production approach industry-specific targets. Hence the S-shape is depicted in Figure 5.



To simplify the approach, the Group B scenarios do not define a particular level of employment elasticity of growth to be reached by all sectors of the economy. Instead, the objective for each of the 42 sectors of the economy is to double its employment elasticity of growth by 2014. As an example, Figure 9 shows the S-curves that were defined for three sectors of the economy.²⁴

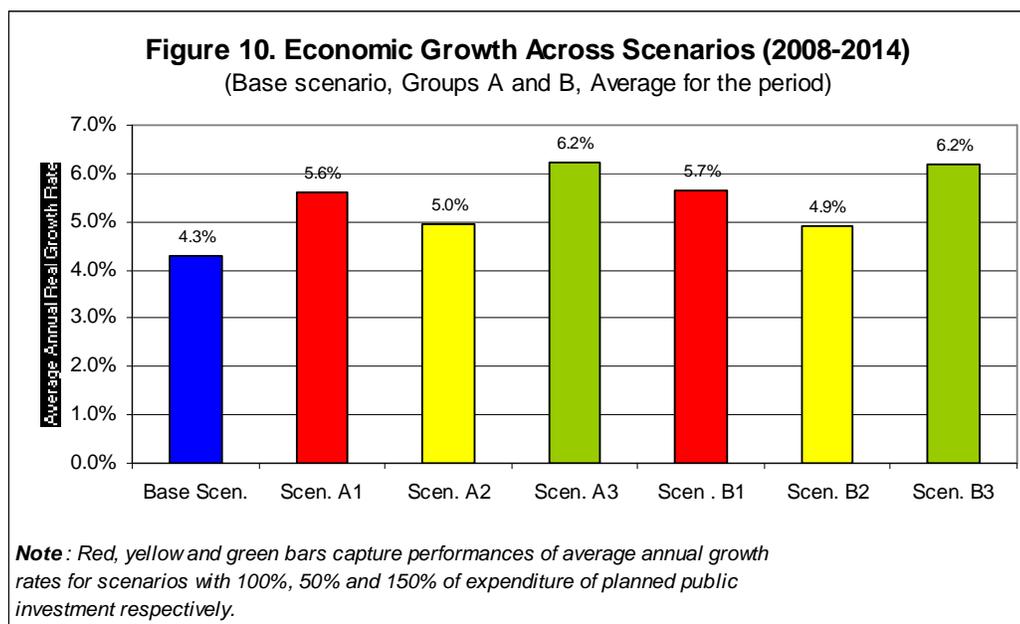
Analysis of scenario results

The simulation exercise helps quantify the differences between Group A scenarios, which leave the historically low employment intensity of growth intact, and scenarios with a higher rate of employment creation in Group B. The simulation results are as follows.

Growth rates

The average annual growth rates generated under Group B scenarios are slightly higher than those produced for Group A. Even though the growth performance of the two sets of scenarios is almost the same, the growth paths that underlie the Group B scenarios are different. The trend increase in the employment intensity of growth gradually brings about modest changes in the distribution of the economic output between labour and capital. For example, for Scenario B1 (100% AsgiSA plus doubling of employment elasticity) the share of wages and salaries in the GDP is estimated to increase to 48.2 percent, from an average of 46.8 per cent for Scenario A1 (100% per cent AsgiSA scenario). Correspondingly, the profit share²⁵ is expected to decline from 40 per cent to 38.5 percent.

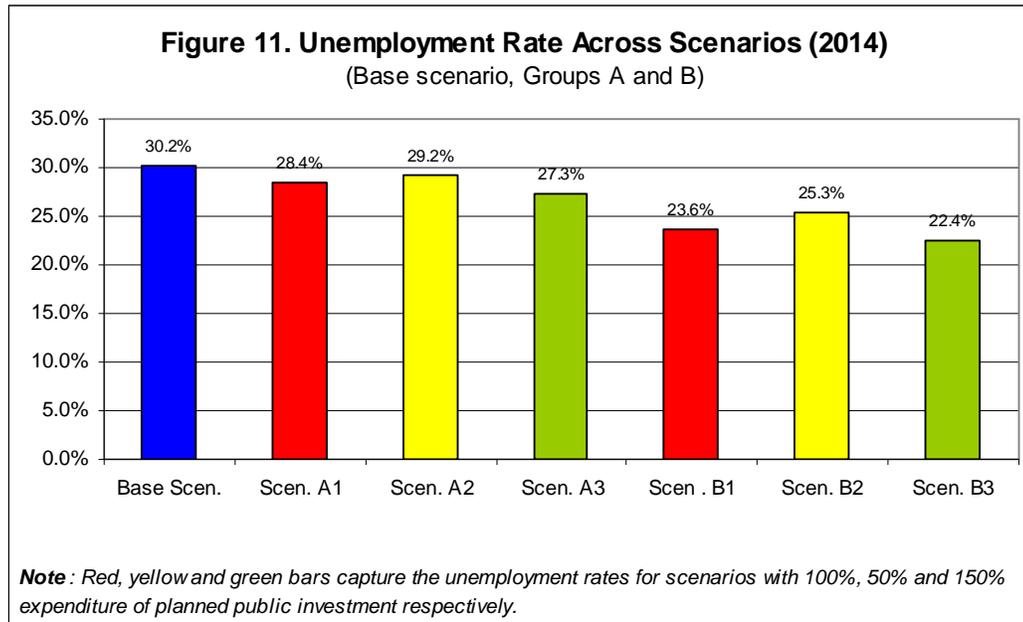
The above changes in the distribution of output among factors of production also engender changes in the components of aggregate demand – which induce changes in the sector outputs and the aggregate supply. Figure 10 presents a summary of the growth performance of Group B scenarios.



Unemployment rate

As expected, the gradual increase in the employment intensity of growth helps Group B scenarios to generate higher levels of employment than the Group A scenarios. Consequently, as Figure 11 shows, by 2014, the estimated unemployment rates for

Scenarios B1 to B3 are lower than the estimates for Scenarios A1 to A3 by about four to five percentage points. However, the projected unemployment rates associated with the Group B scenarios remain above 20 per cent in 2014. The total number of unemployed is estimated at 4.3 million (Scenario B1), 4.6 million (Scenario B2) and 4.1 million (Scenario B3).

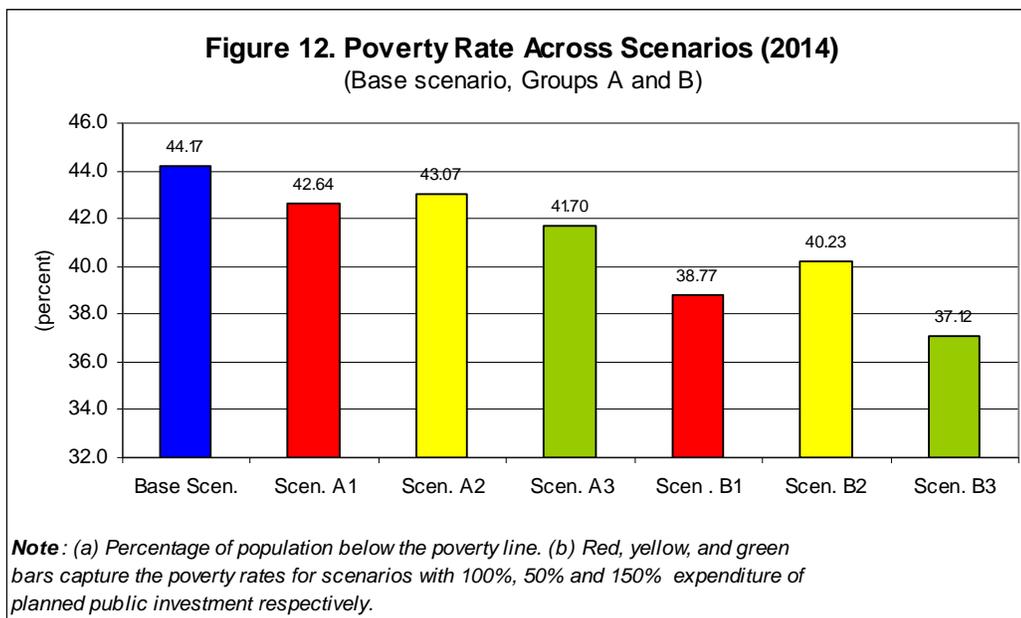


Higher employment rates in Group B relative to Group A scenarios also result in relatively higher average real wage rates for the three scenarios in the former group. However, the differences are not significantly large. The average real salaries in the Group B scenarios are projected to be about 1.7 per cent higher than the results for the Group A scenarios.

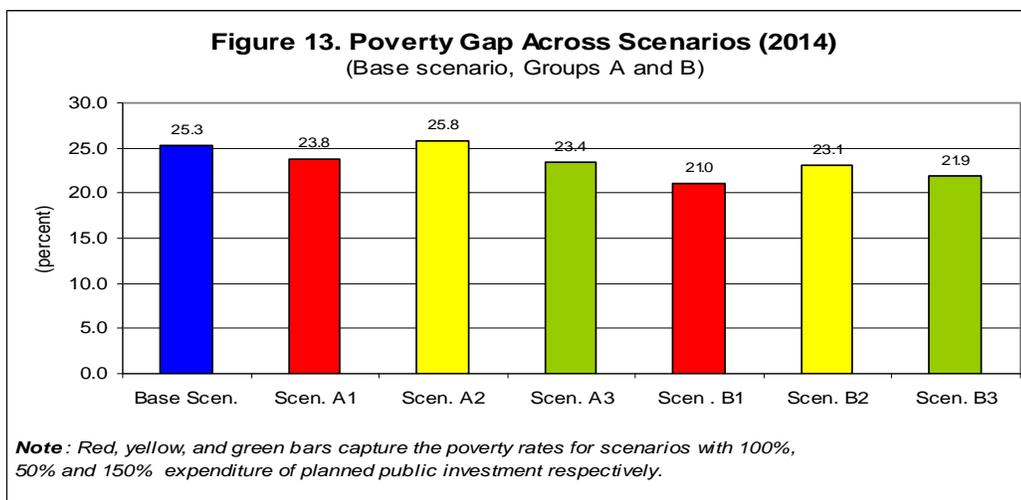
The gradual adoption of more labour-intensive technologies leads to an about 0.5 per cent lower average (for the period between 2008 to 2014) capital labour ratio for Group B scenarios, compared to the Group A scenarios.

Poverty and inequality

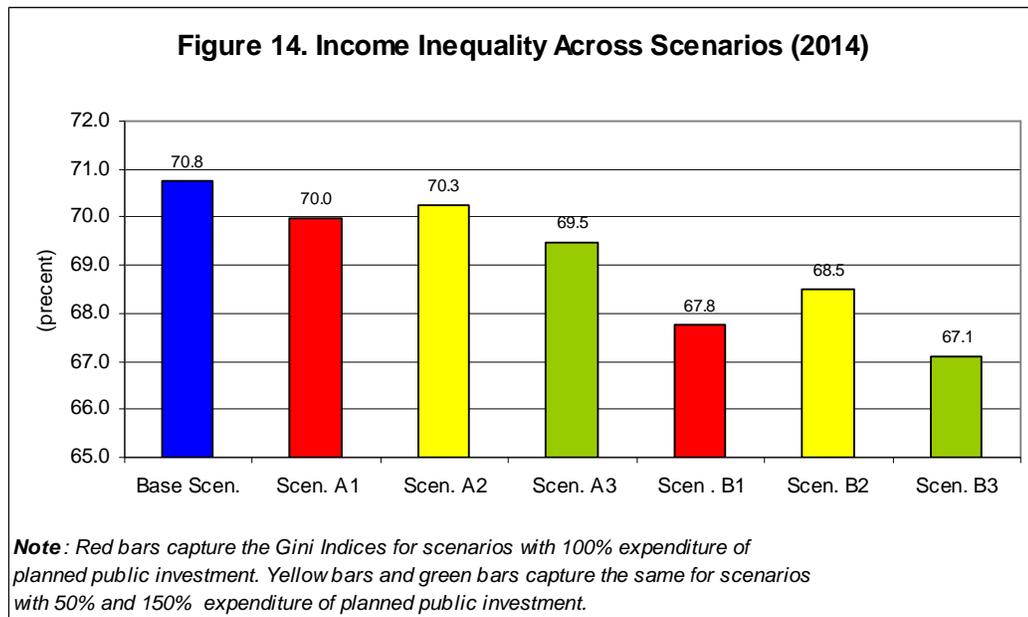
In contrast to the Group A scenarios, the three scenarios in Group B produce pro-poor results. This is reflected in the negative value of the total elasticity of poverty for the Group's scenarios, signifying that the growth processes that underlie these scenarios tend to lower poverty. For example, Scenario B1 (100% AsgiSA and doubling of employment elasticity) yields -0.416 as its total elasticity of poverty. This means a one per cent increase in the real GDP reduces the poverty rate by 0.4 percent.



One reason for the projected pro-poor results for the Group B scenarios is the rise in the mean real household income in the Group B scenarios, which is projected to be about 2 per cent higher than the results for the Group A scenarios. Higher levels of employment among the three scenarios in Group B help widen the personal income channel that links economic growth to poverty. Moreover, to the extent that the unemployed from poor families are the main beneficiaries of the rise in the employment intensity of economic growth,²⁶ the growth processes that underlie Group B scenarios accelerate the decline in income inequality. This, in turn, contributes to further reductions in the poverty rate and poverty gap for the Group B scenarios. Figures 12-14 compare results for poverty rate, poverty gap, and income inequality for the two groups of scenarios.



An interesting finding relates to the comparison of results from scenarios A1 (100% AsgiSA scenario) and B2 (50% AsgiSA plus doubling of employment elasticity scenario). The first includes infrastructure investment that is twice the amount of similar investment in the later scenario. In the case of Scenario A1, the full implementation of infrastructure spent helps generate an average annual growth rate of 5.6 per cent for the period 2008 to 2014. This is 0.7 per cent higher than the average growth rate of 4.9 per cent that results from Scenario B2, when the infrastructure investment is equivalent to 50 per cent of Scenario A1. Thus Scenario A1 is clearly superior in terms of helping to raise the rate of growth.



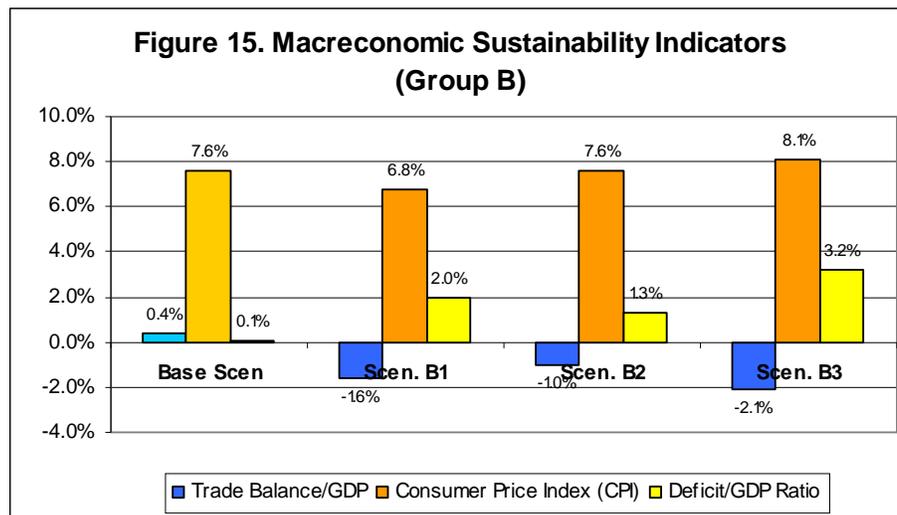
In terms of developmental outcomes, however, the results paint a different picture. The scenario with the higher average growth rate is associated with a higher unemployment rate (28.4 per cent against 25.3 per cent for Scenario B2), a higher poverty rate (42.6 per cent versus 40.2 per cent) and higher income inequality (Gini-coefficient of 0.70 compared to 0.68). These findings highlight the possibility of achieving better development results through a slower pace of infrastructure investment that allows for a gradual increase in the employment intensity of growth.

Sustainability of Group B economic paths

The general economic indicators for Group B scenarios (Figure 15) reflect three stable economic paths. The three scenarios produce trade, fiscal, financial and real indicators that satisfy the stated basic sustainability criteria. These results show that the South

African economy is sufficiently able to follow more labour intensive growth paths and avoid major swings in its general economic indicators.

At the same time, the results show that there are certain trade-offs between Group A and Group B scenarios. For example, the relative rise in levels of employment in Group B scenarios, which are accompanied by relative increases in household incomes, are expected to translate into relatively higher average wage shares and lower corresponding profit shares. As a result, the average wage share of 48.2 per cent for the period 2008 to 2014 for Scenario B1 in Group B is higher than the corresponding average share of 46.8 per cent for Scenario A1 of Group A. At the same time, the average profit rates for the Group B scenarios continue to remain relatively high, even though they are slightly lower than their corresponding values for Group A scenarios.



Importantly, these and other similar results in Table 5 reflect important changes in the pattern of income distribution in South Africa. These are crucial to accelerating the pace of poverty reductions.²⁷ Since the scenarios from Group A and B generate relatively similar growth rates, Group B's significantly lower poverty rates are basically due to improvements in income distribution that are, at macroeconomic level, captured by raising the wage share and per capita households' real disposable income.

Despite relatively better developmental outcomes, the simulation results for Group B scenarios show that even measures to gradually double the employment intensity of growth within the next seven years will not be sufficient to halve the unemployment rate by 2014.²⁸ The results of Group B scenarios show that, by 2014, the

unemployment rate will still be significantly high. Since Group B scenarios already embody high employment elasticity of growth, it is not reasonable to expect even higher elasticity within the next six years.

GROUP C POLICY SCENARIOS: QUANTIFICATION OF IMPACT OF GUARANTEED PUBLIC EMPLOYMENT

The model results for Group B scenarios quantitatively underscore the working of the growth-employment-poverty nexus, as detailed in the analytical section of this chapter. On the one hand, the simulation results highlight the effectiveness of reducing poverty through employment (i.e., the employment-poverty channel). On the other, the results reveal the enormity of the challenge facing the market-based growth-employment nexus if it is to reduce the high level of unemployment in South Africa significantly. Even though Group B scenarios allow the employment intensity of growth to double during the next seven years, none of the three public infrastructure investment scenarios will help lower the unemployment rate to below 20 per cent by 2014.

Looking forward, it seems economically unrealistic to go a step further and examine the possibility of more than doubling the employment elasticity of growth within the next six years. An alternative is for the public sector to embark on a major employment creation programme. Group C policy scenarios examine the feasibility and impact of adding a guaranteed public employment scenario to the Group B scenarios.

Guaranteed Public Employment (GPE)

Access to a form of public employment programme in economic crises and as a means of survival has a long history, especially as a temporary emergency measure.²⁹ In recent times, the rise in the number of unemployed and underemployed in many countries has led to calls to use public employment schemes on a permanent basis.³⁰ Over the years, many countries have had various experiences with the provision of public employment schemes. Antonopoulos³¹ provides a summary table of the cross-country variations in the policies and content of guaranteed employment programmes. This includes, amongst other things, overcoming challenges related to the source of financing, types of projects, eligibility criteria for the participants, method of

remuneration, institutional arrangements, degree of decentralisation, level of community involvement and the length of guaranteed employment for participants. In 2004, South Africa embarked on the Expanded Public Works Programme (EPWP) as a medium-term active labour market policy to generate one million new jobs for unemployed low-skilled individuals over five years. Recent evaluations of EPWP performance³² highlight the achievements and weaknesses of this programme. As a first step, the economic and development impacts of EPWP are simulated as a distinct policy scenario. The salient features of EPWP used for this purpose include: (a) its plan to provide part-time employment for one million unemployed by 2010; (b) its provision of an average 60 days of employment per year per person; and (c) its average daily wage rate of R50.³³

In the next step, given the core objective of designing policy scenarios that radically reduce poverty and inequality, scenarios C1 to C3 examine the consequences of implementing a targeted guaranteed public employment (GPE) creation programme, designed to combat unemployment and poverty at national level. The scenarios assess the impact of integrating a GPE programme into the three scenarios of Group B. The main features of the GPE programme that have been captured by the model scenarios are:

- One part-time job per unemployed person
- 10 days of work per month or 120 days of work per year
- Remuneration of R100 per day (R1000 a month) that will be annually adjusted to the inflation rate
- During the first year of the programme, the programme is designed to cover 200000 unemployed. The number of participants in the GPE programme is designed to expand to 1.6 million by 2011 and to cover 3 million unemployed by 2014. The GPE is expected to encompass about 75 per cent of the estimated unemployed by 2014.³⁴

The successful implementation of a GPE programme in South Africa requires identifying a broad range of economic sectors that can absorb and benefit from it. The expert group that the DBSA brought together to engage in the process of scenario formulation³⁵ also examined the potential for sector absorption of a large-scale guaranteed public employment programme. They identified a partial list of works that

can benefit and are needed within community services, public works, private sector and public enterprises. (Box 3)

Box 3: Partial List of Types of Work For GPE

- Water conservation and water harvesting
- Drought proofing, forestation and tree plantation
- Irrigation canals including micro and minor irrigation works
- Provision of irrigation facility to land beneficiaries of land reforms
- Renovation of traditional water bodies including unsilting of tanks
- Flood control and protection works including drainage in water logged areas
- Rural connectivity to provide all-weather access
- Any other works that may be identified by the central government in consultation with a provincial government
- Landscaping, garden maintenance, pathways, storm water disposal, painting, cleaning gutters, glazing, basic maintenance, etc
- After school supervision for all levels of after school activity
- Childminders, school feeding programmes, old age care
- Road maintenance
- Waste collection
- Cleaning streets
- Environmental clean-up and recycling
- Access roads
- Housing programmes
- Forestry
- Working for water
- Community schemes of all types
- Community catchment management
- Making building materials
- Brick-making
- Park maintenance
- School maintenance
- Food gardens.

Analysis of scenario results

Simulations of Group C scenarios provide quantification of the impacts of a set of policy scenarios that combine options for AsgiSA infrastructure investment, changes in production technology to double the employment intensity of growth, and a guaranteed public employment programme.

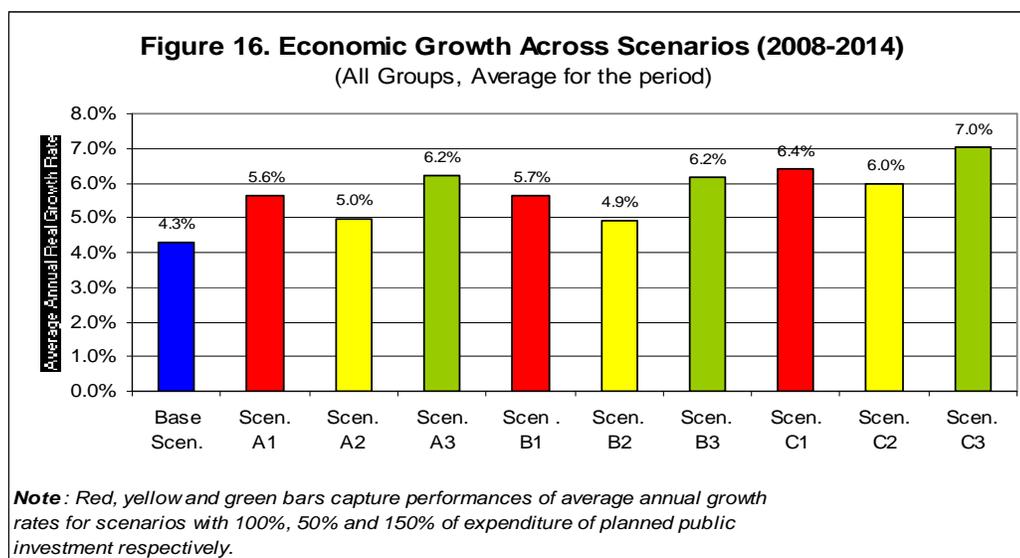
The central issue in simulating the impact of Group C scenarios is not to estimate the direct effect of the GPE programme on employment. Rather, it is to capture the dynamic effects of the programme. Questions of specific interest are: what are the implications of the GPE programme for economic growth and macroeconomic balance? What are the GPE programme's effects on the labour market? And what are the programme's poverty and inequality impacts? The simulation results are as follows.

Growth rates

A combination of the current EPWP and Scenario B1 (100 per cent AsgiSA plus doubling of employment elasticity scenario) is estimated to raise the average annual growth rate by 0.2 per cent during the next seven years – from 5.7 per cent (for Scenario B1) to 5.9 percent.³⁶ However, a combination of the GPE programme and Scenario B1 (i.e., Scenario C1) raises the average annual growth rate to 6.4 percent. The corresponding rates for Scenario C2 (50% AsgiSA plus doubling of employment elasticity plus GPE) and C3 (150% AsgiSA plus doubling of employment elasticity plus GPE) are 6 per cent (compared to 4.9 per cent for the same scenario without GPE, i.e., Scenario B2) and 7 per cent (compared to 6.2 per cent for the same scenario without GPE, i.e., Scenario B2). Therefore, the addition of GPE to Group B scenarios significantly enhances the economy's growth performance over the next six years (Figure 16).

These results reflect the net effects of two inter-related dynamics. On the one hand, the GPE programme helps raise the income of millions of families, which in turn significantly increases households' consumption expenditure. This exerts a positive pressure on the demands for outputs by different sectors of the economy and thus the aggregate demand as a whole. On the other hand, the increase in total employment contributes to the rise in the sector outputs in the economy, thus shifting the aggregate supply.³⁷ The outward shifts of both the aggregate demand and aggregate supply help

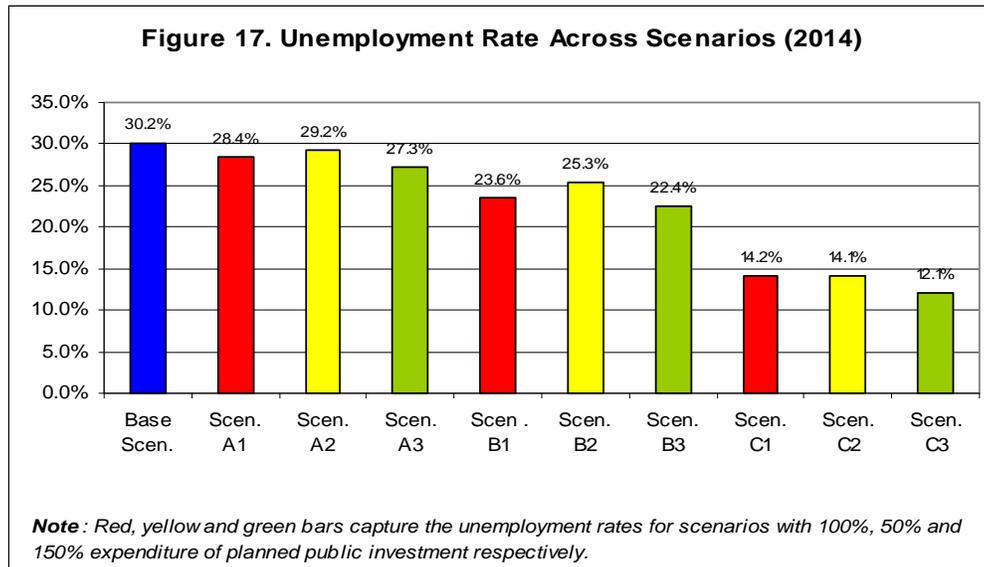
realign the two at a higher level of output. This realignment is also further accommodated by adjustments in the trade sector.



For example, a comparison of the results of Scenario B1 (100% AsgiSA plus doubling of employment elasticity) and Scenario C1 (100% AsgiSA plus doubling of employment elasticity plus GPE) shows that, by 2014, the per capita real household disposable income is about 3.4 per cent higher for Scenario C1, which consequently translates into 4.5 per cent higher real household consumption expenditure.³⁸ On the supply side, the real output is estimated at about 5 per cent higher for Scenario C1.³⁹ Finally, the real imports are estimated to be 4 per cent higher.⁴⁰

Unemployment rate

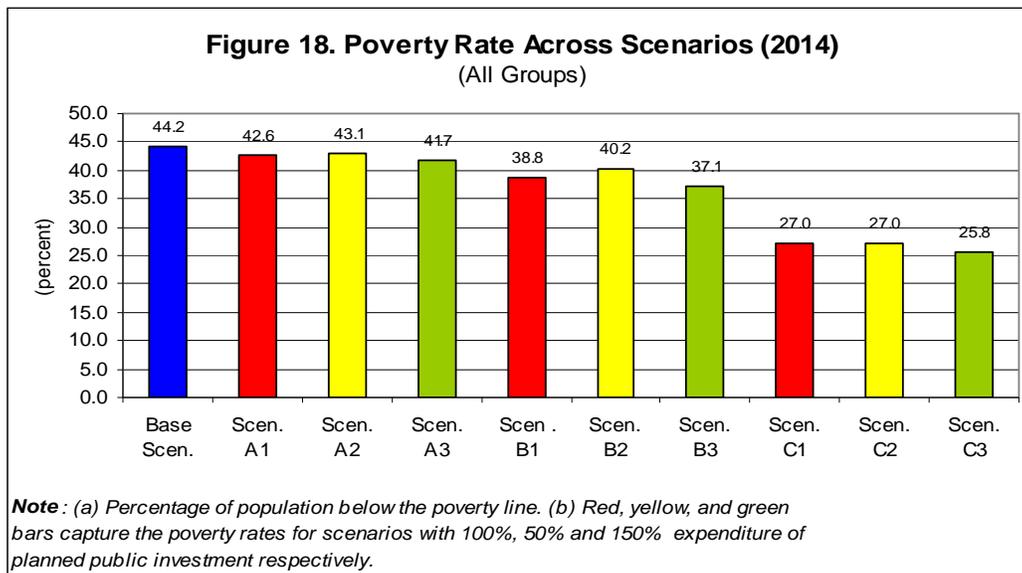
The simulation results capture the direct and indirect effects of the GPE programme on employment. The programme is expected to absorb an increasing portion of the unemployed directly into its pool. By 2014, it is expected to cover an equivalent of 1.5 million full-time jobs.⁴¹ In addition, the increase in the average economic growth that accompanies the inclusion of the GPE programme also induces increases in private sector employment. For example, the model's estimate for this indirect effect of GPE on total employment is about 200 000 jobs in the private sector for Scenario C1 (100% AsgiSA plus doubling of employment elasticity plus the GPE) in 2014, which is about 1.3 percent of total employment for that year.



The overall impact of the above on the unemployment rate is highly significant. The model estimates that, by 2014, the unemployment rates associated with the three scenarios in Group C will drop to 14.2 percent, 14.1 per cent and 12.1 percent, respectively. These figures are about 10 per cent lower than their corresponding numbers for Group B scenarios.

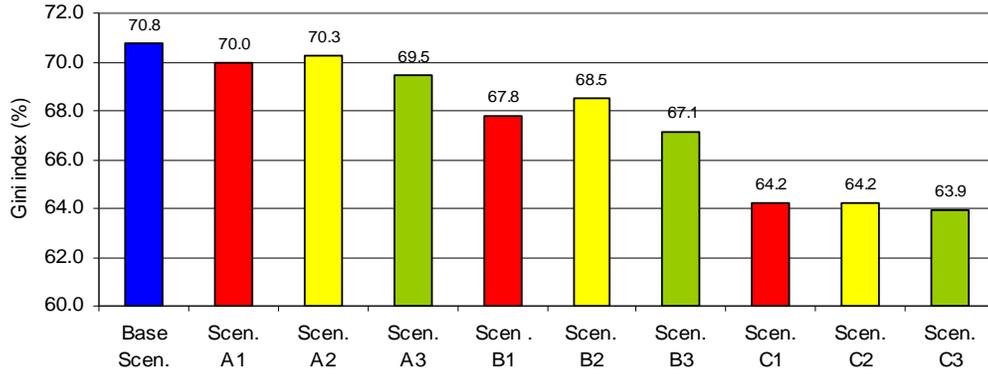
Poverty and inequality

The addition of EPWP to Group B Scenarios (AsgiSA investment scenarios plus doubling of employment elasticity) adds to its desirable impact on poverty and inequality. For example, when EPWP is added to Scenario B1 (100% AsgiSA plus doubling of employment elasticity) the poverty rate, poverty gap and the Gini-index are projected to further decline by 4 percent, 2 per cent and 1 percent, respectively. Under this scenario, the poverty rate drops to 25.5 per cent and the Gini index to 66.8 percent.



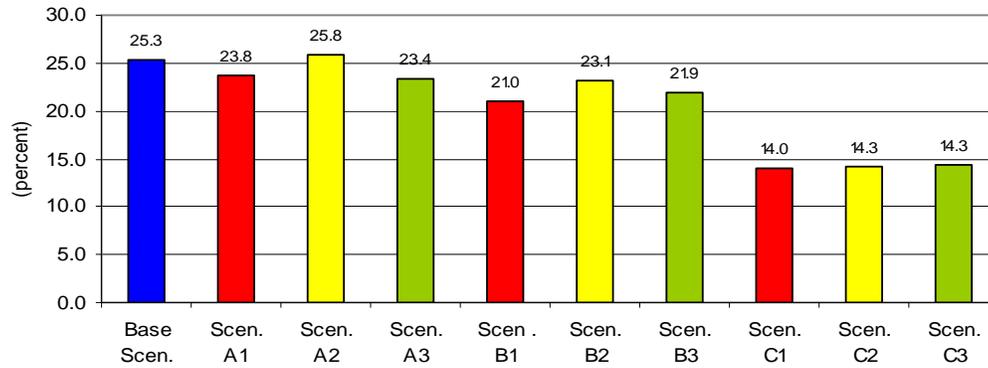
The policy scenarios with GPE have significantly larger impacts on poverty and inequality. The simulation results show that the poverty rate for each scenario in Group C is more than 8 per cent lower than the corresponding scenario in Group B. Figure 18 compares the model results for the poverty rate associated with Groups B and C. Similarly, income inequality drops considerably. Relative to the Group B scenarios, the Gini index related to each scenario in Group C drops by more than 3 per cent (Figure 19).

Figure 19. Income Inequality Across Scenarios (2014)
(All Groups)



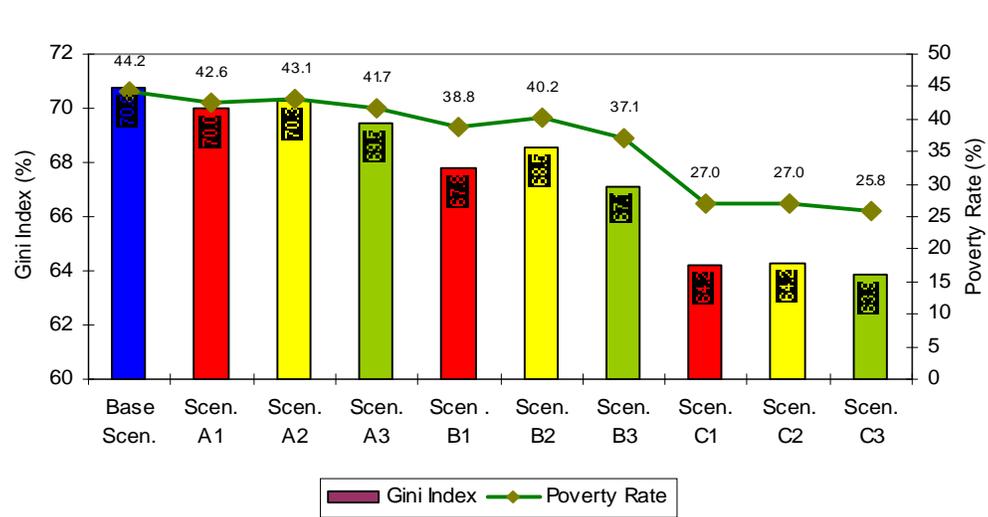
Note: Red bars capture the Gini Indices for scenarios with 100% expenditure of planned public investment. Yellow bars and green bars capture the same for scenarios with 50% and 150% expenditure of planned public investment.

Figure 20. Poverty Gap Across Scenarios (2014)
(All Groups)



Note: Red, yellow, and green bars capture the poverty rates for scenarios with 100%, 50% and 150% expenditure of planned public investment respectively.

Figure 21. Inequality and Poverty Across Scenarios (2014)
(All Groups)



Overall, the growth paths that underlie Group C scenarios benefit the poor more than the non-poor – that is, they are pro-poor. This is reflected in the relatively high values of the total elasticity of poverty.⁴² Figure 21 depicts the nexus between income distribution and poverty for Group C and other scenarios.

Sustainability of Group C policy scenarios

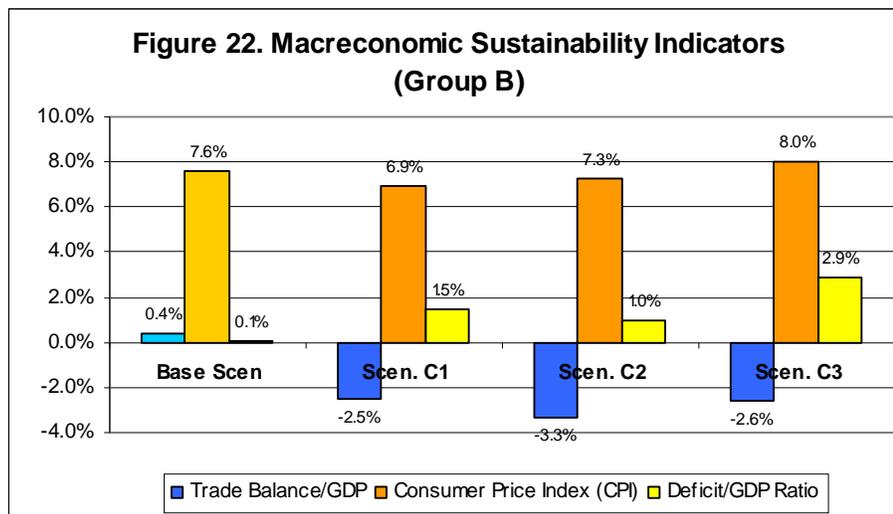
The model results for the diverse macro and micro economic indicators of Group C capture how the South African economy would react and absorb a hypothesised guaranteed public employment programme when it is accompanied with a major public infrastructure investment undertaking.

The direct cost of the hypothesised GPE programme is estimated at R2.5 billion to provide for 200 000 part time workers in the first year of the programme. But as the programme expands to reach about 3 million unemployed by 2014, the corresponding cost of the programme is estimated to reach almost R49 billion in current 2014 prices. This cost estimate, however, does not provide a complete picture of the financial impact of the programme. A more accurate and useful approach is to present the net cost of the programme in both absolute and relative terms. For example, as the GPE programme reaches 3 million unemployed by 2014 and further stimulates private sector employment creation, the overall income of its direct and indirect beneficiaries is expected to rise and, as shown earlier, millions of families are expected to move out of poverty. This process facilitates the lowering of the dependency of many families on different social security grants. Consequently, relative to Group B scenarios, the total number of persons eligible, and thus the total budget for the old age pension, disability grant, child support grant and care dependency grant are expected to decline. The social security module of the model captures the evolution of each social grant and estimates the corresponding government saving associated with each grant programme. For example, the model's projections for Scenario C1 for 2014 show that the total number eligible for child support is expected to be almost 900 000 lower than the corresponding number for Scenario B1. Overall, relative to Scenario B1, the number of social security grant recipients is estimated to decline by 1.1 million persons under Scenario C1, which translates into a saving of R5.6 billion by the government.

Moreover, the Group C scenarios that (relative to Group B) generate relatively higher average annual growth rates are also expected to generate higher overall tax revenue

for the government. The model's tax module, which includes both income tax and indirect tax, estimates government's tax revenue under each scenario. It shows, for example that in 2014, Scenario C1 is expected to produce R12.4 billion more tax revenue than the similar scenario without GPE (i.e., Scenario B1).

Therefore, a combination of government saving related to the social security budget and the rise in tax revenue reduces the net cost of the GPE to R30 billion in 2014, which is R19 billion lower than the initial crude calculation. This is equivalent to 0.7 per cent of the estimated nominal GDP for the same year. It is reasonable to conclude that, when one takes into account the positive impacts of GPE on growth, employment, poverty and distribution, the inclusion of a GPE programme in the public investment and employment policy scenarios is not expected to threaten the country's fiscal position negatively. This is also evident from the model's projection of the deficit/GDP ratio for each scenario (Figure 22).



As stated earlier, the evolution of macroeconomic balance under the Group C scenarios involves necessary adjustments in the composition of aggregate demand and supply. As part of this process, the growth paths of Group C scenario include shifts in the production and sector composition of output for domestic use and, to some extent, increased imports in order to accommodate the rise in household income and thus consumption expenditure. Consequently, the simulation results show a small decline in the share of exports in total GDP and a small rise in the import share. However, as Figure 22 shows, the trade deficit relative to GDP remains manageable for the three scenarios of Group C.

Finally, the scenario results show small differences between the average inflation rates for the Group C and Group B scenarios (Figure 6). The main underlying reasons for this outcome is, on the one hand, the rise in the economy's potential outputs due to public investment in social and economic infrastructure and, on the other hand, the GPE's concurrent inducement of rises in both demand and supply in the economy.

SOUTH AFRICA'S FUTURE DEVELOPMENT PATHS AND POLICY SCENARIOS

In the first part of this chapter, four possible futures for South Africa were presented. Subsequently, three groups of policy scenarios were put forward and focused on the main question posed by the scenario group: namely, what are the prospects for increased infrastructure spending to help achieve faster growth and radically reduce poverty and inequality? This section combines the general findings from the three groups of scenarios (and a number of additional modelling experiments) to arrive at the four future scenarios envisioned by participants in response to the focus question. Two of the four future scenarios, 'Full steam ahead' and 'Riding steady on the local train', present the possibility of increased infrastructure investment that supports growth and reduces poverty and inequality. The other two scenarios, 'Coming off the tracks' and 'Derailed!' suggest that the implementation of the planned infrastructure investment, combined with other possible domestic or international shocks, do not favourably reduce inequality and poverty.

The main purpose of the modelling exercise was to provide answers to the above overarching focus question for the period between 2008 and 2014. This meant focusing mainly on the first two future development paths that envision growth paths with strong desired effects on poverty and inequality. Results from the Group C scenarios (scenarios C1 to C3: AsgiSA options plus doubling of employment elasticity plus the GPE programme) reflect prospects for infrastructure investment to generate a combination of relatively high rates of growth and significantly lower income inequality and poverty rates. This group of scenarios is able to halve the unemployment rate and reduce the poverty rate and the poverty gap by about 40 percent by 2014. As such, they represent economic paths that clearly fall within the future development path represented by 'Full steam ahead'. Similarly, policy scenarios B1 and B3 (100% and 150% AsgiSA plus doubling of employment elasticity) generate moderate growth rates

Figure 23. Nexus of Employment and Poverty (2014)

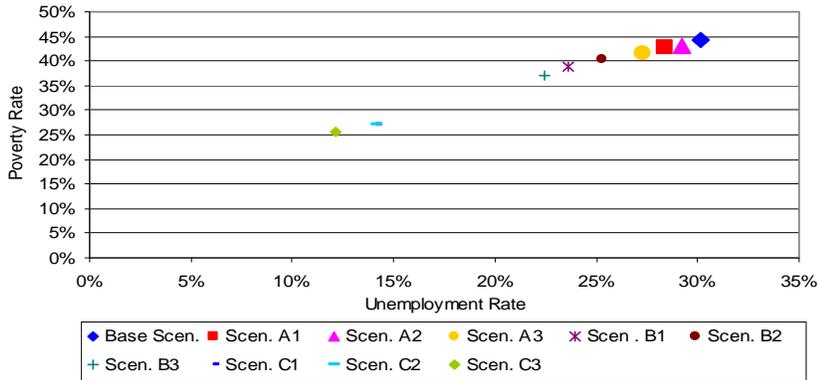


Figure 24. Nexus of Income Distribution and Poverty (2014)

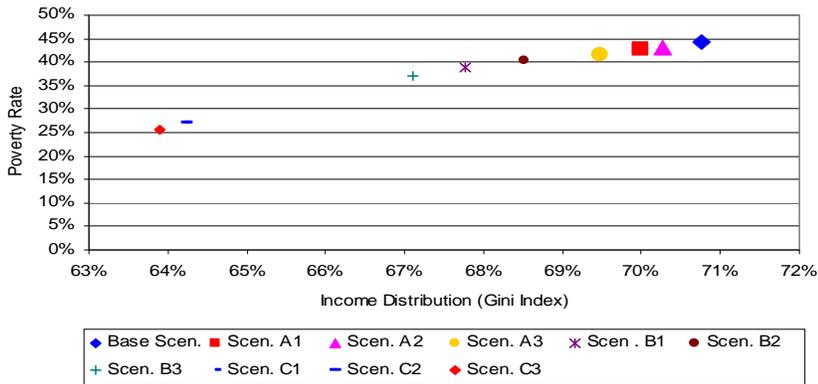


Figure 25. Nexus of Employment and Inequality (2014)

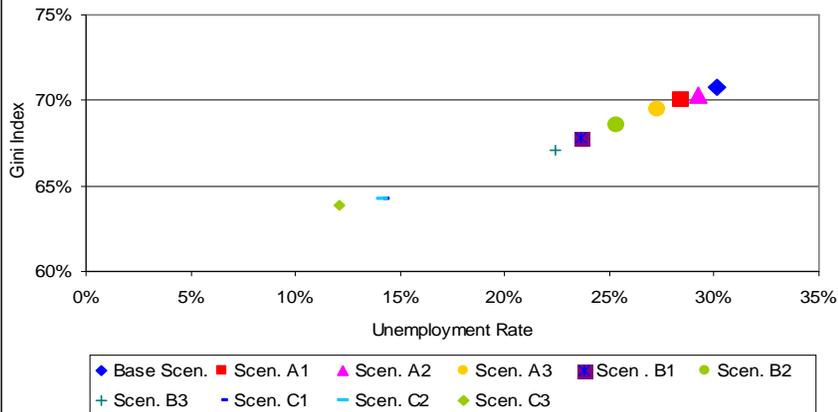
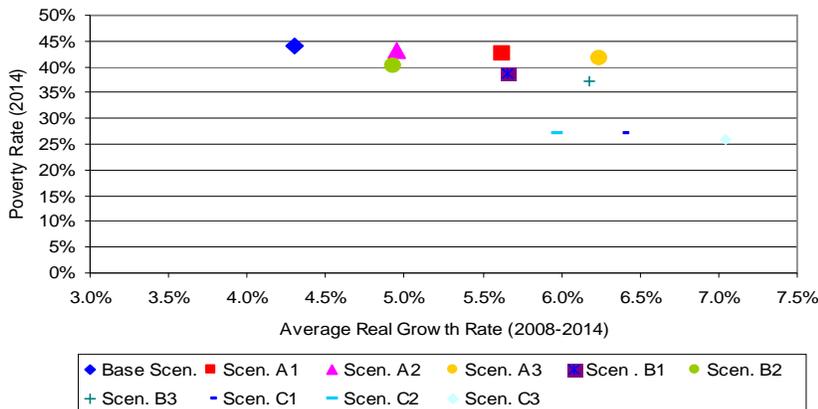


Figure 26. Nexus of Growth and Poverty



and lead to moderate reductions in inequality and poverty. These scenarios also represent other possible economic paths within the same future scenario.

One policy experiment (Scenario B2: 50% AsgiSA plus doubling of employment intensity) yielded results that reflect the main features of the second future development path, namely, 'Riding steady on the local train'. It produced lower than 5 per cent average annual growth rate with small reductions in poverty rate and income inequality.

The base scenario (no AsgiSA) and Group A scenarios, which only included different options for the amount of infrastructure investment, produced moderate to high rates of growth. However, they resulted in a worsening poverty rate and poverty gap. Thus these scenarios reflect the overall ethos of the future development path 'Coming off the tracks'.

Beyond the three groups of scenarios, a number of additional experiments were conducted to examine the prospects for the economy to land on future development paths represented by 'Coming off the tracks' or 'Derailed!' Two important findings of these experiments are:

First, several experiments incorporated the possibility of certain negative domestic or international shocks to the economy (e.g., credit crunch, increased oil prices, decline in growth rates in OECD countries and in sub Saharan countries). Their results demonstrated that the existence of the South African social security system potentially provides an important buffer against worsening poverty under negative economic conditions. This, however, was found to depend on whether the amounts of the social grants and the relevant means tests are indexed to inflation and the social security budget adjusted accordingly.

When the scenarios did not include annual full adjustment of these nominal values to the inflation rate, a certain set of negative shocks were able to get the economy 'Coming off the tracks' and thus land on low growth paths with worsening of poverty and inequality. However, when the grant amounts and the means tests were allowed to adjust fully to the inflation rate, and especially when the child support grant was allowed to extend to children below 18 years old, the overall social security system was able to prevent even some relatively severe negative shocks from leading to the worsening of poverty, thus allowing the economy to 'Ride steady on the local train'. In such circumstances, the budget for the social security programme was allowed to

adjust to accommodate the rising demand for grants, with implications for the size of the budget deficit/surplus relative to growth.

Second, the 'Coming off tracks' (i.e., high growth with worsening of poverty) of the South African economy needs the growth process to be highly polarising with few or no safeguards in place. In such a future scenario, even though economic growth is expected to be relatively high, the process needs to be so polarising that its negative effect on poverty (through rising inequality) begins to dominate any positive effect of high growth on poverty. Such a growth path is, therefore, expected to benefit the non-poor more than the poor.⁴³

The experiments to replicate the 'Coming off the tracks' future scenario produced the following insights. On the one hand, the scenarios had to focus mainly on achieving high growth exclusively through market mechanisms and downplay the role of public measures to increase employment and protect the poor and vulnerable. Therefore, scenarios had to include measures that weakened the current safeguards for the poor in the economy: for example, the amounts of the social grants and the means tests were left unchanged during the next six years. The scenarios also had to include the surge of imported capital goods to speed up the implementation of the infrastructure investment to hasten the growth process. They therefore included the possibility of worsening the employment intensity of growth. Under these circumstances, plus assumptions about favourable international environment (moderate growth patterns in OECD countries and robust commodity prices) the model generated economic paths that are consistent with the 'Coming off the tracks' future scenario. However, an economic path that is characterised, on the one hand, by its high growth rate and rising budget surplus and, on the other, by rising inequality, poverty and unemployment is not socially or politically sustainable.

CONCLUSION

There are many trends, events, and drivers that shape the future of a country, but some are more important and evident than others. The two key driving forces of the South African economy are growth and poverty. Current and planned large injections of public investment into social and economic infrastructure projects are creating an opportunity to harness growth and poverty and propel the economy along a desirable development path. Thus the overarching question is: what are the prospects for

increased infrastructure spending to help achieve faster growth, and radically reduce poverty and inequality?

This chapter has identified and presented four possible development paths for the South African economy. Moreover, it has described a limited number of policy scenarios that provide feasible answers to the focus question. With the help of an economic model of South Africa and analysis of simulation results of these policy scenarios, the chapter identifies the following important determinants as to whether we will be able to utilise AsgiSA to harness growth and poverty:

- The scenarios clearly highlight the relative importance of the role of government in the economy's future path. Whether the economy lands on 'Full steam ahead', on 'Coming off the tracks' or any of the other paths depends on the strategy and policy framework that guide the state with respect to how, to what extent, and for what purpose it will use the policy tools at its disposal.
- AsgiSA will be able to raise the average growth rate of the economy. However, the outcome will not be automatically pro-poor, resulting in substantial reductions in the poverty and unemployment rates.
- The economy is capable of producing sustainable pro-poor economic outcomes. However, multitudes of additional policy interventions are needed to complement AsgiSA – to form a complete set of integrated policies for growth and accelerated reductions in unemployment, poverty and economic inequality. The scenarios in this chapter, directly and indirectly, point to the importance of a strong public investment programme to support growth and economic development, industrial policy aimed at increasing the employment-creating thrust of the growth process, a public employment policy system to help the unemployed, and accommodating macroeconomic policies whose aim should be to achieve a growth path that embodies simultaneous progress towards minimising income inequality and achieving full employment.

ENDNOTES

¹ Following Kakwani, Khandker and Son (2003) and UNDP Human Development Report (2005), “pro-poor” growth is defined as a growth path that delivers proportionally greater benefits to the poor than to the non-poor. Section 5A explains the concept in more details.

² Ibid.

³ Kakwani *et al* (2003)

⁴ Kakwani *et al* (2003) uses a measure of the average deprivation in the society for which he uses $f(x)$ as probability density function of individual income (x) that is a random variable.

⁵ Osmani (2002).

⁶ Adelzadeh (2006) provides a full explanation of this system.

⁷ In Equation 1, κ captures whether growth is inherently accompanied by rising or declining inequality. Kuznets (1955) suggests that inequality initially worsens as economic development takes off but, in the later stage of development, inequality begins to improve. Recent empirical studies have questioned this proposition (Anand and Kanbur 1984; Deininger and Squire 1998) and have found no support for Kuznets’ inverted U-shaped pattern of income inequality. Recent studies have argued that it is not possible to state *a priori* the sign and magnitude of κ , since how κ changes depends on a country’s initial level of economic development, inequality and policies (Kakwani and Son 2002, Bourguignon 2004).

⁸ See Appendix A for the derivation of this equation.

⁹ Kakwani (1993).

¹⁰ Kakwani (1993).

¹¹ Kakwani, Khandker and Son (2003).

¹² For details see Adelzadeh (2006).

¹³ Given the size of DIMMSIM both in terms of its macro/sectoral parts and its household components, it is not possible to list and discuss the assumptions related to all the exogenous variables of the model in this short space. For a full list of assumptions, please contact adelzadeh@adrs-global.com.

¹⁴ This differs from the current government policy, which leaves adjustments of the amount of the grants and the means test to the discretion of the Treasury. However, recent proposals may lead to automatic adjustments of the means test and the grant amounts to the inflation rate.

¹⁵ The macroeconomic component of the model generates annual results in real and nominal terms for 45 economic sectors. The results include annual values for sector outputs, investments, employments, exports, imports, wage rates, and prices. The model produces results for 26 categories of household consumption expenditures in both real and nominal values. Moreover, the model’s projections include more than 100 prices and deflators, 16 categories of private sector’s income and expenditure, 16 categories of households income and expenditure, and 28 categories of government sector income and expenditure. The microsimulation component of the model estimates annual forecasts of poverty, inequality, budget for and distribution of social grants, and direct and indirect taxes in aggregate levels and the cross tabulation of results by region, gender, race, locality and family type.

¹⁶ The Gini coefficient measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution. It measures the area between the Lorenz curve and the hypothetical line of absolute equality, expressed as a share of the maximum area under the line. It is defined as a ratio with values between zero and one. A low Gini-coefficient represents more equal income, while a high Gini-coefficient reflects more unequal distribution. Zero implies perfect equality and 1 implies perfect inequality. The Gini-index is the Gini-coefficient expressed in a percentage. (OECD Glossary of Statistical Terms (<http://stats.oecd.org>)).

¹⁷ The model’s projection for the real GDP (2000 price) for the Base Scenario for 2014 is R1 689 billion. With the injection of the additional public investment, the real GDP in 2014 is projected at R1 846 billion for Scenario A1, R1 765 billion for Scenario A2, and R1 922 billion for Scenario A3.

¹⁸ Statistics South Africa (2008).

¹⁹ The Gini-index is the Gini-coefficient expressed in a percentage.

²⁰ Therefore under the Base Scenario, and when taking into account all the channels through which growth is linked to poverty, one per cent increase in the real GDP will lead to 1.86 per cent increase in the poverty rate.

²¹ Poverty gap is the mean shortfall from the poverty line (counting the nonpoor as having zero shortfall), expressed as a percentage of the poverty line. This measure reflects the depth of poverty as well as its incidence.

²² See Chapter 11 for specific policy recommendations to increase the economy’s employment creation potentials.

²³ The employment elasticity of growth for each sector of the economy is defined as the ratio of the growth rate of employment in that sector and the growth rate of the sector’s real gross value added at basic prices.

²⁴ The targets for sectors that currently have negative employment elasticity are set to half of their current levels, thus expecting them to become 50 percent less job-shedding by 2014.

²⁵ Profit share is defined as the share of the net operating surplus of the GDP.

²⁶ According to the Statistics South Africa’s latest released Labour Force Survey (March 2008), the unemployed Black African (almost 3.5 million) constituted about 88 percent of total number of unemployed (about 3.9 million) in 2007 (Table 5, p. 39). According to the model estimates for 2008, the poverty rate among the Black Africans is about 6 times higher than the poverty rate among the White South Africans. Any major employment creation

scenario is thus expected to increase the pool of employed Black Africans.

²⁷ This issue was analytically presented in the section on the nexus between growth and poverty.

²⁸ This takes into account that realistically any serious effort to help diffuse employment-enhancing technologies in South African economy will be gradual.

²⁹ For example see Dreze and Sen (1989) and Hirway and Terhal (1994).

³⁰ For example see Minsky (1986), Papadimitriou (1998), Mitchell (2001), and Wray (2007). According to Antonopoulos (2007) the economic literature on this issue at least goes back to the period following the industrial revolution with the periodic economic crises and the accompanied rises in the unemployment rates. In years that followed the Great Depression economists not only argued for the government to implement countercyclical monetary and fiscal policies, some went further to argue for the government to guarantee full employment through direct job creation as needed (Kaboub 2007). More recently, Minsky (1986) argued for governments to serve as an employer of last resort. In his view, market economies did not possess an internal mechanism to fully match jobs to those seeking them. Concerned with poverty in the United States, he advocated that the “war on poverty” ought to be fought through public job creation. Much like the liquidity role that the U.S. Federal Reserve facilitates in the financial markets, in the labour market only the government could create “an infinitely elastic demand for labour at a floor or minimum wage that does not depend upon long- and short-run profit expectations of business. Since only government can divorce the offering of employment from the profitability of hiring workers, the infinitely elastic demand for labour must be created by government”. Minsky envisioned government as employer of last resort as a permanent policy whereby the state assumes a buffer-stock employment role, absorbing the unemployed during periods of contraction and releasing them back into the market as needed.

Development economists have argued for public employment creation as a means to address the widespread problem of high rate of unemployment and the associated underutilisation of labour resources. Hirway (2007) traces this view to Nurkse and Hirschman and more recently to Tinbergen who have argued that surplus labour in developing economies suffered from a shortage of capital formation and that constructing productive assets would expand employment opportunities while potentially encouraging crowding-in of new investment. Tinbergen in particular viewed public works programmes as “transitional” ones that moved a labour surplus economy closer to full employment through “strategic use of surplus labour” in generating productive assets that, although needed, the private sector would not provide (Hirway 2007). In more recent time, Bhaduri (2005) and Kregel (2006) have also argued for employment guaranteed programmes as a means to advance pro-poor development.

³¹ Antonopoulos (2007).

³² Mitchell (2008), Hemson (2007).

³³ See Mitchell (2008).

³⁴ The first three features of GPE are similar to Mitchell (2008) proposals to overcome some of the shortcomings of the current EPWP.

³⁵ See Introduction to this chapter.

³⁶ A combination of the current EPWP and Scenario B1 was simulated as a distinct policy scenario, using DIMMSIM. The main features of EPWP that were integrated into the scenario include: (a) part-time employment for one million unemployed by 2010; (b) an average 60 days of employment per year per person; and (c) the average daily wage rate of R50, (Mitchell 2008).

³⁷ Real output is measured by the model’s estimations of the real gross value added at basic price for 41 sectors of the economy. The total output is the sum of the sector outputs.

³⁸ In the case of Scenario C1, the model estimates that the per capital real households disposable income and the real households consumption expenditure will be R18 410 and R1.15 trillion in 2014. The similar result for Scenario B1 is R17 802 and R1.10 trillion.

³⁹ The model’s estimate for the real gross value added at basic price is R1.717 151 million for Scenario C1 for 2014. The similar projection for Scenario B1 is R1.635 569 million.

⁴⁰ The model’s estimate for the real imports for Scenarios 7 and 4 for 2014 are R747 949 million and R719 154 million respectively.

⁴¹ These figures take into account the assumption that every two employment provided under the GNE is equivalent of one full time employment.

⁴² High in absolute value terms.

⁴³ Therefore, such an economic path is expected to have a positive total elasticity of poverty reflecting a positive inequality elasticity of poverty that is greater (in absolute value terms) than the negative growth elasticity of poverty.

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Appendix A

FORMAL PRESENTATION OF THE SYSTEM OF INTER-RELATIONSHIP BETWEEN GROWTH, POVERTY, INCOME DISTRIBUTION, PROVISION OF SOCIAL SERVICES AND EMPLOYMENT⁴³

Poverty reductions, especially rapid reductions in poverty, depend on two important factors. First, the size of the economic growth rate: that is, the higher (lower) the growth rate, the larger (smaller) the poverty reduction will be. Second, changes in inequality that generally accompany economic growth: that is, a rise (fall) in inequality decreases (increases) the impact of growth on poverty reduction. Kakwani *et al* (2003) derives a measure of *total elasticity of poverty* that captures the net effect of the above two factors on the overall poverty index, and uses it to define the formal conditions for pro-poor growth. In the following pages, we adopt a different formal approach to derive a similar measure of total elasticity of poverty and conditions for pro-poor growth.⁴³ The approach is informed by the need to include explicitly the links between poverty and both the labour market and government's poverty related expenditures. Osmani (2002) defines these channels as the personal income channel and social provisioning channel. The former refers to the growth of the economy, which through employment, translates into higher personal income amongst the poor. The latter refers to the resources generated by growth (e.g. taxes) that can potentially be used by a society to provide services to the poor.

Following Kakwani (1993, 2003), the general class of poverty measures (v) can be fully represented by a poverty line (z) that captures the country's minimum standard of living, the mean household income (y) and the Gini index (G) as a measure of inequality. Therefore:

$$v = v(z, y, G) \quad \text{with} \quad \partial v / \partial z > 0; \partial v / \partial y < 0; \partial v / \partial G > 0 \quad [1]$$

In equation 1, the mean household income (y) is defined as the average household income after tax and includes current transfers from general government.

The next equation expresses mean household income as a function of employment, E , and government's cash and in-kind transfers to households, S . Therefore, we can write:

$$y = y(E, S) \quad \text{with} \quad \partial y / \partial E > 0; \partial y / \partial S > 0 \quad [2]$$

In equation 2, variable E captures the impact of the level of employment in the economy and the associated rate of compensation (i.e. total compensation of employees) on the mean household income. It, therefore, reflects both the quantity and quality of employment in the economy.⁴³ Our assumption is that the average household income is a positive function of both the level of employment in the society and its quality. Therefore, for example, it is assumed that, *ceteris paribus* (all things being equal), the average household income increases (decreases) when the share of total employment in formal, manufacturing or unionised sectors of the economy increases (declines).⁴³

In equation 2, variable S captures the impact of cash and non-cash government transfers to households on the mean household income.⁴³ It is closely related to the concept of the social provisioning channel used by Osmani (2002 and 2004). According to equation 2, an overall rise in employment – *ceteris paribus* – is expected to be accompanied by an overall increase in mean household income. Similarly, mean household income is expected to increase –

ceteris paribus– as a result of the state’s cash and in-kind transfers to households.

The next equation expresses total employment (E) as a function of the size of the economy, which is represented by the *real* gross domestic product (GDP). It is assumed that employment will increase (decrease) with the rise (fall) of GDP and suggests that economic growth is central to any employment, and as we will see later, poverty reduction focused strategy.⁴³ Thus:

$$E = E(GDP) \quad \text{with } \partial E/\partial GDP > 0 \quad [3]$$

Finally, the last equation of the model captures one of the basic empirical relationships between the Gini-coefficient measure of inequality (G) and mean household income. Since mean household income is directly related to the size of the economy, studies have found that a positive or negative relationship between inequality and growth implies a parallel relationship between inequality and mean household income (Kuznets, 1955; Blank, 1989;⁴³ Arnard and Kanbur, 1984; and Deininger and Squire, 1998). Therefore, equation 4 postulates that income distribution in a country is a function of mean household income:

$$G = G(y) \quad \text{with } \partial G/\partial y < 0 \quad [4]$$

As will be discussed later, it is not possible to express *a priori* the sign of the relationship between mean household income and inequality.

The total differentials of the above equation system yield:

$$\begin{aligned} dv &= \frac{\partial v}{\partial z} dz + \frac{\partial v}{\partial y} dy + \frac{\partial v}{\partial G} dG \\ dy &= \frac{\partial y}{\partial E} dE + \frac{\partial y}{\partial S} dS \\ dE &= \frac{\partial E}{\partial GDP} dGDP \\ dG &= \frac{\partial G}{\partial y} dy \end{aligned} \quad [5]$$

Assuming that the poverty line (z) is kept constant in real terms, the above system can be reduced to one central expression that captures the channels through which changes in the real growth rate of the economy impact on the poverty index:

$$\rho = \frac{dv/v}{dGDP/GDP} = (\varepsilon_y^v + \varepsilon_G^v \varepsilon_y^G) \varepsilon_E^y \varepsilon_{GDP}^E + (\varepsilon_y^v + \varepsilon_G^v \varepsilon_y^G) \varepsilon_S^y \varepsilon_{GDP}^S + \varepsilon_G^v \varepsilon_{GDP}^G \quad [6]$$

Where:

ρ = total elasticity of poverty as a measure of the overall rate of decline in the poverty index, due to a 1 percent real increase in GDP.

ε_y^v = poverty elasticity (partial elasticity) of mean household income as a measure of the rate of decline (increase) in the poverty index, as a result of a small increase (decrease) in mean household income. It is expected to be negative, $(\partial v/v)/(\partial y/y) < 0$.

ε_G^v = poverty elasticity of the inequality index, using Gini index. $(\partial v/v)/(\partial G/G) > 0$ is expected to be positive, suggesting that the poverty index declines (increases) with reductions (rises) in inequality.

ε_y^G = inequality elasticity of mean income can be either positive or negative.

ε_E^y = income elasticity of employment is expected to be positive (equation 2).

ε_{GDP}^E = employment elasticity of growth is assumed to be positive (equation 3).

ε_S^y = income elasticity of social provisioning is assumed to be positive (equation 3).

ε_{GDP}^S = social provisioning elasticity of growth can be either positive or negative.

ε_{GDP}^G = inequality elasticity of growth which can be either positive or negative.

Equation 6 can be expressed in a more compact form as:

$$\rho = \psi + \varphi + \kappa\gamma \quad [7]$$

Where:

ψ represents a combination of elasticities related to the employment nexus between growth and poverty. It is a measure of how much a small increase in GDP reduces poverty through employment. It captures both the income and the inequality effects. In the rest of this paper, we refer to ψ as the *poverty elasticity of employment*.

φ represents a combination of elasticities related to the social provisioning nexus between growth and poverty. It is a measure of how much a small increase in GDP reduces the poverty rate through the social provisioning channel. It captures both the income and the inequality effects. In the rest of this paper, we refer to φ as the *poverty elasticity of social provisioning*.

κ measures the direct effect of 1 percent increase in GDP on inequality (Gini index).

γ measures the increase in the poverty index as a result of a small increase in the inequality index.

Equation 7 shows clearly how a 1 percent increase in GDP is channelled through employment and social provisioning to impact on mean household income and inequality, which in turn impacts on the total poverty rate.

In Equation 7, κ captures whether growth is inherently accompanied by rising or declining inequality. Kuznets (1955) suggests that inequality initially worsens as economic development takes off; but, in the later stage of development, inequality begins to improve. Recent empirical studies have questioned this proposition (Anand and Kanbur 1984; Deininger and Squire 1998) and have found no support for Kuznets' inverted U-shaped pattern of income inequality. Recent studies (Kakwani and Son 2002, Bourguignon 2004) have argued that it is not possible to state *a priori* the sign and magnitude of κ , since how κ changes depends on a country's initial level of economic development, inequality and policies.

In order to separate the channels through which changes in inequality impact on poverty, equation system [5] is summarized differently to derive the following equations:

$$\rho = \frac{dv/v}{dGDP/GDP} = \varepsilon_y^v (\varepsilon_E^y \varepsilon_{GDP}^E + \varepsilon_S^y \varepsilon_{GDP}^S) + \varepsilon_G^v (\varepsilon_y^G \varepsilon_E^y \varepsilon_{GDP}^E + \varepsilon_y^G \varepsilon_S^y \varepsilon_{GDP}^S) + \varepsilon_G^v \varepsilon_{GDP}^G \quad [8]$$

or

$$\rho = \mu + \sigma \quad [9]$$

Where:

$\mu = \varepsilon_y^v (\varepsilon_E^y \varepsilon_{GDP}^E + \varepsilon_S^y \varepsilon_{GDP}^S)$ represents the *growth elasticity of poverty* (Kakwani, 1993), which is the percentage change in poverty due to a 1 percent increase in economic growth, provided that the growth process does not change inequality (i.e. the benefits of growth are distributed equally among everyone in the country).

$\sigma = \varepsilon_G^v (\varepsilon_y^G \varepsilon_E^y \varepsilon_{GDP}^E + \varepsilon_y^G \varepsilon_S^y \varepsilon_{GDP}^S) + \varepsilon_G^v \varepsilon_{GDP}^G$ represents the *inequality elasticity of poverty*. It is an aggregate measure of all the channels through which a 1 percent increase in GDP impacts on poverty through its impact on inequality. In other words, it is a measure of how much the changes in the total poverty index relate to changes in inequality, given a 1 percent increase in GDP.

Equation 9 shows that the total poverty index is equal to the sum of two combinations of elasticities. The first (μ) is an extension of Kakwani's concept of growth elasticity of poverty (Kakwani, 1993). It measures percentage change in the poverty index that results from the impact of a 1 percent increase in GDP on employment and social provisioning, provided that the growth process does not change inequality.

The second combination of elasticities (σ) – a measure of the inequality elasticity of poverty – is the sum of different channels through which a 1 percent increase in GDP impacts on poverty through its net effects on inequality. σ captures three channels through which growth impacts on inequality. The first and second measures capture the impacts of growth on inequality through employment and social provisioning channels ($\varepsilon_y^G \varepsilon_E^y \varepsilon_{GDP}^E, \varepsilon_y^G \varepsilon_S^y \varepsilon_{GDP}^S$). The third measures the direct effect of growth on inequality (ε_{GDP}^G).

Kakwani, Khandher and Son (2003) show that economic growth is pro-poor (pro-rich) if the change in inequality that accompanies growth reduces (increases) total poverty. In the above system, this implies the growth is pro-poor if both total elasticity of poverty (ρ) and the growth elasticity of poverty (μ) are negative and $|\rho| > |\mu|$. These two criteria for pro-poor growth are satisfied under the following conditions and assuming that the mean household income elasticity of growth is positive ($\varepsilon_{GDP}^y > 0$)⁴³:

a) if $\varepsilon_{GDP}^S > 0$ and $\varepsilon_{GDP}^G < 0$ (therefore $\varepsilon_y^G < 0$), both μ and σ will be negative, which implies that $|\rho| > |\mu|$. This implies that the pro-poor growth conditions are met if government's spending on social provisioning increases with economic growth, and if, at the same time, economic growth is accompanied by a decline in inequality. Relative to other possibilities, under these conditions, *ceteris paribus*, the pro-poor channels of the growth process will be the most extensive.

b) if $\varepsilon_{GDP}^S > 0$ but $\varepsilon_{GDP}^G > 0$ (therefore $\varepsilon_y^G > 0$), both μ and σ will be positive, which implies that $\rho > \mu > 0$. This implies that the growth process is not pro-poor (is pro-non poor) because poverty is expected to worsen through economic growth, both directly and through the increase in inequality.

c) if $\varepsilon_{GDP}^S < 0$ but $\varepsilon_{GDP}^G > 0$ (therefore $\varepsilon_y^G > 0$), most probably, σ will be positive, which implies that a direct effect of a 1 percent increase in GDP is to worsen (increase) inequality, i.e. growth is not pro-poor. The growth elasticity of poverty (μ) is also weakened due to a decline in social provisioning as the economy grows by 1 percent. Overall, the growth path is not pro-poor.

d) if $\varepsilon_{GDP}^S < 0$ and $\varepsilon_{GDP}^G < 0$ (therefore $\varepsilon_y^G < 0$), σ will be negative. The negative social spending elasticity of growth means that one component of μ will be positive and the second part will have a negative value. The overall value of μ will, most likely, be negative, thus satisfying one of the conditions for pro-poor growth. This combined with negative ε_{GDP}^G implies that the second condition ($|\rho| > |\mu|$) is also satisfied. Therefore, even without a negative correlation between changes in social provisioning and economic growth, as long as the employment intensity of growth is relatively high, the economic growth path will be pro-poor. In this case, a strong poverty elasticity of employment ensures that the poverty elasticity of growth is negative (i.e., reduces poverty) and the negative inequality elasticity of growth ensures that economic growth, by reducing inequality further, facilitates reductions in the poverty index.

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Appendix B

BASIC STRUCTURE AND FEATURES OF DYNAMICALLY INTEGRATED MACRO-MICROECONOMIC SIMULATION MODEL OF SOUTH AFRICA (DIMMSIM)

Dynamically Integrated Macro-Micro economic Simulation Model (DIMMSIM) is one of the four economic models of South Africa that are built by the Applied Development Research Solutions and are available at the ADRS website (www.adrs-global.com). It integrates a macroeconometric model of South Africa with a household microsimulation model of the country to capture the dynamic interactions between the macroeconomic performance and the poverty and income distribution at household level. Several features of the model give it an edge for the analysis of poverty and inequality and for the impact analyses of alternative macro and micro policies for growth and development. For example, the specification of the model provides the necessary flexibility to capture the underlying structure of the South African economy; it is inter-temporal and dynamic by nature; it is sufficiently disaggregated, in terms of economic sectors, consumption goods and labour market related variables, to allow for the establishment of strong links to the microsimulation part of the model; and the final integrated model provides for dynamic, short term and long term policy simulation exercises. Following is a brief non-technical introduction to the DIMMSIM's two underlying models, empirical methodologies, and the simulation approach.

DIMMSIM's Macroeconomic Component

One of the two economic models that underlie DIMMSIM is a macroeconometric model. Instead of incorporating an input-output system to derive sector results, the model incorporates sector specific estimations designed to capture the differentiation between the determinants of specific variables related to different sectors of the economy. Therefore, DIMMSIM has a bottom-up approach to the determination of seven variables related to 45 economic sectors and includes a significant number of policy parameters (Figure 1).⁴³

Basic Structure of the Model: The model is relatively large, composed of 2864 equations with 374 estimated equations. Its main behavioural relationships include estimated equations for a number of aggregate variables and estimations at disaggregate levels for output, investment, employment, wage rates, exports, imports, prices, consumption and investment deflators. Its underlying accounting relationships reflect bottom-up calculations of relevant variables at real and nominal levels that ensure consistency in relation to the flow of income, expenditure, and savings in the economy. Therefore, the model solution for each period is consistent with the various identities required by the national account at real and nominal levels. Since the macro model is linked to a household model, a number of the accounting relations are met through household level information.

The model is most suitable for simulating impacts of changes in policies related to fiscal and monetary issues as well as changes in economic sectors, private businesses, government and households' incomes and expenditures.

Empirical Methodology and Model Specification: The model uses the cointegration technique for its estimated equations. Among the several such techniques available for the analysis, we chose the Autoregressive-distributed lag (ARDL) estimation procedure, developed by Pesaran (1997) and Pesaran, Shin and Smith (1996). The advantage of this technique is that it offers explicit tests for the existence of a unique cointegrating vector, rather than assuming uniqueness, as do the otherwise most widely used Engle-Granger technique. Another advantage of the technique is that the endogenous variables are valid explanatory variables.

Since the existence of a long run relationship is independent of whether the explanatory variables are integrated of order $I(1)$ or of order $I(0)$ ⁴³, the ARDL remains valid irrespective of the order of integration of the explanatory variables.⁴³ Thus, the ARDL methodology has the advantage of not requiring the identification of the precise order of integration of the data to be used in the analysis – an advantage it enjoys over the Johansen technique.

The ARDL approach hinges on the existence of a co-integrating vector among the variables in the regression model. The existence of a CV is tested by the variable addition test, a technique that utilises the F tests developed by Perron. Where a CV existed, both short and long run estimates of the regression model are computed. It is an established fact that wherever there is a long-run relationship, there must exist a valid error correction mechanism that depicts the adjustment process towards this long run relationship. The critical test for the validity test of this adjustment process is that the coefficient of adjustment must be negative, between 0 and 1, and statistically significant.

DIMMSIM's Microsimulation Component

The modelling principle employed to build the South African household model is the microsimulation modelling technique, whose application to socio-economic modelling was pioneered by Guy Orcutt in the United States in the late 50's and early 60's (Orcutt, 1957; Orcutt *et al.*, 1961). The South African model which was originally built as a static model (Adelzadeh, 2001) has been expanded and complemented with dynamic properties for the purpose of building DIMMSIM.

The main components of the model are its database and its tax and social policy modules. The South African model uses a micro-database of individuals and households using official annual October Household Survey (since 1995), the Income Expenditure Survey (1995 and 2000), the Census (1996 and 2001) and the bi-annual release of the Labour Force Survey, which are the main sources of countrywide economic and demographic microdata. The model's database is prepared in terms of *family units*, because it relates closely to the definition of the financial unit used by many of the government tax and transfer programmes.⁴³ The model's database includes 125 830 individuals, making up 61 684 families or 29 800 households. The database includes weights for individuals, families and households, which are used to translate each of the three samples to their corresponding populations for a given year. Each unit record includes more than 400 columns of information for each individual in the family – including demographic, labour force, marital status, housing, income and expenditure information.

The data ageing is obtained by 'reweighting' and 'uprating' each record. Reweighting is used to modify the demographic, family and labour force characteristics of the model's population. Uprating, on the other hand, is used to update individual and family's incomes and expenditures. CALMAR (*calibration of margins*) is a reweighting algorithm that has been used to alter weights in a sample dataset to reflect a new population of reference. It applies given marginal totals to a set of initial weights on a survey record file. DIMMSIM endogenously updates incomes and expenditures of individuals and families.

The South African microsimulation model includes three government's taxation policies (i.e., personal income tax, excise tax, and value added tax) and six transfer programmes (i.e., old age grant, child support, disability grant, care dependency grant, care giver support, and the basic income grant). Four of the programs constitute government's main social security programmes (Figure 1).

The process of integrating the microsimulation model into the DIMMSIM included: First, the tax and transfer parameters of the model were given time dimensions to allow for their

possible future changes as part of developing policy scenarios and also to allow for the annual adjustments of some of the parameters, such as the annual adjustment of the poverty line to the rate of inflation. Second, prior to the simulation with DIMMSIM, the demographic weights were aged for the next ten years using the existing forecast of South African population and its distribution among the nine provinces and by race and gender and age categories. The simulation program is instructed to use corresponding individual weights for a given forecasting year. Finally, new programs were written to allow for the annual updating of households income and expenditure using appropriate combinations of 21 consumption deflators, 38 sectoral price changes, and the consumer price index (CPI) that are annually generated by the macroeconomic model part of DIMMSIM.

Accounting Consistency Within DIMMSIM

Technically, two important distinguishing features of DIMMSIM relate to establishing two-way interactions between its underlying models and generating the model's macro and household level results that embody the necessary accounting requirements related to linked macro-micro models for each period.

A considerable part of the model is concerned with enforcing the necessary accounting relationships both within and between the two models to ensure simulation results are consistent, meaningful and reliable. DIMMSIM's iterative process of generating each period's forecast ensures that the accepted simulation results for each period satisfies all the specified accounting relationships. For example, with regard to the macroeconomic model, the components of the product account add up, and the income and product sides of the accounts are equal. Moreover, the price/quantity relationships are consistent. Some of these relationships include:

- Total employment at the macroeconomic level, which corresponds to the sum of sectoral employments, is equal to the total employment at households level, generated by the microsimulation model.
- The income tax module of the microsimulation part of DIMMSIM estimates family level income tax for each period, and feeds the information to the equation for the calculation of households disposable income, and the equation that captures sources of government current income, Y_g , where the government's overall revenue from taxes on income and wealth is made up of households and business enterprises contributions.
- Similarly, the VAT module of the microsimulation component of the DIMMSIM uses detailed households level expenditures to calculate the contribution of households to the government's revenue from the VAT and excise taxes, where n_3 represents the number of goods and services covered by the VAT payment.
- The social security modules of the microsimulation model provide for the estimation of households income from government's direct transfers. For each year of the forecast, the model's policy modules that capture the current government's old age pension, child support, disability, care dependency, and war veteran grants estimates total number of eligible persons for each grant and the required budget allocation. Changes to the eligibility and entitlement conditions of either of these policies and changes in the overall poverty rate in the country (e.g., due to a rise in the unemployment rate) implies changes in the budgetary requirements of these programs. In turn, the estimated budgetary requirement of the above government

programs feed into the households' income accounts and government's expenditure account in the macroeconomic model.

MACRO-MICRO INTERACTIONS IN DIMMSIM

The model establishes two-way interactions between its macro and micro components such that (a) changes in macroeconomic variables (e.g., changes in prices, employment, wage rates, benefits, transfers, etc.) influence welfare of individuals and families, and (b) changes in household level economic conditions (e.g., poverty, inequality, consumption, taxes, eligibility for social grant, etc.) influence macroeconomic outcomes (Figure 1). The Gauss-Seidel's iterative method is mainly used to solve the overall system. The procedure runs the two models for a number of interactions, allowing interactions between the macro and micro parts of the model, before it converges and generates the final results for each year of the forecast period. This ensures that each period's results reflect convergence of the macroeconomic variables and household level variables at the aggregate level. Therefore, the two models are dynamically integrated and generate time-based results that reflect the actual process of policymaking and evaluation .

For more information on DIMMSIM, visit ADRS website or send you enquires to asghar@adrs-global.com.