Assessing Interregional Equity and Efficiency Effects of Intergovernmental Transfers in South Africa

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ABSTRACT

This paper uses a multiregional model combining nine regional submodels interacting through trade and factor mobility to derive equity and efficiency effects of intergovernmental revenue transfers implied by the 2011 census results in South Africa. Based on a simulation designed to mimic broadly the impact of these population shifts for government fiscal transfers, the analysis demonstrates that resulting shifts in intergovernmental fiscal transfers has significant inter- and intraregional equity effects, although its nationwide impact is less important. When transfer revenues fall and, consequently, regional and local government revenues drop, poor households are the most affected, as they depend more on public services that are essentially financed by governments. The value added of the work lies in the explicit regional modelling accomplished that can be replicated for other countries with decentralised fiscal systems. There is no parallel work in South Africa and indeed in the rest of Africa that we are aware of that has applied such a rich technique to analysis of intergovernmental transfers.

JEL Classification: R13, H77, D60

Keywords: Census 2011; Intergovernmental transfer; multiregional applied general equilibrium; efficiency; equity

1. INTRODUCTION

According to the Census 2011 data from Statistics South Africa, in 2011 the country's population was 51.8 million, up from the census 2001 count of 44.8 million. There is marked growth in the provinces of Gauteng and Western Cape. There is apprehension amongst policy makers about South African demographic trends. South Africa's unbalanced economic development has resulted in the concentration of population and economic resources in the urban areas with high economic activity. Demographic change has many economic implications.

In the present paper we concentrate on the effect on the level of economic activity and we focus in particular on the impact of fiscal transfers implied by the demographic shifts. We are particularly interested in the extent to which shifts in population lead to changes in equitable share allocations and the degree to which the national government's equity goal is achieved through the resulting shift in transfers. Informed by results of the country's 2011 census, the paper uses analyzes the effects of government expenditures, taxation, and intergovernmental grants on equity and efficiency goals. The value added of the work carried out in this paper lies in the explicit regional modelling accomplished through the use of a multiregional model combining nine regional submodels interacting through trade and factor mobility. There is no parallel work in South Africa and indeed in the rest of Africa that we are aware of that has applied such a rich technique to analysis of intergovernmental transfers.

The literature on the assessment of varying government transfers is largely based on econometric modelling (see for example Alesina and Ardagna (1998), Baldacci et al. (2004), Giudice et al. (2007) and De Cos and Moral-Benito (2012))[1], gap modeling approaches (Taylor (1994), Bacha (1990), Chenery and Strout (1966))[2], as well as applied general equilibrium (AGE) modeling (Patridge and Rickman (2010), Dewatripont (1987), Dixon et al (2002)). In this paper we follow the AGE approach, as we want to understand the system-wide impacts of fiscal transfers on regional economies, which is presumably of interest to both regional and national governments. AGE models are able to trace changes in property prices opportunities for households, and migration between regions following reforms to arrangements of distributing available revenue. Regional AGE models typically are comparative static equilibrium models of interregional trade and location based in microeconomics, using utility and production functions with substitution between inputs. They have quite a sophisticated theoretical foundation and rather complex, non-linear mathematics which allows them to be able to model (dis)economies of scale, external economies of spatial clusters of activity, continuous substitution between capital, labour, energy and material inputs in the case of firms, and between different consumption goods in the case of households.

During the past decade, several regional AGE models have been developed for the analysis of policy related questions, especially when involving the regional interactions and/or transport or the analysis of regional disparity. Examples of well known AGE models with disaggregation on the level of regions are Bröker et al (2001), Capros et al (1998), Böhringer and Löschel (2004), Bchir et al. (2002), Kemfert and Welsch (2000), Anas and Yu (2007) and Welsch (2008). The model used in this paper fits within this general framework of models and implements many of the techniques used in AGE modeling, but with more disaggregation on the level of trade as well as on the government sector.

The basic framework of the model takes into account the specificities of the South African economy. These are related to the regions/provinces modeled, the South African labour market (with a large share of unemployment) and the strong decentralized unitary government in South Africa. South Africa is a unitary-state country with three spheres of government (local, provincial, and national) and a federal-like constitution. General government expenditure constitutes roughly 33

[1] For South Africa, Jooste and Marinkov (2012) have developed and used a model on the "optimal" path of fiscal consolidation.

[2] These models, popular in the eighties and nineties, set out saving, foreign exchange, investment, and inflation gap restrictions on potential output growth and capacity utilization to illustrate the effects of stabilization and other heterodox shock anti-inflation packages.

percent of GDP. The portion raised nationally is approximately 29 percent, while locally raised revenue is approximately 4 percent. Provincially raised revenue is insignificant and rarely constitutes more than 2 percent of provincial revenue. Financial interactions between spheres of government and fiscal consolidation take on an added dimension of complexity in countries with such multiple government spheres. Most of the literature on the relationship between different spheres of government and their interaction on the financial side has focused on the optimal assignment of public service provision and its financing between different levels of government.[3] The literature on macroeconomic management in multi-tiered governments, though less well developed, emphasizes that the increasing tendency toward decentralization and fiscal federalism raises the issue of how to maintain sustainable public finances. A key issue discussed concerns incentives faced by multi-tiered fiscal authorities, for example, the problem of *soft budget constraints* faced by subnational governments tasked with providing an essential service such as basic education or healthcare. This has led many countries to adopt fiscal coordination mechanisms to address the problem.[4]

The following section gives the structure and specificities of the multiregional AGE model as well as the data used. The third section motivates the simulations run while the fourth section discusses the simulation results. The fifth section concludes the paper.

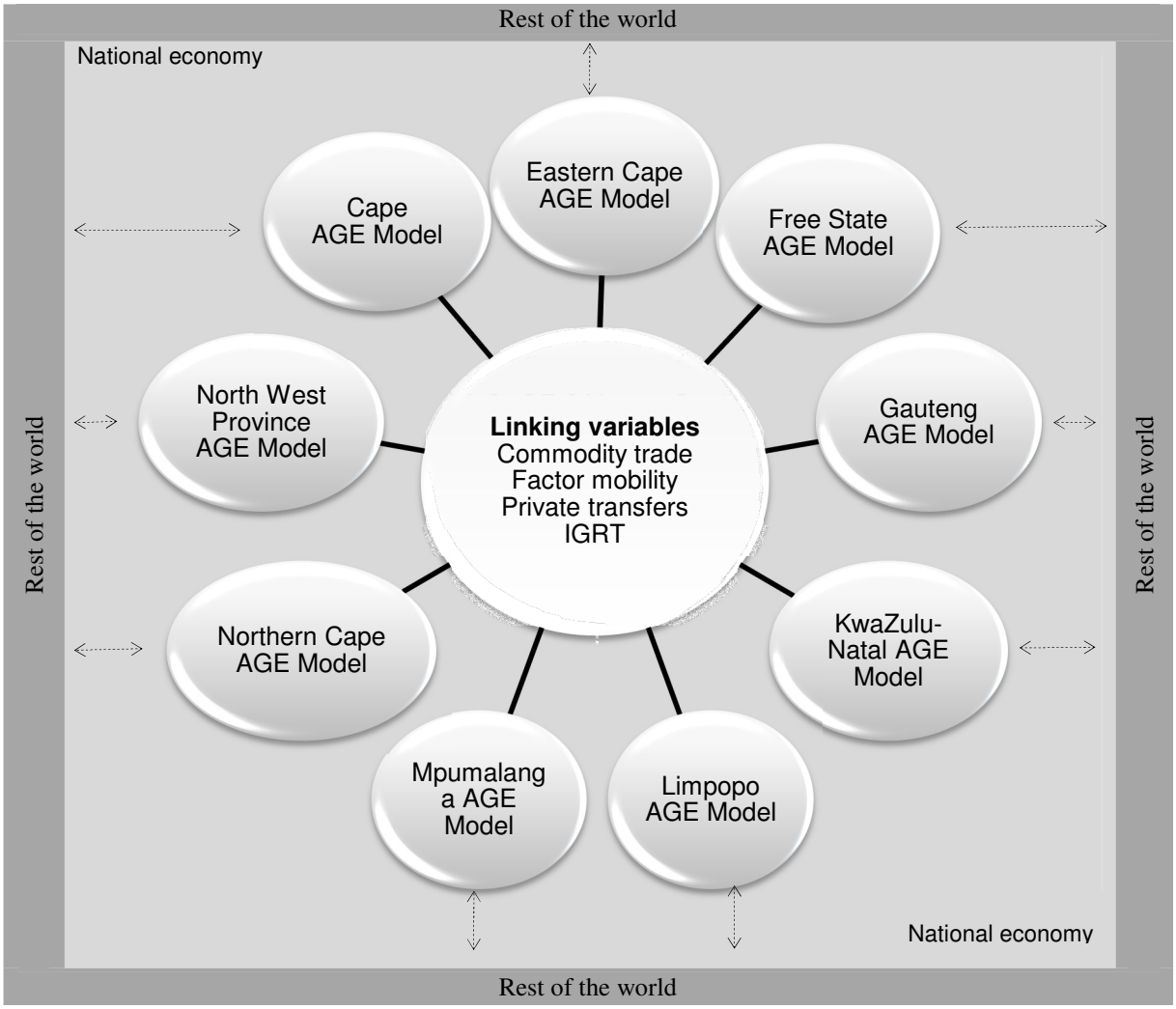
[3] This is the classical fiscal federalism literature. Studies have looked at how different levels of government react to changes in the balance between central government grants and local revenues, for example, the *flypaper effect*. See Oates (1999) for an extensive review of this literature.

[4] These range from formal subnational fiscal rules (for example, expenditure and borrowing ceilings) to informal coordination mechanisms.

2. THE MODEL

This section reports the main features of the Integrated Multi-region Applied General Equilibrium (IMAGE) model built for South Africa and used to assess the equity and efficiency of the current South African intergovernmental revenue transfers (IGRT). The model combines nine submodels (Figure 1) that replicate the economies of the nine provinces/regions that constitute South Africa.[5]

Figure 1—Schematic representation of the Integrated Multi-region Applied General Equilibrium (IMAGE) model



Source: Authors.
Note: AGE = applied general equilibrium; IGRT = intergovernmental revenue transfers; RSA = rest of South Africa.

An AGE model is a multimarket and multiagent system of equations that simulates the working of a market economy using real-world data. The use of AGE models in policy analysis permits the integration of both direct and indirect interactions throughout the economy; that is, if something changes in one part of the economy due to government policy, the model automatically computes the effects in the other parts.

The neoclassical general equilibrium theory is at the core of the IMAGE model, which seeks to explain production, consumption, and prices in an economy in which producers and consumers respond to relative prices as a result of profit-maximizing and utility-maximizing behaviours,

[5] Regions are modeled as synonymous with provinces in the South African model.

respectively. Markets simultaneously adjust relative prices in order to reconcile supply and demand decisions, and thus determine levels of production and consumption.

As noted by Partridge and Rickman (2010), although regional AGE models follow country model archetypes, they present some additional complexities. First, 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 economy. Second, 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. Third, regional saving is less likely to influence regional investment. Fourth, the intergovernmental fiscal transfers play an important role in reducing the disparity in living standards between regions. Consequently, the IMAGE model establishes the relationships among regions at four levels: (1) commodity trade, (2) factor mobility, (3) IGRT, and (4) private transfers. These relationships are discussed separately.

Commodity Trade

The first difference between the standard country model and the regional model is the number of trading partners. Specifically, the IMAGE model features three trading partners instead of the two usually encountered by standard AGE models. The availability of a given product in one region, or absorption, is met by an aggregation of products from the region, from other South African regions, and from the rest of the world. A nested constant elasticity of substitution specifies an imperfect substitution relationship among demands from the three regions. The derivative demands of the product from a 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.

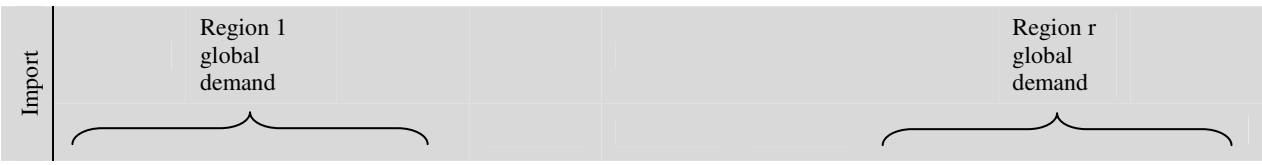
As in standard AGE models, region *r* prices of goods and services are determined through the neoclassical market-clearing price system (*perfect competition hypothesis*). That is, producers and consumers take as given the relative prices that equalize the quantities demanded and produced for each commodity.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

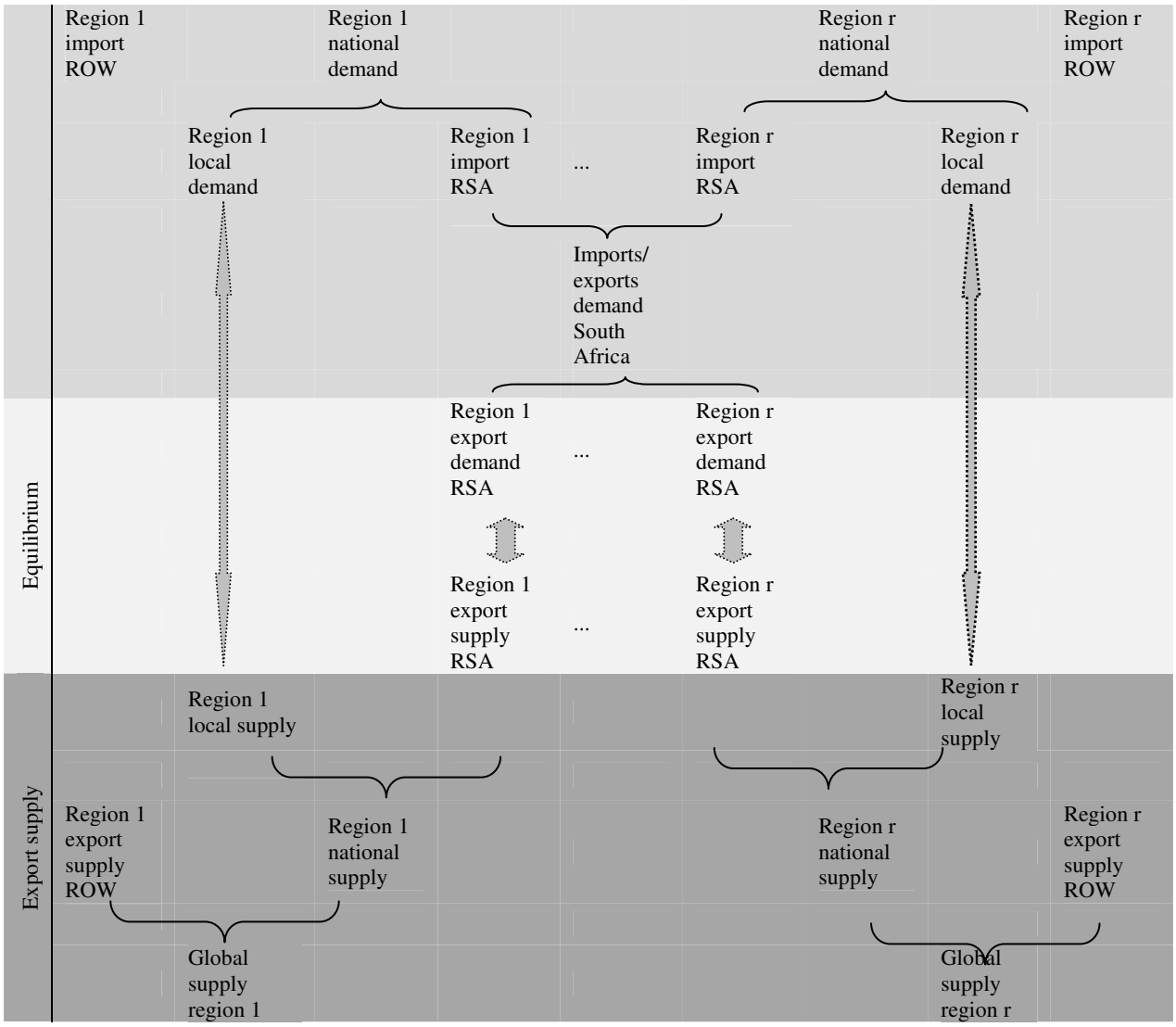
The treatment of world prices is also similar to that in the standard AGE framework. Fixed international prices of imported commodities are assumed (*small country hypothesis*). However, the converted prices of foreign goods, which are defined by international fixed prices, the exchange rate, and government 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 export demand. In general, standard AGE models assume a fixed export demand for internationally traded commodities. However, an increasing number of models integrate a downward sloping export demand system that links export demand to the ratio of the fixed world price to the export free on board (f.o.b.) price. In the IMAGE model, the export demand of a region is determined by the demand for imports from other regions of the country.

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 2). The export demand of a specific region follows a cost minimization 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 export demand among regions. Regional prices thus clear export supply and demand in the 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 price in all regions in South Africa.

Figure 2—Structure of interregional trade in goods and services





Source: Authors.
Note: ROW = rest of world; RSA = rest of South Africa

An imperfect transformation among the regional market, the RSA market, and the international market is specified for 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 f.o.b. price of the internationally exported product. Adjustments in export f.o.b. 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, that is, it is downward sloping. Consequently, export demand depends on world prices and domestic f.o.b. prices.

Factor Supply and Mobility

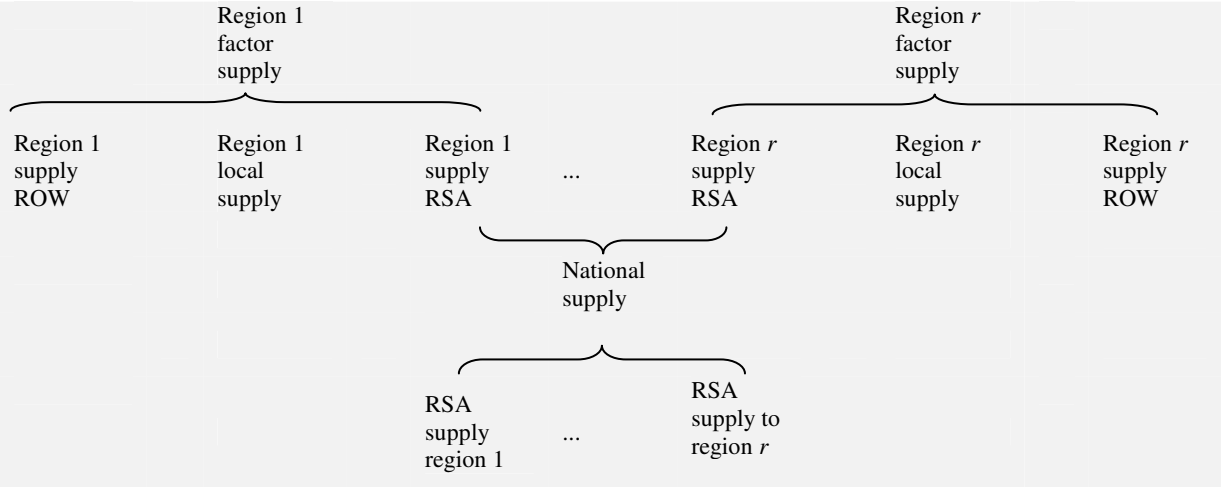
An adaptation of the Harris and Todaro (1970) model of migration is used to explain the interregional mobility of factors, that is, labour and capital. The Harris and Todaro model assumes that the migration decision is based on the differentials between the expected wage in the urban sector and the wage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

The IMAGE model considers a natural interregional flow of labour and capital explained by many factors, including the price differentials between regions. We assume that the relative changes in labour or capital flows (compared to their initial levels given by the regional SAMs) are closely

linked to the changes in the ratio of national to regional prices. When the ratio is greater than 1, there is an increase in the flow of labour or capital from the region toward the rest of the country.

The interregional reallocation of factors is made in two steps (Figure 3). The decision to move is made first, and then the choice about the destination follows. In this relationship, it is assumed that potential migrants or capital holders are risk averse. The assumption is modeled by an inelastic relationship between the changes in interregional labour or capital flows with respect to changes in the expected wage or return-to-capital ratio. The migrant labourers spend their entire revenue in the region of origin.[6]

Figure 3—Interregional mobility of factors



Source: Authors.
Note: ROW = rest of world; RSA = rest of South Africa.

[6] Alternatively, we could assume that migrant revenue is shared between the region of origin and the region of destination by defining a sharing formula.

The change in labour supply 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 2.3). 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.

The change in the supply of capital to the RSA compared to its initial level also depends on the ratio of the return to capital in the region and the RSA. The nationwide return to capital is an average of the regions' 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 RSA to the region is also related to the region's return to capital and the nationwide average return to capital.

Intergovernmental Fiscal Transfers

In line with the country's existing intergovernmental fiscal relations structure, the IMAGE model accounts for three spheres of government: national, regional, and local. Each of these spheres of government is assigned certain powers, functions, and financial resources, each of which in turn may be exclusive, concurrent, or shared. Although national government raises the vast majority of aggregate revenues, its expenditure responsibilities are much lower. There is thus a mismatch between revenues raised and expenditure responsibilities. A converse mismatch exists at the provincial level. This 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, there are massive relative differences among regions' expenditure responsibilities and existing (as well as potential) revenue sources.

Each government sphere spends on providing public services, subsidizing the national economy (activities and products), and transferring revenues to other governments and institutions. The IGRT are modeled in a standard fashion, that is, they are assumed fixed in real terms. Government fiscal policies also follow the standard specification where national government expenses in a given region are exogenous. While national government 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 assumed for regional and local governments. Compensatory taxes at endogenous uniform rates are applied to households' gross incomes.

Equilibrium and Closure Rules

Regional Supply and Demand

Producers maximize their profit under a given technology and prices. Industry-specific producers are modeled as representative producers that are assumed to have a nested constant elasticity of substitution (CES) production technology. In addition, there is a separation between production activities and commodities. A fixed proportional relationship between activity output and the domestic supply of commodities 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 in the presence of complete markets, there is a separation between their production and consumption decisions. With the fixed factor endowments assumption, their incomes are closely related to the return to these factors. Consumers

maximize their utility under limited budgets and given market prices. In addition, households are modeled 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 the 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[7] are observed. The skilled labour market is assumed to be perfectly competitive, so that the prevailing wage rates equalize exogenous supply and endogenous demand for high-skilled workers. In contrast, there is imperfect competition in the unskilled labour markets, where total demand does not equal supply. There is an excess supply of labor, which 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 analysis is performed in a static comparative, which does not imply capital accumulation and investment rules. As a consequence, exogenous investment and capital supply are assumed. Saving is investment driven. 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 the trade of goods and services and other transfers, the *external current account* balance is specified at the national level. The nationwide balance of the external current account is exogenous. Thus, an endogenous exchange rate or the relative price of goods and services traded with the rest of the world clears the external current account. However, regional submodels 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. The latter, defined as the relative price of goods and services traded with the RSA, are set as *numeraires*.

The Data

Interregional trade is specified according to the information provided by the regional Social Accounting Matrixes (SAMs). Data on imported and exported commodities (and other interregional linking variables) are available in one aggregate account: the rest of South Africa (RSA). That is, the nine regional SAMs do not feature information on the region of origin and the region of destination for the traded products. The model presented here is shaped according to this information. The IMAGE model is operationalized through the calibration procedure, which consists of finding parameters that permit equations to exactly reproduce the benchmark situation given by nine region-level SAMs.[8] The structure and analysis of the regional SAMs are presented in the appendix.

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 (Figure A.1 in the appendix), the value of parameters chosen for regional submodels are identical.

The values of the income elasticity of demand are drawn from the work done by the Economic Research Service of the U.S. Department of Agriculture for 114 countries (Table A.2 in the appendix).[9] The elasticity of wage rates with respect to the unemployment rate is set at -0.1, according

[7] Frictional unemployment exists because both jobs and workers are heterogeneous. A mismatch related to skills, payment, working time, location, attitude, and tastes can result between the supply of and demand for labor.

[8] The SAMs are provided by the South African Department of Trade and Industry and were constructed by Coningharth Economists in 2008.

[9] The data are available at www.ers.usda.gov/data/internationalfooddemand. The values estimated for Botswana are

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 labor is fixed at 2.5, the highest value surveyed by Annabi et al. The trade elasticities are estimated by Gibson (2003) for the Armington elasticities (Table A.3 in the appendix), 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.

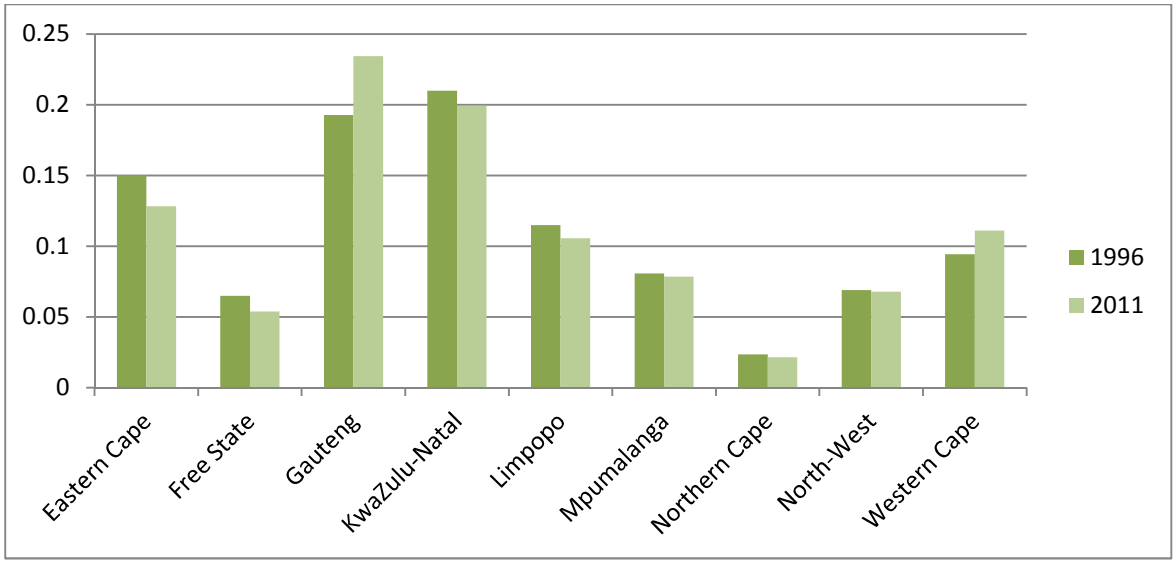
The next set of parameters related to the interregional relationship is (1) the import and export elasticities, (2) the elasticity of factor mobility among regions with respect to prices, and (3) the transformation elasticity of factors among regions. As long as we do not have estimates for these parameters and the results of this analysis are likely to be influenced by their values, then the main simulation is carried out under two scenarios: low and high interregional relationships. These are discussed in depth in the following section.

used for South Africa because this database does not cover the latter country. South Africa and Botswana are comparable countries according to the Human Development Indexes annually computed by the United Nations Development Programme (UNDP).

3. SIMULATION SCENARIOS

The IMAGE model just developed for South Africa is used to assess the effectiveness of the current IGRT. The starting point in simulation design is the year 2012 that saw the release of the 2011 Census by Statistics South Africa. After correcting for an estimated undercount of 14.6 percent the census estimated that the population was at 51.8 million with marked growth in the provinces of Gauteng and Western Cape (Figure 4). In several respects the results of the census were not as expected, and may well significantly impact on intergovernmental transfers. Shifts in population lead to changes in equitable share allocations and the relative demand for public services across the provinces. The impact of these shift for equitable sharing can be mimicked by careful design of the simulation discussed in greater detail subsequently. In this respect, our simulation is based on the vertical imbalance of national government revenues and expenses among regions. The degree to which the national government's equity goal is achieved through the current IGRT is quantified.

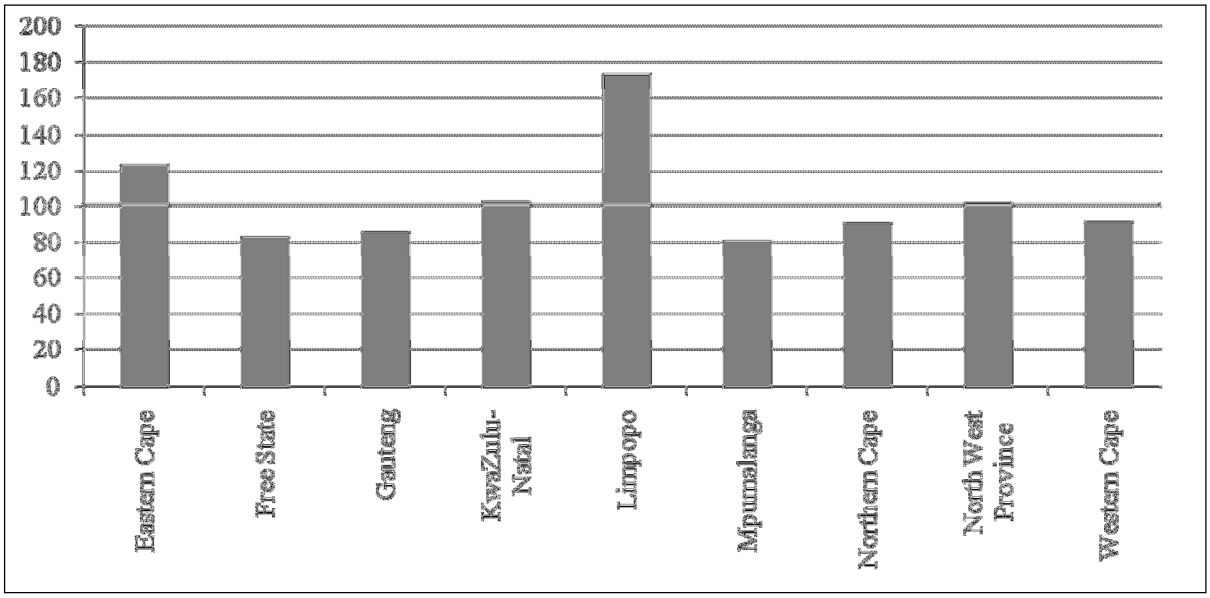
Figure 4—Shifts in distribution of population among provinces



Source: Statistics South Africa

To do this, we first present the revenues and expenses of the national government in each region to better understand the simulation performed later. Figure 5 shows the disparities between collected revenues and expenses by the national government in all regions.

Figure 5—National government spending-to-income ratio by region (%)



Source: Regional Social Accounting Matrixes for 2006.

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

In contrast, national government spending is less than the collected revenues in Mpumalanga, Free State, and Gauteng: it spends R81, R83, and R86 for every R100 collected, respectively. Northern Cape and Western Cape receive R91 and R92 for every R100 collected in these regions.

To mimic the implied changes in the IGRT and in keeping with the fiscal consolidation stance of government, we arbitrarily reduce the growth in fiscal transfers under the current system. The effectiveness of the policy is captured through welfare effects measured by the changes in equivalent variation. It is assumed that the national government's primary saving rate is identical for all regions, so we avoid simulating the national government fiscal balance alongside our main simulation scenario. Once national government fiscal balances are determined for all regions, we estimate the excess or deficit in spending if all collected revenues by the national government in the region are spent in the region. The excess/deficit in spending is then calculated in proportion to the initial national government spending in terms of transferred revenues to the region. In the baseline scenario, this excess/deficit in spending is nil. In the simulation scenario, it is assumed that 50 percent of the excess in spending is cancelled out for some regions and 50 percent of the deficit in spending is transferred back to other regions.

Limpopo, Eastern Cape, KwaZulu-Natal, and North West Province receive less transfer revenues when growth in the IGRT is reduced, and consequently national government spending falls in these regions. In contrast, Northern Cape, Western Cape, Free State, Mpumalanga, and Gauteng have additional fiscal spare, that is, national government spending increases in these regions.

National government fiscal policy is not affected by the changes in transfer revenues, as it is retransferring revenues among regions. However, regional government fiscal policy is directly affected by the changes in transfer revenues. We adopt a revenue-neutral hypothesis for regional governments so that with fixed regional expenses and savings, the regional government budget is balanced through a compensatory tax or subsidy on households' gross income.

The simulations are performed under two scenarios: *low* and *high* interregional trade and factor mobility. The *low interregional relationship* scenario assumes that interregional trade elasticities are identical to international trade elasticities. Assuming no changes in regions' ownership of factors and consequently temporary mobility of labour, we assume an inelastic interregional supply

of labour and capital 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 labor mobility and the transformation elasticity is assumed, that is, after the decision to supply more or less labor to the other regions is made, the choice of the destination is still limited because of the hypothesis of temporary mobility of labour. However, it is assumed that the choice of the destination (the transformation elasticity) of capital is twice as flexible as the supply elasticity. As long as the openness of the regional economy is greater than that of the country economy, results drawn from the low scenario should be interpreted as lower bound results. Therefore, the *high interregional relationship* scenario measures the sensitivity of the results to higher economic interaction among regions. In this regard, the elasticities are set at values three times higher than their counterpart in the low scenario. The next section presents the results of the simulation under the two scenarios of interregional economic interactions.

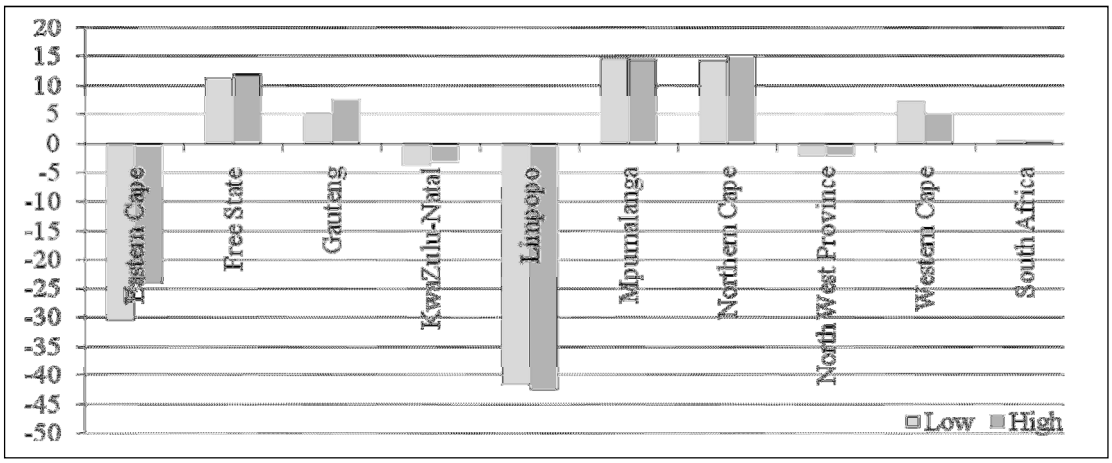
4. SIMULATION RESULTS

The simulation results demonstrate that there are significant interregional equity effects, although the overall impact is less important. Nationwide welfare falls by 0.6 percent (Figure 6). However, its distributional effect among regions is important. Changes in welfare are negative in four regions: Limpopo (42–43 percent), Eastern Cape (24–30 percent), KwaZulu-Natal (3–4 percent), and the North West Province (2 percent). As net receivers of IGTR, the regions witness a loss of revenues.

As depicted in Figure 6, changes in welfare are positive in five regions: Mpumalanga (15 percent), the Northern Cape (14–15 percent), Free State (11–12 percent), Gauteng (5–8 percent), and the Western Cape (5–7 percent). These positive changes in welfare are imputed to the additional revenues spent in these regions following the partial cancelling of revenue transfers initially destined for other regions.

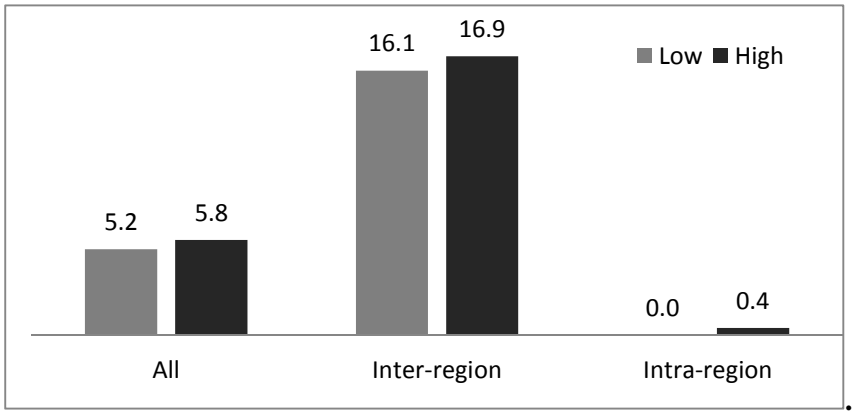
Theil indices are used to measure the regional disparities. The overall regional disparity increases by 5 to 6 percent (Figure 7). This is essentially imputed to the 16 to 17 percent increase in disparities between regions.

Figure 6—Equivalent variation of initial consumption expenses (%)



Source: Authors' calculations.

Figure 7—Variation in Theil indices (%)



Source: Authors' calculations.

Although the overall intra-regional disparities remain unchanged (Figure 7), the inter-regional disparities are important and vary from one region to another. Disparities between top and bottom income categories increase in Limpopo and the Eastern Cape, regions initially receiving net positive

IGRT (Tables 1 and 2). The reduction in revenue transferred to other regions—consequently, an increase in national government spending in the region—benefits the bottom income groups in the Northern Cape, Mpumalanga, and Free State.

Table 1—Percent change in EV of initial consumption expenses: Low scenario

Household category	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Lim-popo	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: Authors' calculations.
Note: EV = equivalent variation.

Table 2—Percent change in EV of initial consumption expenses: High scenario

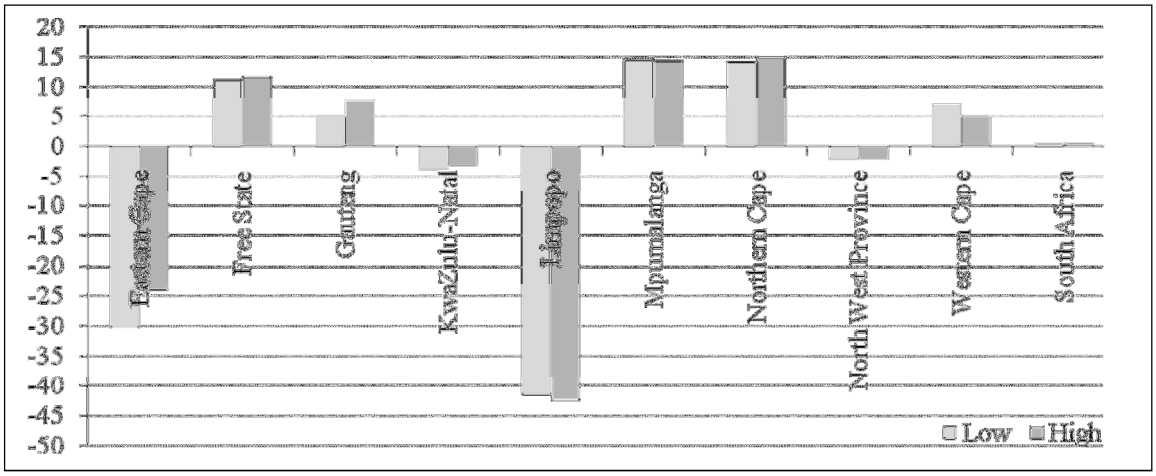
Household category	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Lim-popo	Mpuma-langa	Northern Cape	North West Province	Western Cape
P1	-22.1	10.4	8.0	-2.7	-40.8	15.0	13.2	-1.9	5.0
P2	-20.3	10.4	7.0	-2.9	-37.9	12.4	11.4	-2.2	4.4
P3	-20.8	10.5	6.8	-2.9	-38.4	12.4	11.3	-2.0	4.6
P4	-20.7	10.5	6.6	-2.9	-38.8	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: Authors' calculations.
Note: EV = equivalent variation.

Therefore the policy simulation would lead to an increase of regional disparities. Regions such as Limpopo and Eastern Cape witness significant welfare losses compared to other regions. 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 witness welfare gains and their income disparities fall.

Now focusing on efficiency effects, the overall GDP effect is small decreasing only by 0.2 percent in the low scenario and 0.1 percent in the high scenario. Higher regional integration lowers the adverse effect of reducing the IGRT. However, the regional disparities are more important (Figure 8). The group of regions receiving revenues within the IGRT system witnesses a drop in GDP. The decrease 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.

Figure 8—Change in gross domestic product (%)



Source: Authors' calculations.

IGRT have income and price effects in all regions. The simulation leads to a drop in income in regions receiving transfer revenue, with 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 also increases the pressure on prices, which reduces the purchasing power and households' well-being.

Assuming a revenue-neutral hypothesis for all governments, that is, fixed spending and savings, changes in revenue are captured through a compensatory tax or subsidy on households' gross incomes and, consequently, their consumption. The simulation creates a revenue deficit for regional governments in Limpopo, Eastern Cape, KwaZulu-Natal, and the North West Province. Therefore, these governments are in a situation in which they must reduce their expenses and/or increase their income. Assuming that expenditures are fixed, the alternative is that government increases taxes. This is done through an introduction of a uniform compensatory tax on households' gross income. The additional tax rates required to fully compensate the loss of regional government revenue are 12.4 percent in Limpopo, 6.8 percent in the Eastern Cape, 0.9 percent in KwaZulu-Natal, and 0.5 percent in the North West Province.

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

Households' gross incomes fall in the low and high trade and factor mobility scenarios (Tables 3 and 4). Income decreases in the initially net receiver regions because of the transfer cut and the ensuing positive compensatory tax rates. It declines in the initially net payer regions because of the inflationary and depreciatory effects. Consequently, domestic factor and commodity prices fall relative to external prices. Consumer price indexes also fall, and, consequently, real consumption increases for the net payers and decreases for the net receivers.

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

Table 3—Percent change in revenue: Low scenario

	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Lim-popo	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 4—Percent change in revenues: High scenario

	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Lim-popo	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: Authors' calculations.

5. CONCLUSION

A multiregional model combining nine regional submodels interacting through trade and factor mobility is used to analyse welfare effects of fiscal policy in South Africa. Informed by recent population shifts among provinces, implied intergovernmental fiscal transfers are shown to play an important role in reducing interregional living standards disparity in the model. Although the results that emerge from our empirical analysis are varied, it is worth highlighting two general points.

First, we demonstrate that changes in grants have significant interregional equity and efficiency effects although the overall impact is less important. Simulated intergovernmental transfers lead to a decrease in welfare in regions initially receiving revenues, that is, Limpopo, Eastern Cape, KwaZulu-Natal, and the North West Province. However, welfare increases in regions that were initially transferring revenues, that is, Northern Cape, Mpumalanga, Free State, Gauteng, and the Western Cape. The change in GDP is also negative for the former group of regions, while it is positive for the latter ones.

Second, there are also significant intraregional equity effects, although the economywide effect is small. When transfer revenues fall and, consequently, regional and local government revenues decrease, poor households are the most affected, as they depend more on public services, which are essentially financed by governments. When the government fiscal position improves, it is also poor households that benefit more from additional government expenses. Cuts in grants can be compensated by increases in taxation. However, the effect of an increase in subnational taxation is that households' incomes drop and income disparity widens. Because of the regressive nature of the integrated compensatory tax—and eventually public expenses when the government has to cut its expenses instead of increasing taxes—poor households are hit hard in regions where the tax rate increases. In contrast, poor households benefit more in regions where the compensatory tax rate falls.

This paper has immediate policy implications that go beyond South Africa in various policy modelling areas, including fiscal policy design in countries with decentralised government systems seeking to grow their economies with broader inclusion. However, the analysis represents a modest first step toward more complete empirical assessment of fiscal consolidation in economies with multispherical governments. A number of extensions can be performed with the current model. Intergovernmental fiscal transfers may 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. It is essential to extend the model to capture these dynamic interactions. The work can also be extended to explore many other issues, such as the impact of the equitable formula on national and subnational performance; the effects of varying the equitable formula to regions, that is, a move from population-based to needs-based formula using the poverty status of regions; the effects of matching grants versus block grants; the effects of conditional grants, considering the conditional grants by sector or by classification; the effects of targeted use of transfers versus nontargeted use; the effects of revenue raising at the provincial level, that is, reducing the national income tax and using that fiscal space for provincial personal income taxes; the effects of changing the component shares of conditional grants per province; and the effects of various funding possibilities for raising revenue for regional public goods, revenue-neutral financing, redistributive taxes, and uniform tax deductions.

APPENDIX: SAM DESCRIPTION, SUPPLEMENTARY TABLES AND FIGURES

Regional SAMs are available for the nine regions that constitute South Africa. All SAMs are for the year 2006 and are structured to include the following (see Table A.1 in the appendix):

- 35 to 47 accounts for activities/commodities
- 44 accounts for labor payments divided into 4 population groups and 11 occupations
- 4 accounts for capital payments or the gross operating surplus (GOS)
- 4 accounts for enterprises
- 48 accounts for households, disaggregated into 4 population groups and 12 consumption deciles
- 7 accounts for government income sources and 6 accounts for its expenditure items
- 2 accounts for government capital accumulation and corporation and household capital accumulation
- 4 accounts for the rest of South Africa
- 5 accounts for the rest of the world
- 1 account for residuals and discrepancies

The adjustment procedure aims to set up a common framework for the nine regional SAMs, as well as being 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 9 regional SAMs in order to generate a uniform framework with 35 industries/commodities, detailed as follows: 1 agriculture, 1 mining, 4 food, 1 beverage, 19 manufacturing, and 9 services.
- The 44 accounts for labor payments are aggregated into the 11 occupational groups.
- The 4 accounts for enterprises are grouped into 2 categories: “Public Enterprise” and “Private Business Enterprise,” the latter including “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 4 accounts for the rest of South Africa are aggregated into one account.
- The 5 accounts for the rest of the world are also aggregated into one account.
- Institutional accumulation accounts are aggregated into one account.
- The allowance for depreciation or payments of capital recorded directly in the capital account is first transferred to institutional units and then channeled to the capital account; the model follows the principle that saving is made by institutional units, either resident or nonresident.
- Residual accounts are cancelled out by combining them into the change in inventories featured in the accumulation account.

Table A.1—Dimension of the regional Social Accounting Matrix

SAMs accounts	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Lim-popo	Mpuma-langa	Northern Cape	North West Province	Western Cape
Activity	42	36	37	45	46	47	37	35	47
Commodity	42	36	37	45	46	47	37	35	47
Labor	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
Discrepancy	1	1	-	1	1	1	1	1	-

Source: Regional Social Accounting Matrixes for 2006.

Table A.2—Income elasticity of consumption products

Products	Value	Products	Value
Agriculture	0.655	Other fabricated metal products	1.367
Mining	1.367	Machinery and equipment	1.367
Meat, fish, fruit, vegetables, oils, and fat products	0.697	Electrical machinery and 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 and 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 and chemical products (including plastic products)	1.208	Communication	1.221
Rubber products	1.367	Insurance	1.367
Nonmetallic 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

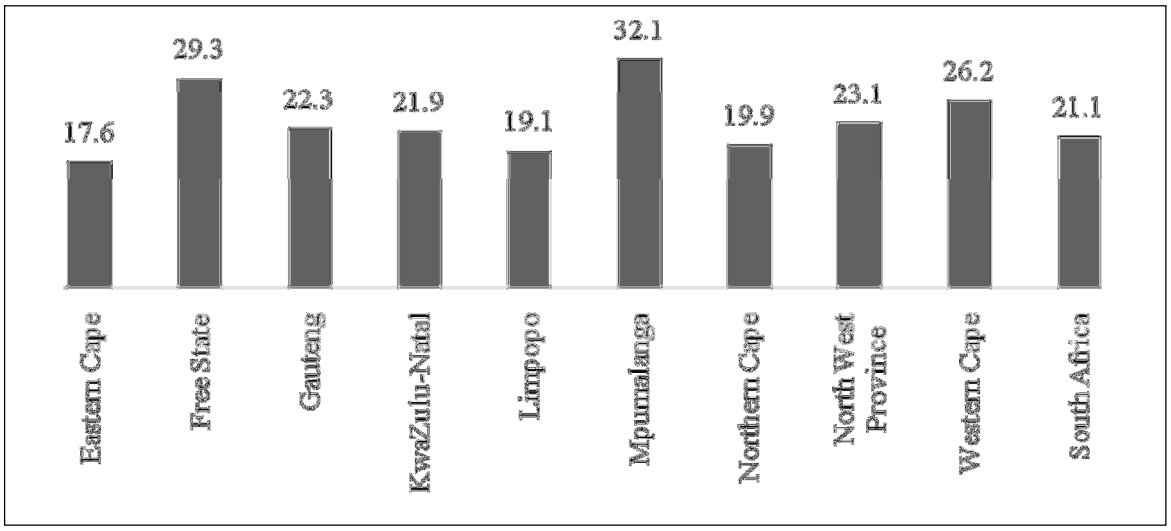
Source: Regmi and Seale (2010).
Note: Data are the 1996 International Comparison Program (ICP) data for Botswana.

Table A.3—Armington elasticities

Products	Value	Products	Value
Agriculture	1.273	Other fabricated metal products	0.747
Mining	2.771	Machinery and equipment	0.490
Meat, fish, fruit, vegetables, oils, and fat products	0.937	Electrical machinery and 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 and 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 and chemical products (including plastic products)	0.730	Communication	0.568
Rubber products	1.135	Insurance	0.616
Nonmetallic 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 A.1—Unemployment rates by province (%)



Source: Statistics South Africa (2009).

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