CHAPTER 5: A MULTI-REGION GENERAL EQUILIBRIUM ANALYSIS OF FISCAL CONSOLIDATION

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5.1 Introduction

The global economic crisis in 2008 and 2009 has brought to the fore a mismatch between South Africa's revenues and expenditures. General government expenditure constitutes roughly 33% of gross domestic product (GDP), of which approximately 29% is raised nationally and 4% locally. Provincially raised revenue is insignificant and rarely constitutes more than 2% of provincial revenue.

The slowdown in economic activity has reduced tax revenues, while government expenditures have risen as a counter measure to the recession, as well as for the capitalisation of public enterprises. Consequently, the government budget balance has deteriorated, from a surplus of 0.9% of GDP in 2008/09 to a projected deficit of 7.3% in 2010/11. Gross loan debt is projected to reach 43.1% of GDP in 2013/14, which is a significant rise from its level of 27% in 2009/10 (National Treasury, 2010). The situation becomes even more pessimistic if sustainability indicators incorporate projected events such as changes in the age structure of the population and the burden of HIV/AIDS. Unless modified, current fiscal policy is likely to pass huge tax bills onto future generations.

Government has already started fiscal consolidation efforts, realising that deficits of this magnitude not only lead to large public debts that may become unsustainable, but also destabilise the economy through rising inflation and interest rates. As a first direct signal of government's intent in this regard, the 2010/2011 Budget provides for a one percentage point reduction in the expenditure-to-GDP ratio from 2011/12 to 2013/14. With fiscal consolidation a high-priority policy issue in South Africa today, it is important to understand how the gains and losses from deficit reduction are distributed. The cut in grants can be viewed as a series of events, rather than fiscal consolidation, and allows us to assess the extent to which sub-national governments adjust expenditures and use their own fiscal powers (where these are significant) to offset the cuts in their grant allocations.

Applied General Equilibrium (AGE) models are among the methods and tools used to better understand the interactions between national and sub-national government spheres. They are able to shed light on the extent to which sub-national government participates in fiscal consolidation and hence macroeconomic adjustment. They are also able to trace the changes in property prices and in opportunities for households, and the migration between regions following reforms to existing revenue-distributing arrangements.

In countries with multiple government spheres, financial interactions between spheres of government and fiscal consolidation take on an added dimension of complexity. Most of the literature on the financial relationship among government spheres has focused on how to allocate optimally and to finance public service provision across the different levels of government.[71] Although less well developed, the literature on macroeconomic management in multi-tiered governments emphasises the tendency towards decentralisation and fiscal federalism, which raises the concern of maintaining sustainable public finances. A key issue is the incentives that multi-tiered fiscal authorities face. For example, tasked with providing an essential service such as health, sub-national governments face the problem of 'soft budget con-

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71 This is the classical fiscal federalism literature. Studies have looked at how different levels of government react to changes in the balance between central government grants and local revenues, for example, the 'flypaper effect'. See Oates (1999) for an extensive review of this literature.

straints'. To address this concern, many countries adopt fiscal coordination mechanisms.[72] In this chapter, a multi-region AGE model is used to analysis the effects of government expenditures, taxation and intergovernmental grants on equity and efficiency goals when used as an instrument of fiscal consolidation in a unitary-state country with three spheres of government (local, provincial and national) such as South Africa. An explanation of the structure and specificities of the multi-region AGE model is followed by a discussion of the data requirements, simulation and results.

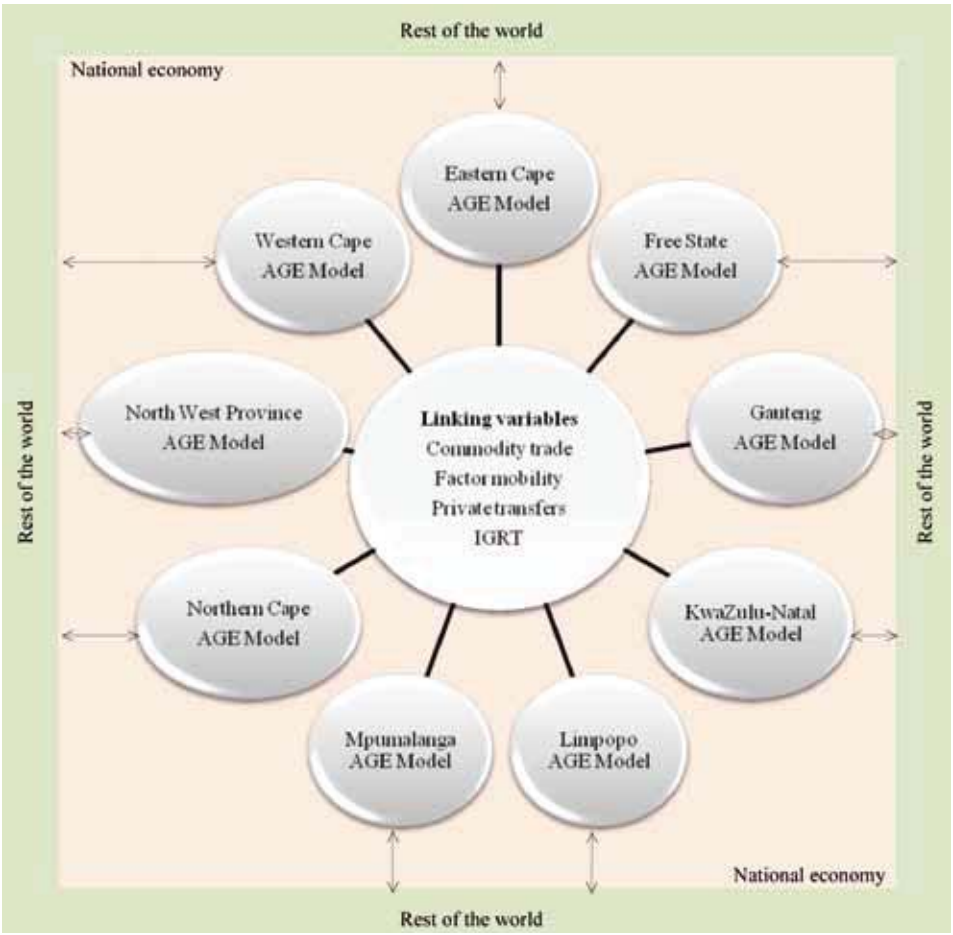
5.2 The AGE Model

The Integrated Multi-region Applied General Equilibrium (IMAGE) model is built for South Africa and used to assess the equity and efficiency of the current South African Intergovernmental Revenue Transfers (IGRT). It combines nine sub-models (Figure 5.1) which replicate the economies of the nine regions that constitute South Africa using an AGE framework.[73]

An AGE model is a multi-market and multi-agent system of equations, which uses real-world data to simulate the workings of a market economy. In policy analysis, using AGE models allows the integration of both direct and indirect interactions throughout the economy. In other words, if government policy causes something to change in one part of the economy, the model automatically computes the effects in the other parts.

At the core of the IMAGE model is the neoclassic general equilibrium theory, which seeks to explain production, consumption and prices in the economy, in which producers and consumers respond to relative prices as a result of profit and utility-maximising behaviours, respectively. Markets simultaneously adjust relative prices in order to reconcile supply and demand decisions and, thus, determine production and consumption levels.

Figure 5.1 Schematic representation of the IMAGE model



Source: Authors

72 These range from formal subnational fiscal rules (e.g., expenditure and borrowing ceilings) to informal coordination mechanisms.

73 Regions are synonymous with provinces in South Africa.

Partridge and Rickman (2010) note that, although regional AGE models follow country model archetypes, they present some additional complexities, which include:

- Regions trade not only with foreign countries, but also with other regions; therefore, the openness of the regional economy is greater than that of the country's economy.
- Labour mobility is greater among regions of a country than among countries; furthermore, there is a mismatch between the place of factor employment and the place of expenditure of factor income.
- Regional saving is less likely to influence regional investment.
- The intergovernmental fiscal transfers play an important role in reducing the gap in the living standards among regions.

The IMAGE model establishes the relationships among regions at four levels: i) commodity trade; ii) factors mobility; iii) intergovernmental revenue transfers; and iv) interregional private transfers and other specificities.

5.2.1 Commodity trade

The model presented here is shaped according to the information on interregional trade provided by the regional Social Accounting Matrices (SAMs). Data on imported and exported commodities (and other interregional linking variables) is available in one aggregate account: the Rest of South Africa (RSA). The nine regional SAMs do not give information on the region of origin and the region of destination for the traded products. The number of trading partners is the first difference between a standard country model and a regional model. Specifically, the IMAGE model features three trading partners instead of the two usually found in standard AGE models. The availability of a given product in one region or absorption is met by an aggregation of products from three regions: the region, other South African regions and the rest of the world. A nested constant elasticity of substitution (CES) specifies an imperfect substitution relationship among demands from the three regions. The derivative demands of the product from the region r, the RSA, and the rest of the world are closely related to the price of the product in the region, the average price of the product from the RSA, and the converted world price of the imported product.

As in the standard AGE models, the region r prices of goods and services are determined through the neoclassical market-clearing price system (perfect competition hypothesis). That is, producers and consumers take as given the relative prices that equalise the quantities demanded and produced for each commodity. Therefore, simultaneously determined producer and consumer prices vary only by given tax or subsidy and margins rates.

The treatment of the world prices is also similar to the standard AGE framework. Fixed international prices of imported commodities are assumed; in other words, there is no constraint on the availability or the supply of foreign goods (small country hypothesis). However, the converted prices of foreign goods, which are defined by international fixed prices, the exchange rate, and government fiscal interventions, determine the allocation of demand between national and international products.

The second feature of the IMAGE model is the interregional trade of goods and services and the treatment of the export demand. Standard AGE models usually assume a fixed export demand for the internationally traded commodities. However, an increasing number of models integrate a downward-sloping, export-demand system that links the export demand to the ratio of fixed world price and to the free on board (FOB) price. In the IMAGE model, the export demand of a region is determined by the demand for imports from other regions of the country.

The interregional trade is governed by the following rule: for a given commodity, the nationwide export demand is equal to the aggregation of the nine regions' imports (Figure 5.2). Then, the export demand of a specific region follows a cost minimisation rule. A constant elasticity of substitution is used to determine the export demand for the region from the nationwide export demand. Regional export prices determine the allocation of demand for exports among regions. Thus, the average price of imported commodities from the RSA is the average price of exported commodities by the RSA. The latter is the weighted average export prices in all regions in South Africa.

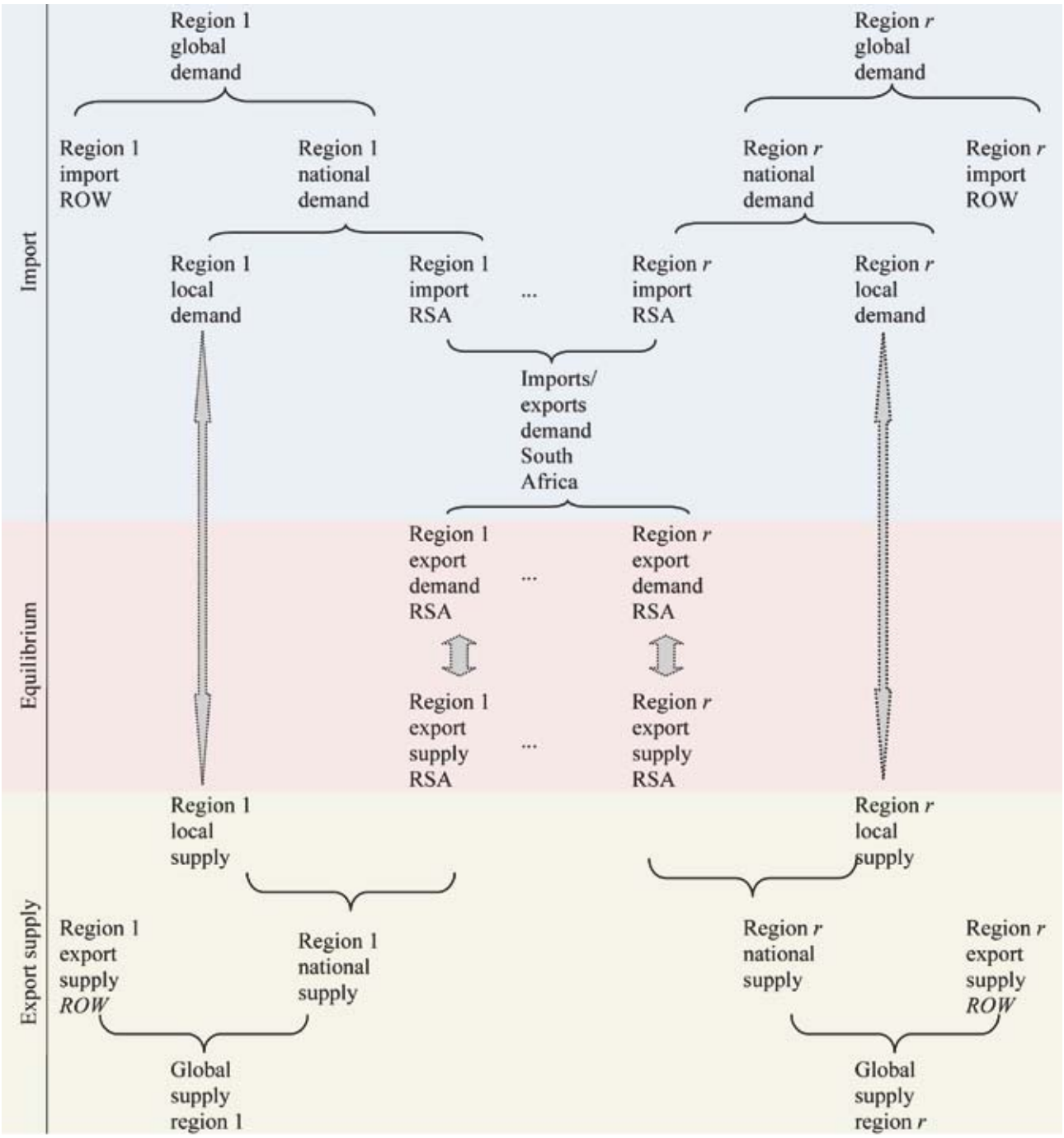
An imperfect transformation among the regional market, the RSA market, and the international market is specified for the regional production. Therefore, export supplies of a product to the region, the RSA, and the rest of the world are closely linked to the price of the product in the region, the average price of the product from the RSA, and the FOB price of the internationally exported product. Adjustments in the export FOB prices balance export demand from and export supply to the rest of the world. Export demand from the rest of the world follows the standard specification, i.e. downward sloping. Consequently, export demand depends on world prices and domestic FOB prices.

5.2.2 Factor mobility

An adaption of the Harris and Todaro (1970) model of migration is used to explain the interregional mobility of factors, i.e. labour and capital. The model assumes that the migration decision is based on the differentials between the expected wage in the urban sector and the wage rate in the rural sector. This implies that rural–urban migration occurs as long as the expected wage from migrating to the urban area is greater than the wage in the rural area.

The IMAGE model considers a natural interregional flow of labour and capital explained by many reasons, including the price differentials between regions. The relative changes in the labour or capital flows (compared to their initial levels given by the regional SAMs) are assumed to be closely linked to the changes in the ratio of national to regional prices. When the ratio is greater than one, there is an increase in the flow of labour or capital from the region toward the rest of the country.

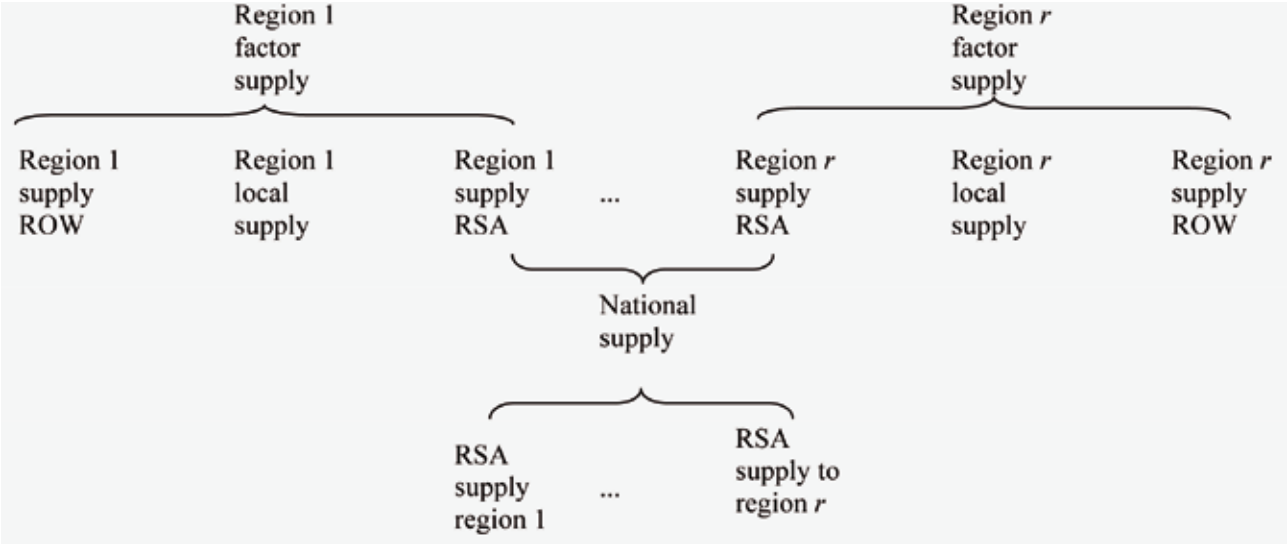
Figure 5.2 Structure of the interregional trade in goods and services



Source: Authors

Figure 5.3 shows the interregional reallocation of factors, which is in two steps: first, the decision to move, then the choice about the destination is made. In this relationship, potential migrants or capital holders are assumed to be risk averse. The assumption is expressed by an inelastic relationship between the changes in interregional labour or capital flows with respect to changes in expected wage or return-to-capital ratio. In other words, the migrant labourers spend their entire revenue in the region of origin.[74]

Figure 5.3 Interregional mobility of factors



Source: Authors

Labour

The change in labour supply to the RSA, compared to its initial level, depends on the ratio of the expected wage rate in the region and the nationwide average expected wage rate. The expected wage rates are equal to the gross wage rates adjusted by the unemployment rates. The nationwide average wage and unemployment rates are equal to the regional wage rates weighted by the regional supply and demand of labour respectively.

The total supply of labour to the RSA is an aggregate of the regional supplies (See Figure 5.3). It is then distributed among regions according to an imperfect transformation relationship. The supply of labour from the RSA to one region is closely related to the ratio of its expected wage rates in the region and the nationwide average wage rate.

Capital

The change in the supply of capital to the RSA compared to its initial level also depends on the return-to-capital ratio in the region and the RSA. The nationwide return to capital is an average of the region's returns weighted by their demand for capital.

The aggregate supply of capital is distributed among regions through a constant elasticity of transformation. The supply of capital from the rest of South Africa to the region is also related to the region's return to capital and the nationwide average return to capital.

5.2.3 Intergovernmental fiscal transfers

The IMAGE model accounts for three spheres of government: national, regional and local. Each sphere is assigned certain powers, functions and financial resources, which may be exclusive, concurrent or shared. While national government raises the bulk of aggregate revenues, its expenditure responsibilities are much lower. There is thus a mismatch between revenues

74 Alternatively, the assumption could be that the migrant revenue is shared between the region of origin and the region of destination by defining a sharing.

raised and expenditure responsibilities. A converse mismatch exists at the provincial level. This vertical mismatch is known as vertical fiscal imbalance. Horizontal fiscal imbalance exists among regions, and also among localities within regions where different regions have different abilities to raise funds. Thus, regions have massively different expenditure responsibilities and existing (as well as potential) revenue sources.

Each government sphere spends on providing public services, subsidising the national economy (activities and products), and transferring revenues to other governments and institutions. The IGRT are modelled in a standard fashion, i.e. they are assumed to be fixed in real terms. Government fiscal policies also follow the standard specification, namely that the national government expenses in a given region is exogenous. While the national government's fiscal balance is endogenously determined in all regions, its overall balance is exogenous. Therefore, a revenue-neutral hypothesis is assumed for national government and its revenue loss, if any, is compensated by an endogenous uniform tax on household gross incomes across all regions. Rigidity in expenses and revenue-neutral assumptions are also made for regional and local governments. Compensatory taxes at endogenous uniform rates are applied to households' gross incomes.

5.2.4 Interregional private transfers and other specificities

A standard formulation is used to model the private transfers, i.e. they are fixed among regions, as well as between a given region and the rest of the world. The assumptions associated to the rest of the model are discussed below.

Regional supplies and demands

As producers maximise their profit under a given technology and prices, industry-specific producers are modelled as representative producers who are assumed to have a CES production technology. In addition, production activities and commodities are separated. A fixed proportional relationship, between activity output and domestic supply of commodity, permits any activity to produce one or multiple commodities and any commodity to be produced by one or multiple activities.

Consumers' behaviour is rational, which implies that their production and consumption decisions are separated in the presence of complete markets. With the fixed factor endowments assumption, their incomes are closely related to the return to these factors. Consumers maximise their utility under limited budgets and given market prices, while households are also modelled as representative agents that are assumed to have Stone-Geary type of preferences.

Institutional constraints

AGE models differ primarily in the choices of closure rules that equilibrate commodity, factor and foreign exchange markets. These models also differ in rules specified to reconcile the government budget constraint and in the mechanism used to equilibrate savings and investment levels in the economy.

The labour market is assumed to be fully segmented. Each category of labour is assumed to be perfectly mobile across industries. Skilled workers are fully employed in the economy, although low rates of frictional unemployment[75] are observed. The skilled labour market is assumed to be perfectly competitive so that the prevailing wage rates equalise exogenous supplies and endogenous demands for high-skilled workers. In contrast, the competition is imperfect in the unskilled labour markets, where the total demand does not equal the total supply, and an excess supply of labour remains unemployed. The wage rate paid to unskilled workers is closely related to the unemployment rates through a wage-curve specification.

Institutional units are endowed with one type of capital, which is mobile among industries with one return to capital in the economy. The static comparative analysis does not imply capital accumulation and investment rules. As a consequence, exogenous investment and capital supply are assumed. Therefore, saving is driven by investment. Savings are generated by exogenous constant rates for households and by residual savings for firms. Savings of the national, provincial, and local governments are exogenous, as are savings of the RSA and the rest of the world.

Although every region exchanges directly with the rest of the world through trade of goods and services and other transfers, the external current account balance is specified at the national level. The nationwide balance of external current account is

75 Frictional unemployment exists because both jobs and workers are heterogeneous. A mismatch in skills, payment, working time, location, attitude and tastes can result between the supply and the demand of labour.

exogenous. Therefore, an endogenous exchange rate or the relative price of goods and services traded with the rest of the world clears the external current account.

On the other hand, regional sub-models also feature external current accounts with the RSA. To avoid free lunches among regions, the balances of the external current accounts with the RSA are fixed. They are balanced through adjustments in region-specific exchange rates, which are defined as the relative price of goods and services traded with the RSA and are set as 'numeraires'.

5.3 The Data

The IMAGE model is operationalised through the calibration procedure, which consists of finding parameters that permit equations to reproduce exactly the benchmark situation given by nine region-level SAMs.[76]

5.3.1 Regional SAMs

Regional SAMs are available for the nine regions that constitute South Africa. All SAMs are for the year 2006 and are structured as follows (see Table 5.5 in Annexure 5A):

- 35 to 47 accounts for activities/commodities;
- 44 accounts for labour payments divided into four population groups and 11 occupations;
- Four accounts for capital payments or the gross operating surplus (GOS);
- Four accounts for enterprises;
- 48 accounts for households, disaggregated into four population groups and 12 consumption deciles;
- Seven accounts for government income sources and six accounts for its expenditures items;
- Two accounts for government, and corporations and households capital accumulation;
- Four accounts for the RSA;
- Five accounts for the rest of the world; and
- One account for residuals and discrepancies.

The adjustment procedure aims both to set up a common framework for the nine regional SAMs and to be consistent with the standard structure of AGE models.

Activities and products are aggregated into a suitable number of accounts according to the mapping made among the nine regional SAMs in order to generate a uniform framework with 35 industries/commodities: one agriculture, one mining, four food, one beverage, 19 manufacturing and nine services.

The 44 accounts for labour payments are aggregated into the 11 occupational groups.

The four accounts for enterprises are grouped into two categories: Public Enterprise and Private Business Enterprise (which includes Combi-Taxi Enterprise and Informal Enterprise).

The 48 accounts for households are aggregated according to the 12 consumption deciles.

Income and expense accounts of the three levels of government – national, provincial, and local – are adjusted to match receipts (row) and spending (column). The four accounts of the RSA are aggregated into one account. The five accounts of the

76 The SAMs provided by the Department of Trade and Industry and constructed by Coningharth Economists in 2008.

rest of the world are also aggregated into one account. Institutional accumulation account is aggregated into a one account. The allowance for depreciation, or payments of capital recorded directly in the capital account, is first transferred to institutional units and then channelled to the capital account; the model follows the principle that savings are made by institutional units (either resident or non resident). Residual accounts are cancelled out by combining them to the change in inventories featured in the accumulation account.

5.3.2 Other data

Alongside the SAM data, the calibration procedure of the IMAGE model requires additional information, essentially the elasticities, the Frisch parameter, and the unemployment rates. With the exception of unemployment rates, which are different from one region to another (see Figure 5.8 in Annexure 5A), the value of parameters chosen for regional sub-models are identical.

The values of the income elasticity of demand are drawn from the work done by the Economic Research Service of the US Department of Agriculture for 114 countries (see Table 5.6 in Annexure 5A).[77] The elasticity of the wage rates with respect to the unemployment rate is set at -0.1 according to estimates by Kingdon and Knight (2005). The value of -3.34 is chosen for the Frisch parameter, an estimate for middle-income countries by Hertel *et al*. (1997). The elasticity of substitution between capital and labour is fixed at 2.5, the highest value surveyed by Annabi *et al*. (2006). The trade elasticities are estimated by Gibson (2003) for the Armington elasticities (see Table 5.7 in Annexure 5A), and by Behar and Edwards (2004) for the export elasticities. The latter take the values of 1.3 for the transformation elasticity and 6.0 for the export demand elasticity.

The next set of parameters related to the interregional relationship is i) the import and export elasticities; ii) the elasticity of factor mobility among regions with respect to prices; iii) the transformation elasticity of factors among regions. Since estimates are not available for these parameters and the results of this analysis are likely to be influenced by their values, the main simulation is carried out under two scenarios: low and high interregional relationships.

5.3.3 Simulation scenarios

The IMAGE model developed for South Africa is used to assess the effectiveness of the current IGRT. The degree to which the national government equity goal is achieved through the current IGRT is quantified. The simulation is based on the vertical imbalance of national government revenues and expenses among regions.

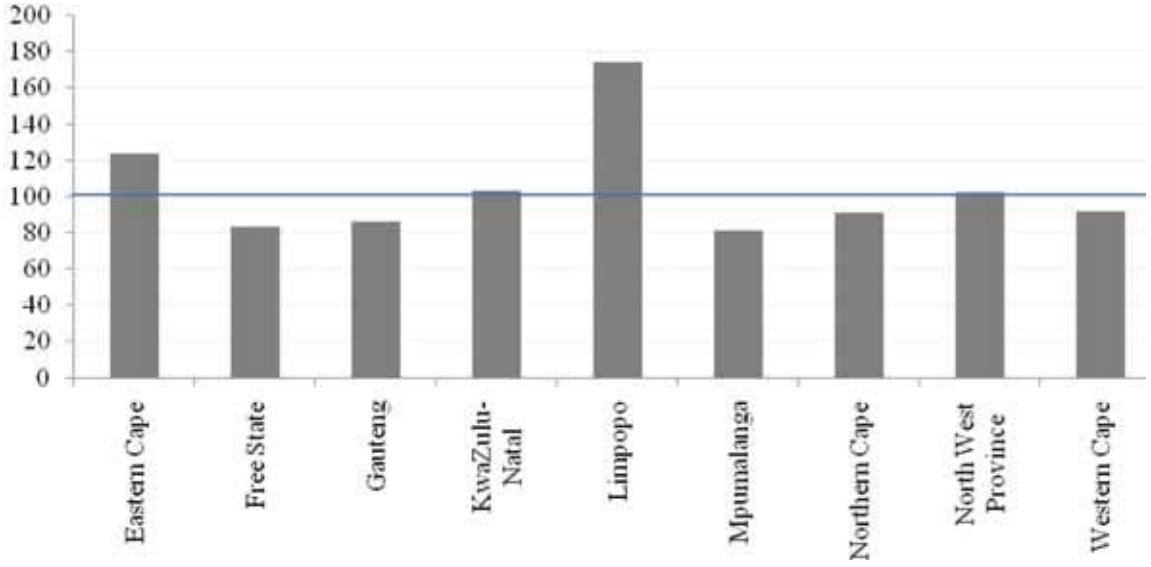
First the revenues and expenses of the national government in each region are presented in order to understand better the simulation performed later. Figure 5.4 shows disparities between collected revenues and expenses by the national government in all regions.

The regions that receive by far the most transfers from national government are Limpopo and Eastern Cape, where R174 and R124 respectively are spent for every R100 collected in the region. The two other regions that receive net transfers from the national government, but to a lesser extent, are KwaZulu-Natal and North West Province: R103 and R102 for every R100 collected respectively.

On the other hand, national government spending is less than the collected revenues in Mpumalanga, the Free State and Gauteng: for every R100 collected, it spends R81, R83, and R86 respectively. The Northern Cape and Western Cape also received R91 and R92 for every R100 collected in these regions.

77 The data is available at www.ers.usda.gov/data/internationalfooddemand. The values estimated for Botswana are used for South Africa, which is not covered by this database. South Africa and Botswana have similar Human Development Indexes, as computed annually by the United Nations Development Programme (UNDP).

Figure 5.4 National government spending-to-income ratio by region (%)



Source: Regional SAMs for 2006

To analyse the effectiveness of the IGRT in South Africa, the current system of fiscal transfer was arbitrarily reduced by 50%. The effectiveness of the policy is captured through welfare effects, as measured by the changes in equivalent variation.[78]

National government's primary saving rate is assumed to be identical for all regions, in order to avoid simulating the issue of the national government fiscal balance alongside the main simulation scenario – the IGRT. Once national government fiscal balances are determined for all regions, the spending excess/deficit of all revenues collected by national government in the region is estimated. The spending excess/deficit is then calculated in proportion to the initial national government spending in terms of transferred revenues to the region. In the baseline scenario, this spending excess/deficit is nil. In the simulation scenario, it is assumed that 50% of the spending excess is cancelled out for some regions and 50% of the spending deficit is transferred back to other regions.

When 50% of the IGRT is cancelled out, regions such as Limpopo, Eastern Cape, KwaZulu-Natal and North West Province receive less transfer revenues, and consequently national government spending falls. On the other hand, Northern Cape, Western Cape, Free State, Mpumalanga, and Gauteng have additional fiscal spare capacity; that is, national government spending increases in these regions.

Changes in transfer revenues do not have an impact on national government fiscal policy, as it is re-transferring revenues among regions. However, regional government fiscal policy is directly affected by the changes in transfer revenues. A revenue-neutral hypothesis is adopted for regional governments so that, with fixed regional expenses and savings, their budgets are balanced through a compensatory tax or subsidy on households' gross income.

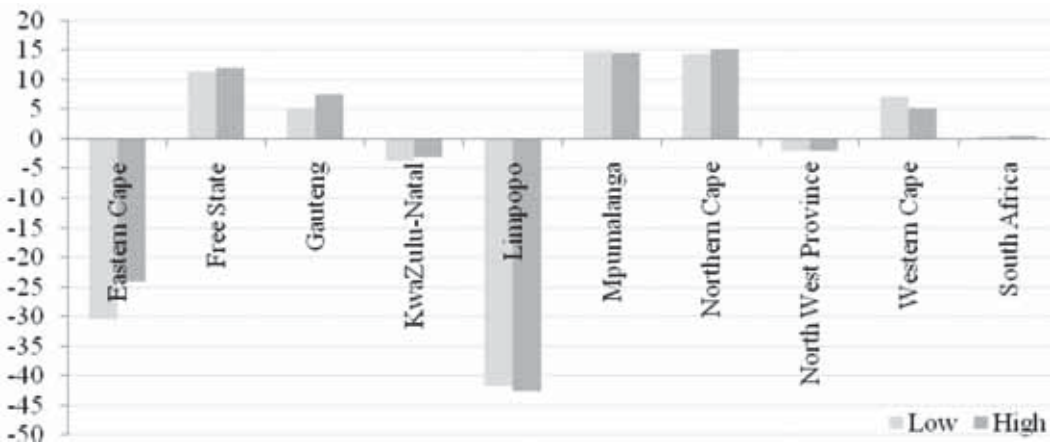
The 50% cut of grants is performed under two scenarios: *low* and *high* interregional trade and factor mobility. The *low* interregional relationship scenario assumes that the interregional trade elasticities are identical to the international trade elasticities. Assuming no changes in regions' ownership of factors and consequently temporary mobility of labour, an inelastic interregional supply of labour and capital is assumed with respect to the changes in their relative regional prices. While the elasticity value of 0.1 is set for labour, a relatively more flexible value of 0.3 is chosen for capital. An identical elasticity value for labour mobility and the transformation elasticity is assumed, i.e. after making the decision to supply more or less labour to the other regions, the choice of the destination is still limited because of the temporary mobility of labour hypothesis. However, it is assumed that the choice of the destination (the transformation elasticity) of the capital is twice as flexible as the supply elasticity. So long as the openness of the regional economy is greater than that of the country's economy, results drawn from the *low* scenario should be interpreted as lower bound results. Therefore, the *high* interregional relationship scenario measures the sensibility of the results to higher economic interaction amongst regions. In this regard, the elasticities are set at values three times higher than their counterpart in the *low* scenario.

78 The experiment is limited to 50% reduction of the IGRT for the reason that higher shocks, in particular a full cancelling out (100%), are too big for many regions (e.g. Limpopo) and technically impossible to perform using the model. A progressive reduction of the IGRT simulated through a dynamic framework would be more appropriate in this case.

5.3.4 Simulation results

The simulation demonstrates that reducing the current IGRT has significant interregional equity effects, although the overall impact is less important. Nationwide welfare falls by 0.6% when the IGRT are cut by 50% (Figure 5.5). However, its distributional effect among regions is important. Changes in welfare are negative in four regions: Limpopo (42–43%), Eastern Cape (24–30%), KwaZulu-Natal (3–4%), and the North West Province (2%). As net receivers of IGTR, these regions witness a loss of revenues after a 50% cut of the transfer.

Figure 5.5 Equivalent variation of initial consumption expenses (%)

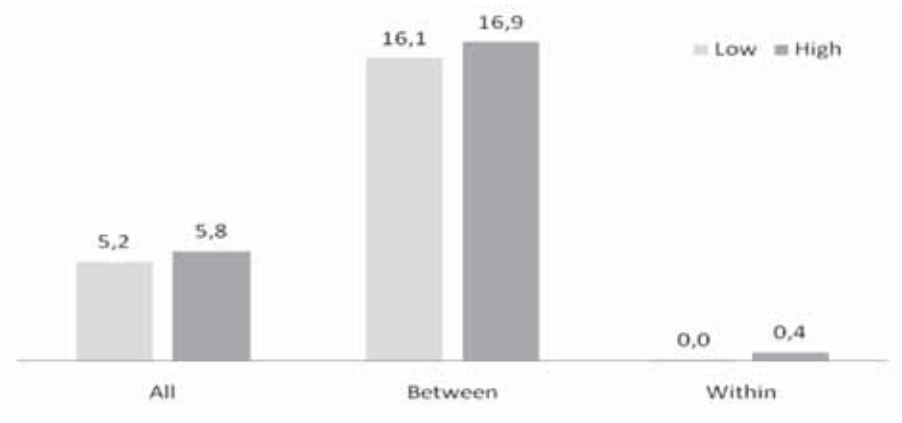


Source: Simulation results

As depicted in Figure 5.6, changes in welfare are positive in five regions: Mpumalanga (15%), the Northern Cape (14–15%), Free State (11–12%), Gauteng (5–8%), and the Western Cape (5–7%). These positive changes in welfare are attributed to the additional revenues spent in these regions following the partial cancelling of revenues that were initially transferred to other regions.

Theil indices are used to measure the regional disparities. The overall regional disparity increases by 5–6% (Figure 5.6). This is essentially imputed to the increase in disparities between regions by 16 to 17%.

Figure 5.6 Variation in Theil indices (%)



Source: Simulation results

Although the overall within-region disparities remain unchanged (Figure 5.6), the intraregional disparities are important and vary from region to region. Disparities between top and bottom income categories increase in Limpopo and the Eastern Cape, regions that were initially receiving net positive IGRT (Tables 5.1 and 5.2). The reduction of revenue transferred to others regions – consequently, an increase of national government spending in the region – benefits more the bottom income groups in the Northern Cape, Mpumalanga, and Free State.

Table 5.1 Percent change in EV of initial consumption expenses, low scenario

Household category	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpuma-langa	Northern Cape	North West Province	Western Cape
P1	-27.2	9.8	5.9	-3.4	-39.8	14.4	10.8	-2.3	6.3
P2	-26.0	9.8	5.6	-3.8	-36.6	12.5	8.7	-2.5	6.0
P3	-26.6	9.9	5.2	-3.7	-37.3	12.9	8.4	-2.2	6.3
P4	-26.3	9.9	4.8	-3.6	-37.8	13.1	9.3	-2.2	6.6
P5	-26.5	9.8	5.1	-3.7	-36.8	12.9	9.0	-2.3	6.4
P6	-26.7	10.0	4.8	-3.6	-38.2	13.4	9.9	-2.2	6.3
P7	-27.8	10.0	5.3	-3.4	-39.4	12.7	10.9	-2.3	6.2
P8	-27.9	10.1	4.8	-3.5	-40.0	13.1	16.2	-2.3	6.5
P9	-28.1	10.4	4.4	-3.4	-41.6	14.2	15.1	-1.9	6.9
P10	-35.4	11.6	4.5	-3.7	-51.7	17.9	13.8	-1.8	7.0
P11	-41.9	12.4	6.9	-3.9	-49.8	17.3	18.5	-2.5	7.2
P12	-31.5	13.9	5.2	-3.7	-42.2	15.4	54.8	-1.9	7.4
ALL	-30.4	11.3	5.1	-3.7	-41.7	14.8	14.3	-2.1	7.0

Source: Simulation results. Note: EV: Equivalent Variation

Table 5.2 Percent change in EV of initial consumption expenses, high scenario

Household category	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpuma-langa	Northern Cape	North West Province	Western Cape
P1	-22.1	10.4	8.0	-2.7	-40.8	15.0	13.2	-1.9	5.0
P2	-20.3	10.4	7.0	-2.9	-37.9	12.4	11.4	-2.2	4.4
P3	-20.8	10.5	6.8	-2.9	-38.4	12.4	11.3	-2.0	4.6
P4	-20.7	10.5	6.6	-2.9	-38.8	12.7	10.2	-2.0	4.7
P5	-20.9	10.5	6.8	-3.0	-38.3	12.7	9.8	-2.1	4.6
P6	-21.4	10.7	6.7	-3.0	-39.3	13.1	9.2	-2.0	4.6
P7	-22.3	10.7	6.9	-3.0	-40.6	12.6	9.5	-2.2	4.6
P8	-22.8	10.8	6.8	-3.1	-41.0	13.1	15.8	-2.1	4.7
P9	-23.0	11.0	6.7	-3.0	-42.6	13.8	15.1	-2.0	4.9
P10	-28.9	12.3	7.6	-3.3	-52.1	17.5	13.2	-1.9	5.1
P11	-33.7	13.1	9.3	-3.3	-50.1	17.4	17.7	-2.3	5.3
P12	-25.0	14.4	8.1	-3.1	-43.0	15.0	58.7	-2.0	5.5
ALL	-24.2	11.9	7.6	-3.1	-42.6	14.5	15.1	-2.1	5.2

Source: Simulation results. Note: EV: Equivalent Variation

Therefore, halving the IGRT in South Africa leads to increased regional disparities. Compared to other regions, Limpopo and the Eastern Cape witness significant welfare losses. In the same vein, low-income households are heavily hit compared to the middle and high-income households within these regions. Regions that were initially transferring revenue see welfare gains and a fall in income disparities.

The overall effect on GDP is small. Reducing the IGRT by 50% leads to a fall of 0.2% in GDP in the low scenario and of 0.1% in the high scenario. Although higher regional integration lowers the adverse effect of reducing the IGRT, its regional disparities are more important (Figure 5.7).

The group of regions receiving revenues within the IGRT system see a fall in GDP, which is particularly significant in Limpopo and the Eastern Cape. GDP falls slightly in KwaZulu-Natal and the North West Province. Regions transferring revenues (Northern Cape, Mpumalanga, Free State, Gauteng and Western Cape) see their GDPs increase.

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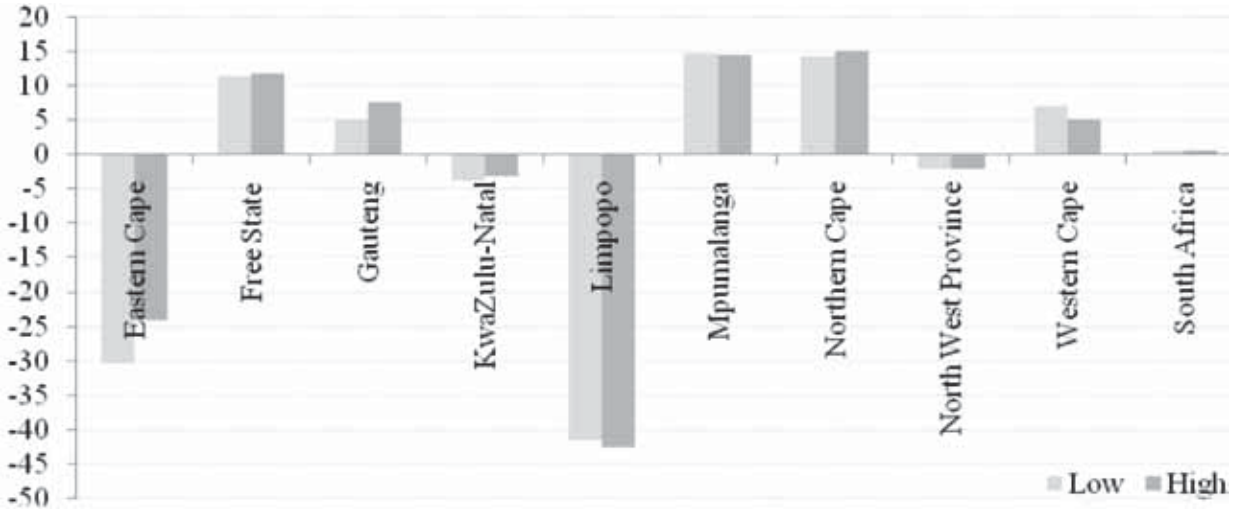
Figure 5.7 Change in GDP (%)



Source: Simulation results

The IGRT have income and price effects in all regions. Reducing the national government transfer payments leads to a fall of income in regions receiving IGRT revenue and has negative effects on households' well-being. Regions initially transferring revenues see their income and welfare increase. However, higher income increases the demand for goods and services and puts pressure on prices, which reduces the purchasing power and households' well-being.

The income and price effects are explored in order to understand better the inter- and intra- regional disparities. Assuming a revenue-neutral hypothesis for all governments (i.e. fixed spending and savings), revenue changes are captured through a compensatory tax or subsidy on households' gross incomes and, consequently, their consumption.

The reduction of IGRT by 50% creates a revenue deficit for regional governments in Limpopo, Eastern Cape, KwaZulu-Natal, and the North West Province. Therefore, these governments can either reduce their expenses and/or increase their income. Assuming that expenditures are fixed, the alternative is that government increases taxes, which is done through the introduction of a uniform compensatory tax on households' gross income. The additional tax rates required to fully compensate the loss of regional government revenue is: 12.4% in Limpopo, 6.8% in the Eastern Cape, 0.9% in KwaZulu-Natal, and 0.5% in the Northern Province.

In contrast, regions that are initially transferring revenues show compensatory subsidy rates of 4.1% in the Northern Cape, 3.7% in Mpumalanga, 3.2% in Free State, 2.5% in Gauteng, and 1.7% in the Western Cape.

In the low and high trade and factor mobility scenarios, households' gross incomes fall (Tables 5.3 and 5.4): in the initially net receiver regions because of the transfer cut and the ensuing positive compensatory tax rates; and in the initially net payer regions because of the inflationary and depreciatory effects. As a result, domestic factors and commodities prices fall relative to external prices. Consumer price indices also fall and, consequently, real consumptions increase for the net payers and fall for the net receivers.

Because of the regressive nature of the compensatory tax, and eventually public expenses when government has to cut on its expenses instead of increasing taxes, poor households are hardest hit in regions where the rate increases. In contrast, poor households benefit more in regions where the compensatory tax rate falls.

Table 5.3 Percent change in revenues, low scenario

	Eastern Cape	Free State	Gauteng	KwaZulu Natal	Limpopo	Mpuma-langa	Northern Cape	North West Province	Western Cape
Gross income	-4.3	-3.6	-2.9	-3.7	-3.2	-3.7	-3.1	-3.6	-3.5
Compensatory tax rate	6.8	-3.2	-2.5	0.9	12.4	-3.7	-4.1	0.5	-1.7
Disposable income	-12.3	-0.2	-0.2	-4.8	-16.6	0.3	2.5	-4.4	-1.6
Consumer price index	-4.5	-3.3	-1.6	-3.7	-3.9	-3.8	-1.7	-3.6	-3.5
Real consumption	-8.3	4.0	1.4	-1.1	-13.2	4.4	16.0	-0.8	2.1

Source: Simulation results

Table 5.4 Percent change in revenues, high scenario

	Eastern Cape	Free State	Gauteng	KwaZulu Natal	Limpopo	Mpuma-langa	Northern Cape	North West Province	Western Cape
Gross income	-1.3	-0.8	-0.6	-1.0	-0.7	-1.3	-1.2	-1.2	-0.9
Compensatory tax rate	6.2	-3.2	-2.4	0.8	11.9	-4.0	-4.4	0.4	-1.3
Disposal income	-8.6	2.8	2.1	-1.9	-13.8	3.2	5.2	-1.7	0.6
Consumer price index	-1.4	-0.8	-0.2	-1.0	-1.2	-1.1	0.6	-1.0	-0.9
Real consumption	-7.5	4.3	2.4	-0.9	-12.9	4.5	17.8	-0.6	1.6

Source: Simulation results

5.4 Conclusion

While previous studies of fiscal consolidation attempts have tended to focus solely on general government, this research has established an important role for sub-national government in fiscal consolidation. A multi-region computable applied general equilibrium model was used to show how efficiency and equity goals are affected. Although the results that emerge from the empirical analysis are varied, two general points are worth highlighting.

First, cuts in grants have significant interregional equity effects, although the overall impact is less important. In regions that were initially receiving revenues, i.e. Limpopo, Eastern Cape, KwaZulu-Natal, and the North West Province, reducing the current IGRT leads to a fall in welfare. However, welfare increases in regions that were initially transferring revenues, i.e. Northern Cape, Mpumalanga, Free State, Gauteng and the Western Cape. In addition, the change in GDP is negative for the former group of regions, while positive for the latter group.

Second, cuts in grants also have significant intra-regional equity effects, although the economy-wide impact is small. When transfer revenues – and consequently regional and local governments' revenues – fall, poor households are the most affected because they depend more on public services, which are essentially financed by governments. When the government fiscal position improves, poor households also benefit more from additional government expenses. Cuts in grants can be compensated by increases in taxation. However, the increase in sub-national taxation means that households' incomes fall and income disparity widens. Poor households are hardest hit in regions where the rate increases because of the regressive nature of the integrated compensatory tax – eventually government has to cut its expenses instead of increasing taxes. In contrast, poor households benefit more in regions where the compensatory tax rate falls.

The current IGRT is therefore effective and contributes to realising the national government equity goal. It would seem difficult to agree on painful measures to keep the budget balanced, if fiscal restraint is widely perceived to be associated with not only a higher net tax burden on current generations, but also a more unequal distribution of their after-tax incomes. Such concerns about intra-generational equity appear to be justified if cuts in social assistance or less regressive taxes are used to reduce the deficit. Not least from a South African welfare state perspective, a programme of fiscal consolidation could easily conflict with ambitious (re)distributive objectives.

The analysis represents a modest first step towards a more complete empirical assessment of fiscal consolidation in economies with multi-spherical governments. A number of extensions can be done with the current model. Intergovernmental fiscal transfers may also have dynamic efficiency gains in the sense that, if higher spending on services such as education, health, transportation, water, sanitation and public housing increase the stock of human capital, then this might increase the rate of economic growth and per capita incomes.

The next phase will be to explore efficiency and equity issues for having uniform minimum standards of public services in South Africa. It is essential to extend the model to capture these dynamic interactions so that the relative sizes of fiscal resources, which have to flow between and among governments and tiers, are determined equitably and in a transparent manner.

The work can also be extended to explore many other issues, such as the impact of the equitable formula on national and sub-national performances; the effects of varying the equitable formula to regions, i.e. a move from population-based to needs-based formula using poverty status of regions; the effect of matching grants versus block grants; the effect of conditional grants, considering the conditional grants by sector or by classification; the effects of targeted use of transfers versus non-targeted use; the effect of revenue raising at the provincial level, e.g. reducing national income tax, creating a fiscal space that can be used for provincial personal income taxes; the effect of changing the component shares of conditional grants per province; and the effects of various funding possibilities for raising revenue of regional

public goods, revenue-neutral financing, redistributive taxes, and uniform tax deductions. Despite the limitations mentioned, the results are quite thought provoking, showing that the design of fiscal consolidation programmes clearly requires a careful balance between intergovernmental and intra-generational fairness.

Annexure 5A Graphs and tables

Table 5.5 Dimension of the regional SAMs

SAMs accounts	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Lim-popo	Mpuma-langa	Northern Cape	North West	Western Cape
Activity	42	36	37	45	46	47	37	35	47
Commodity	42	36	37	45	46	47	37	35	47
Labour	44	44	44	44	44	44	44	44	44
Capital	4	4	4	4	4	4	4	4	4
Enterprise	4	4	4	4	4	4	4	4	4
Household	48	48	48	48	48	48	48	48	48
Govt income (expenses)	7 (6)	7 (6)	7 (6)	7 (6)	7 (6)	7 (6)	7 (6)	7 (6)	7 (6)
Capital account	2	2	2	2	2	2	2	2	2
Rest of South Africa	4	4	4	4	4	4	4	4	4
Rest of the world	5	5	5	5	5	5	5	5	5
Discre-pancy	1	1	-	1	1	1	1	1	-

Source: Regional SAMs for 2006

Table 5.6 Income elasticity of consumption products

Products	Value	Products	Value
Agriculture	0.655	Other Fabricated Metal Products	1.367
Mining	1.367	Machinery & Equipment	1.367
Meat, Fish, Fruit, Vegetables, Oils and Fat Products	0.697	Electrical Machinery & Apparatus	1.367
Dairy products	0.764	Communication, Medical and other Electronic Equipment	1.367
Grain Mill, Bakery and Animal Feed Products	0.458	Manufacturing of Transport Equipment	1.367
Other food products	0.697	Other Manufacturing & Recycling	1.367
Beverages and tobacco products	0.989	Electricity	1.208
Textiles, Clothing, Leather Products and Footwear	0.917	Water	1.208
Wood and Wood Products	1.367	Building and Construction	1.367
Furniture	1.204	Trade	1.367
Paper and Paper Products	1.367	Accommodation	1.208
Publishing and Printing	1.367	Transport	1.221
Chemicals & Chemical Products (incl Plastic Products)	1.208	Communication	1.221
Rubber Products	1.367	Insurance	1.367
Non-Metallic Mineral Products	1.367	Real Estate	1.208
Basic Metal Products	1.367	Business Services	1.514
Structural Metal Products	1.367	Community, Social and Personal Services	1.367

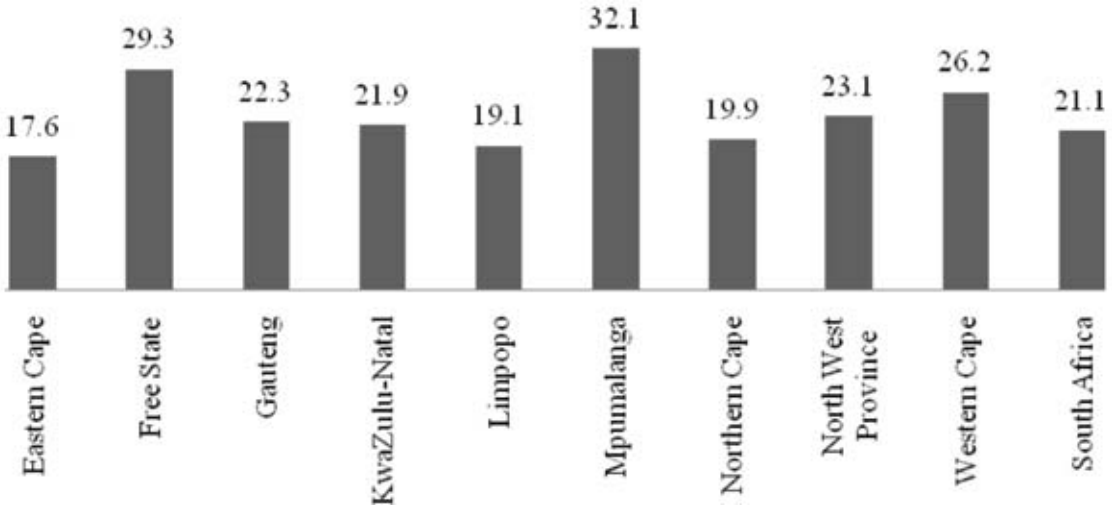
Source: USDA, Economic Research Service, using the 1996 ICP data. From the ERS report Cross-Price Elasticities of Demand Across 114 Countries (TB-1925); Botswana data

Table 5.7 Armington elasticities

Products	Value	Products	Value
Agriculture	1.273	Other Fabricated Metal Products	0.747
Mining	2.771	Machinery & Equipment	0.490
Meat, Fish, Fruit, Vegetables, Oils and Fat Products	0.937	Electrical Machinery & Apparatus	0.944
Dairy products	0.937	Communication, Medical and other Electronic Equipment	0.505
Grain Mill, Bakery and Animal Feed Products	0.937	Manufacturing of Transport Equipment	0.786
Other food products	0.937	Other Manufacturing & Recycling	0.417
Beverages and tobacco products	1.570	Electricity	1.437
Textiles, Clothing, Leather Products and Footwear	2.040	Water	1.437
Wood and Wood Products	1.205	Building and Construction	1.280
Furniture	1.075	Trade	0.603
Paper and Paper Products	0.789	Accommodation	0.420
Publishing and Printing	0.200	Transport	0.861
Chemicals & Chemical Products (incl Plastic Products)	0.730	Communication	0.568
Rubber Products	1.135	Insurance	0.616
Non-Metallic Mineral Products	0.942	Real Estate	1.066
Basic Metal Products	0.447	Business Services	1.066
Structural Metal Products	0.747	Community, Social and Personal Services	1.065

Source: Gibson (2003)

Figure 5.8 Unemployment rates by province (%)



Source: Statistics South Africa (2010)

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