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Micro-simulations of a dynamic supply and use tables economy-wide Leontief-based model for the South African economy

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Background: South Africa has not fully recovered from the 2008 global recession. The World Bank has predicted that South Africa will be one of the worst performers in sub-Saharan Africa in 2020 with tepid growth of 1.3% which is far below the National Development Plan targets growth of 5.4% required a year to reduce unemployment, create decent jobs and generate enough revenue for social development.

Aim: We aim to examine whether changes in the components of final demand (changes in government spending, household consumption expenditure, exports, investment spending) have a considerable effect on the sector's gross value added, job creation and tax revenue generation and whether there were changes in the exogenous final demand in die post-recession period.

Setting: We focus on building supply and use tables based on 62 different sectors of the South African economy.

Methods: An economy-wide Leontief multiplier-based model calibrated on a supply and use framework and a micro-simulation model is used to assess post-recession trends in macroeconomic, labour and fiscal multipliers for South Africa.

Results: The simulations show that during the post-recession era, the effect of exogenous shock in the economy, like an increase in investment spending, although positive, yields a smaller return in terms of tax revenue, job creation and economic growth. At sector level, the results show that the inter-industry links and industry-consumer links have therefore weakened.

Conclusion: Our findings imply that the persisting low growth trajectory associated with weaker inter-industry linkages could be exacerbated, while the fiscal austerity measures associated with weaker forward and backword tax linkages could be prolonged. We recommend government should follow a priorities-based spending policy that yields optimal socioeconomic returns.

Keywords: supply and use tables; fiscal multipliers; employment multipliers; micro-simulations; South Africa.

Introduction

Micro-simulations of dynamic supply and use tables (SUT) are a powerful tool for analysing the dynamic effects of fiscal policy on the macroeconomy. Unfortunately, econometric models have limitations in that they do not handle economy-wide analysis related to inter-industry and intra-industry, forward and backward linkages in response to changes in the final demand or exogenous shocks. Supply and use tables provide a record of economic data in a matrix format, which shows how supplies of different kind of goods and services originate from domestic industries and imports, and how these supplies are allocated between various intermediate inputs and final demand, including exports. The SUT structures allow for the analytic uses at micro- and macro-levels, including economic analyses, impact assessment and policy analyses, sensitivity analyses and the impact of taxation changes, industrial and sectoral analyses, and local government-type investment planning like construction projects, shopping centres, new motorways, rural planning and energy conversion chains (Bouwmeester & Oosterhaven 2013; Eding et al. 1999; Heun, Owen & Brockway 2018; Jackson 1998; Madsen & Jensen-Butler 1999; Mahajan 2007; Merciai & Schmidt 2018; Nicolardi 2013; Piispala 2000; Siddiqi & Salem 1995; Temurshoev et al. 2011; Thurlow & Dorosh 2013; Timmer et al. 2015; Zaman, Surugiu & Surugiu 2010). This differs from the traditional input-output (IO) model which does not specify at sector level the linkages between the supply and use of commodities.

To date, not a single study using SUT Leontief multipliers has examined the effect of taxes or fiscal policy on the South African economy. Our study not only aims to fill this identified gap by providing forward and backward tax multipliers for the South African economy, but we further address other gaps identified in the literature. For instance, previous studies that applied Leontief-based multiplier models to the South African economy, generally focused either on one sector, for example the mining sector (Stillwell 1999), real estate (Boshoff & Seymore 2016), sugar-sweetened beverages (National Treasury 2017), or the agricultural sector (Phoofolo 2018), or their analysis was static, based on a single year (Cloete & Rossouw 2014; Davies & Thurlow 2013; Van Seventer et al. 2016). Kratena and Streicher (2017) used the traditional IO, a static model, to analyse fiscal policy multipliers and spillovers in a multi-regional macroeconomy. Furthermore, previous studies focused only on a few aggregated generic multipliers. For example, the study by Burrows and Botha (2013) focused only on the gross domestic product (GDP) multiplier for South Africa, while Phoofolo (2018) measured output and gross value-added (GVA) multipliers, and income and employment multipliers. In all the aforementioned studies, only one shock in the exogenous variable was performed, which then narrowed policy intervention due to a limited number of multipliers used in the model. The study by Van Seventer et al. (2016) assessed the structural change in the South African economy using aggregated social accounting matrices (SAMs) for the period 1993–2013, focusing mainly on the methodology used to build a mini-SAM. Moreover, there is no previous study for South Africa that uses a dynamic SUT framework and economy-wide Leontief multiplier approach to investigate the post-recession trend effects of fiscal policy.

Our study builds upon this previous literature in a number of ways. Firstly, we extend the model over 62 different economic sectors. Secondly, we split our analysis over two distinct periods corresponding to the pre-recession and post-recession periods. Thirdly, we provide a full range of 47 endogenous employment multipliers. Lastly, we diversify the number of scenarios and simulations from fiscal, labour and macroeconomic perspectives. On this premise, three eminent research questions emerge which this study seeks to address. Firstly, how robust are government strategic interventions in yielding high returns on sectoral employment, tax revenue and GDP multipliers? Secondly, how has the South African economy responded to changes in the exogenous final demand over the period prior to and post-recession? Thirdly, which of the changes in the components of final demand (changes in government spending, household consumption expenditure, exports, investment spending) has high effects have an effect on a sector's gross value added, job creation and tax revenue generation? In addressing these three research questions our study sets out four empirical objectives:

- Firstly, to provide the performance and trend analysis of labour, economic and fiscal multipliers in South Africa.
- Secondly, to compute and analyse both the supply-side tax forward linkages coefficients and the demand-side tax backward linkages coefficients.
- Thirdly, to empirically investigate the impact of a 5% increase in each component of final demand on selected fiscal, labour and other macroeconomic variables.
- Lastly, to provide the impact of government spending on a full range of 43 endogenous employment multipliers.

The importance of this study is multidimensional. It has implications for a variety of policy interventions, such as fiscal policy (using tax multipliers), labour policy (using employment multipliers), poverty and development policy (using income multipliers), investment policy (using investment multipliers), trade policy (using export multipliers), growth and industrial policy (output multipliers, GVA multipliers, GDP multipliers, and gross operating surplus [GOS] multipliers), small, medium and micro-sized enterprises policy (using small business corporation [SBS] instead of tax multipliers), and so on.

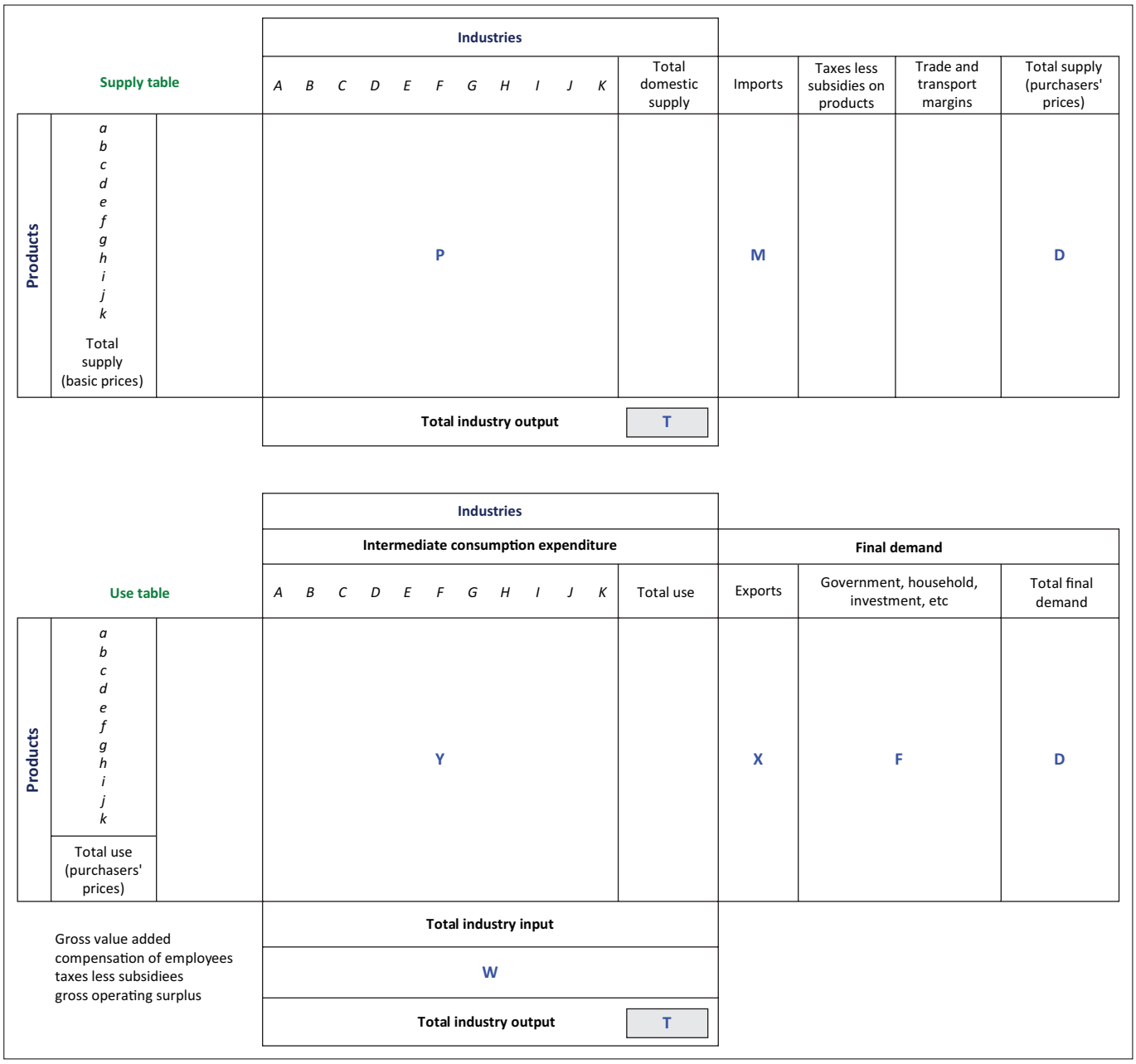
Data and empirical framework

Data

The data used to compile the SUT Leontief-based model was collected from two main data sources, namely Statistics South Africa (Stats SA) and the South African Revenue Services (SARS). From Stats SA, data were collected from the *national account statistics* and from the *labour account statistics*. The nine SUT from 2007 to 2015 were all collected from the *national account statistics*. From SARS, tax data were collected, including company tax (number of taxpayers and tax assessed in millions of rand), value-added tax (VAT) (number of vendors; payments in millions of rand), pay as you earn (PAYE) tax and small business corporation (SBC) tax (number of taxpayers; tax assessed in millions of rand).

Layout of a simplified supply and use framework for South Africa

Statistics South Africa uses the SUT as a coordinating framework for economic statistics, as well as an accounting framework for ensuring the numerical consistency and coherency of data obtained from various sources. South Africa's SUT framework is consistent with the recent United Nations 2008 System of National Accounts (United Nations 2009), the revised 2008 European System of Accounts (Eurostat 2008) and the United Nations' new handbook on the compilation of the SUT released in 2017, therefore, international best-practices. Following Miller and Blair (2009), and using the standard notations, the format of the simplified South African SUT is presented in Figure 1. This format has been used with slight modifications by various authors (Bouwmeester & Oosterhaven 2013; Eding 1996; Jackson 1998; Madsen & Jensen-Butler 1998; Piispala 2000; Siddiqi & Salem 1995). The SUT comprises two tables: the supply table and the use table.



Source: Adapted from Miller, R. & Blair, P., 2009, *Input-output analysis: Foundations and extensions*, Cambridge University Press, New York, NY; and United Nations, 2009, *A system of national accounts 2008 (SNA 2008)*, United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development & World Bank, New York, NY

FIGURE 1: Layout of a simplified supply and use framework for South Africa.

The supply table comprises four matrices which provide information about the origin of goods and services in the economy, imports of goods and services, trade and transport margins, and taxes less subsidies on products. It shows that the total supply (D_{ic}) for industry (i) and commodities (c) has two origins, namely domestic (P_{ic}) and foreign (M_{ic}) (Piispala 2000). The use table contains three main matrices. The first matrix is *intermediate consumption expenditure* (Y_{ic}), which comprises the input cost of goods and services produced within the economy. The second matrix is the *components of final demand* (F_{ic}), which include household consumption expenditure, government consumption expenditure, fixed capital formation, changes in inventory and exports (X_{ic}). Lastly, there are the *components of value added* (W_{ic}), which include compensation of employees, taxes on products (excluding import duties), subsidies on products, GOS and mixed income, and consumption of fixed capital (Piispala 2000).

Following the double entry accounting principles, total supply of goods and services must balance with total demand of goods and services (Boomsma & Oosterhaven 1992). The process of balancing the SUT simultaneously can only be achieved if the following identities for all products (c) and all industries (i) balance:

$$\hat{\mathbf{A}}_{ic=1}^{n}(P_{ic}+M_{ic}+TT_{ic}+TS_{ic}) = D_{ic} = \hat{\mathbf{A}}_{ic=1}^{n}(Y_{ic}+F_{ic}+M_{ic}) \qquad \text{[Eqn 1]}$$

In Equation 1:

- P_{ic} = Domestic output of commodity c in industry i

- M_{ic} = Import of commodity c in industry i
- TT_{ic} = Trade and transport margin of commodity *c* in industry *i*
- TS_{ic} = Taxes and subsidies on products of commodity *c* in industry *i*
- D_{ic} = Total supply at purchasers' prices of commodity *c* in industry *i*
- F_{ic} = Final consumption expenditure of commodity *c* in industry *i*
- Y_{ic} = Intermediate consumption expenditure of commodity *c* in industry *i*

The first identity in Equation 1 comprises the supply and demand of goods and services. From the supply side, Equation 1 shows that total supply (D_{ic}) of commodity *c* by industry *i* equals total domestic supply (P_{ic}) plus imports (M_{ic}) plus trade and transport margin (TT_{ic}) plus taxes less subsidies on products (TS_{ic}). From the demand side, the total supply (D_{ic}) of commodity *c* by industry *i* is also equal to intermediate consumption expenditure (Y_{ic}) plus total final demand (F_{ic}) which also includes exports (M_{ic}). The second identity in Equation 2 shows that the total output of (T_{ic}) is equal to the intermediate consumption expenditure (Y_{ic}) plus components of gross value added (W_{ic}). Put differently, the gross value added is equal to the output less the cost of production:

$$\sum_{ic=1}^{n} T_{ic} = \sum_{ic=1}^{n} (Y_{ic} + W_{ic}) \quad \text{[Eqn 2]}$$

The third identity in Equation 3 contains the components of gross value added, namely compensation of employees (CE_{ic}), GOS (OS_{ic}), taxes less subsidies on products (TS_{ic}) and taxes less subsidies on production (ts_{ic}):

$$W_{ic} = (CE_{ic} + OS_{ic}) + (TS_{ic} + ts_{ic}) \quad \text{[Eqn 3]}$$

Substituting Equation 3 into Equation 2 and solving yields:

$$\sum_{ic=1}^{n} T_{ic} = \sum_{ic=1}^{n} (Y_{ic} + CE_{ic} + OS_{ic}) + \sum_{ic=1}^{n} (TS_{ic}) \quad \text{[Eqn 4]}$$

Supply and use tables and gross domestic product estimations

The SUT combines into a single framework the three approaches to estimate GDP according to the production approach (Equation 5), the income approach (Equation 6) and the expenditure approach (Equation 7).

The production approach: GDP = Output (at basic prices) – Intermediate consumption + Taxes less subsidies on products:

$$GDP = \sum_{ic=1}^{n} (P_{ic} - Y_{ic}) + \sum_{ic=1}^{n} (TS_{ic}) \quad \text{[Eqn 5]}$$

The income approach: GDP = Compensation of employees + GOS + other taxes less subsidies on production + taxes less subsidies on products:

$$GDP = \sum_{ic=1}^{n} (CE_{ic} - OS_{ic}) + \sum_{ic=1}^{n} (TS_{ic} + ts_{ic}) \quad \text{[Eqn 6]}$$

The expenditure approach: GDP = Final consumption expenditure + Exports – Imports:

$$GDP = \sum_{ic=1}^{n} (F_{ic} + X_{ic} + M_{ic}) \quad \text{[Eqn 7]}$$

Having dealt with the three approaches, it became apparent that each method yields the same estimate of the South African GDP at market prices (see Equation 8):

$$GDP = \sum_{ic=1}^{n} (P_{ic} - Y_{ic}) + \sum_{ic=1}^{n} (TS_{ic}) = \sum_{ic=1}^{n} (CE_{ic} - OS_{ic}) + \sum_{ic=1}^{n} (TS_{ic})$$
$$= \sum_{ic=1}^{n} (F_{ic} + X_{ic} + M_{ic}) \quad \text{[Eqn 8]}$$

This means that irrespective of whether the income, production or expenditure method is used, the value of GDP should be the same and each method should lead to the same value of GDP.

Inter-industry linkages, forward and backward linkages

The way goods and services flow within the economy is an indication that economic agencies do not operate in isolation (Leontief 1936). More recently, linkage analysis methods have again attracted increasing attention from policy analysts throughout the world. With regard to the measurement of linkage coefficients, there are two main methods used to examine the interdependency between the production and cost structures of the economy (Miller & Blair 2009). Both methods, that is, the *Chenery-Watanabe method* (backward linkage of industries) and the *Rasmussen method* (forward linkage of industries), are applied to South Africa's SUT Leontief-based model. The Chenery-Watanabe method is derived from the input coefficient, a demand-driven model that attempts to supply a quantitative evaluation of backward and forward linkages for the economy's production structure. The backward linkages of an industry *j* are defined as:

$$BL_j^c = \sum_{i=1}^{n} \frac{x_{ij}}{x_j} = \sum_{i=1}^{n} a_{ij} \quad \text{[Eqn 9]}$$

The forward linkages of an industry *i* are defined as:

$$FL_j^c = \sum_{i=1}^{n} \frac{x_{ij}}{x_j} = \sum_{i=1}^{n} b_{ij} \quad \text{[Eqn 10]}$$

In Equation 9 and Equation 10:

- BL_j^c is the backward linkage of sector *j* for the Chenery-Watanabe method
- FL_j^c is the forward linkage of sector *j* for the Chenery-Watanabe method
- a_{ij} is the input coefficient matrix
- b_{ij} is the output coefficient matrix
- x_{ij} is the magnitude of industry *i*'s output used as production input by industry *j*
- x_j is industry *j*'s output and a_{ij} is the input coefficient of industry *j* to industry *i*

On the other hand, the Rasmussen method is based on the Leontief inverse matrix, $L = (I–A)^{-1}$, and is used to measure inter-industry linkages. The backward linkage is defined as the column sums of the Leontief inverse matrix:

$$BL_j = \sum_{i=1}^{n} g_{ij} \quad \text{[Eqn 11]}$$

The backward linkage is defined as the row sums of the inverse matrix:

$$FL_j = \sum_{i=1}^{n} g_{ij} \quad \text{[Eqn 12]}$$

Here, g_{ij} is the ijth element of the Leontief inverse matrix. The backward linkage BL_j reflects the effect of an increase in final demand of industry j on overall output; in other words, it measures the extent to which a unit change in the demand for the product i of industry j causes production increases in all industries. Conversely, the forward linkage FL_j measures the magnitude of the increase in output in industry i, if the final demand in each industry were to increase by one unit; in other words, it measures the extent to which industry i is affected by an expansion of one unit in all industries. In our analysis we employ both forward and backward multipliers, but in most instances we only report the backward multipliers.

It is vital to mention that micro-simulations from the supply and use framework remain a powerful tool of measuring the effect of, say, an additional R1 increase in government spending on households of different income, race, gender, occupation and age groups. The applications of the SUT model at sectoral level are designed to achieve these purposes: to identify industries and sectors with high comparative and competitive advantages, to determine inter-industry effects through multipliers, to assess backward and forward linkages and, lastly, to assess the number of jobs sustained by the sector through infrastructure projects (Miller & Blair 2009). The tool is also useful to simulate the impact of a fiscal expansion through a hypothetical 1% increase in government expenditure and its effects on growth, employment, poverty reduction, investment and productivity.

Economy-wide models

There are four different but complementing type of economy-wide models:

- Traditional IO models (industry by industry matrix under the 1968 SNA).
- SUT Leontief model (industry by product matrix under the 1993 SNA, and recently the 2008 SNA). In this study, the SUT was preferred over the SAM and computable general equilibrium (CGE) because the SUT allows exhaustive sectoral analysis, while in SAM and CGE, often the number of sectors is much more aggregated, which would forfeit the objective set in this article.
- SAM-Leontief model (a statistical representation of the economic and social structure of a country).
- CGE model which uses the neoclassical theory to analyse the structural and behavioural aspects of the economy.

The SUT is used as a building block in the construction of a SAM (Miller & Blair 2009), which is used as a building block in the construction of a CGE model (Lofgren, Harris & Robinson 2002). The IO, SUT and SAM are partial equilibrium models with fixed prices and fixed coefficients meaning that substitution possibilities in consumption, production, imports and exports are ignored.

Although the behavioural specifications in partial equilibrium models emphasise important linkages in the economy, these models are demand-driven adhering to Keynesian philosophy, best suited for the analysis of structural changes in the economy, but awkward in dealing with issues such as price changes. Moving from partial equilibrium models to a general equilibrium (CGE) model is achieved by including on the one side the function forms, such as the Cobb-Douglas Production Function, the Constant Elasticity of Transformation (CET) and the Constant Elasticity of Substitution (CES), and on the other side by incorporating the behaviour of institutions such as households, government and private firms into the CGE model (Humphrey 1997). Unlike the partial equilibrium models, the CGE adheres to neoclassical philosophy, considers the behavioural drivers of change in the economy and allows a much broader analysis of analytical structure and the behavioural aspects of the economy (Lofgren et al. 2002).

Simulations

This section focuses on the results and presents key findings of the dynamic SUT Leontief-based model for South Africa. The results are grouped in four sets:

- The first set of results captures simulation trends over a 9-year period (2007–2015) to reflect changes in post-recession tax multipliers and other generic multipliers such as: income multiplier, output multiplier, GDP multiplier, GVA multiplier, GOS multiplier, gross fixed capital formation (GFCF) or investment multiplier, fixed capital stock (FCS) multiplier and export multipliers.
- The second set of results shows the sectors that will generate more tax when there is a shock in the economy. For example, given a hypothetical R1 million increase in final demand, the second set of results provides tax multipliers, including both the *tax forward linkage coefficients* and the *tax backward linkage coefficients* for each economic sector in 2007 and in 2015. Tax multipliers include: company tax, VAT, PAYE tax and SBC tax multipliers.
- The third set of results is presented in four different scenarios, assessing what happens to different tax multipliers and other generic multipliers over the period 2007–2015 if: (1) exports increase by 5%, (2) government

spending increases by 5%, (3) household consumption expenditure increases by 5% and (4) total investment increases by 5%.
- The last set of findings is static. It exhaustively presents empirical labour results under 43 different employment multipliers depicting the number of jobs to be created when government spending increases by a hypothetical R1 million.

Employment multipliers are firstly disaggregated to display the effect on economic sectors, skill level, province, occupation, level of education and by Expanded Public Works Programmes (EPWP). Secondly, employment multipliers are further derived and presented in such a way as to distinguish effects between formal and informal employment multipliers, rural and urban employment multipliers, and the youth and adult employment multipliers.

Model 1: Trend analysis of Type I and Type II multipliers for South Africa (2007–2015)

In collectively summarising the findings of the study, it is firstly noted that over the long run (2007–2015), as shown in Table 2, the effect of R1 invested in the South African economy had a positive multiplier effect on growth, tax, employment and poverty. However, the most important observation noted in this study is the significant decline in fiscal multipliers, employment multipliers, output and income multipliers over the period 2007–2015. These results imply that the inter-sector multiplier effect has weakened over the post-recession period. This finding justifies the low growth path that has persisted since the economic meltdown in 2008 (National Treasury 2018). The effect of the average R1 spent in the South African economy yielded a smaller return in terms of economic effect throughout the economy in 2015 (post-recession) than it did in 2007 (pre-recession). This suggests that the inter-industry links and industry-consumer links weakened.

The result of this study supports the finding by Burrows and Botha (2013), who investigated the changing IO multipliers in South Africa for the 1980–2010 period and found a decline in GDP and output multipliers. Contrary to these findings, in the study by Bekhet (2011) on output, income and employment multipliers in the Malaysian economy over four periods (1983, 1987, 1991 and 2000) and using the Malaysian IO tables, he found increasing output, income and employment multipliers. Trend analysis of individual Type I and Type II multipliers are presented in Table 1. It shows that apart from PAYE tax multipliers, all other tax multipliers – companies tax, VAT and SBS tax – declined during the period under review. This suggests that PAYE is the most sustainable tax in the economy. Only PAYE tax multipliers increased, the rest decreased.

From the first set of simulation results in Table 1, it can be inferred that, based on the reference years 2007 and 2015, an additional R1 million worth of exogenous final demand injection into the South African economy through the direct and indirect effect on production would have generated an average of the following values throughout the entire economy, which in this case yield positive but declining results over time. Example:

- Fiscal effect on company tax assessed would have been R104 000 in 2007 (R63 000 in 2015); VAT payment: R129 000 in 2007 (R104 000 in 2015); PAYE tax: R81 000 in 2007 (R126 000 in 2015); SBS tax would have fluctuated around R1000 throughout the period under review.
- Labour effect in terms of employment creation suggests that in 2015 there would have been a total of 4.7 jobs created, of which 3.4 would have been in the formal sector and 1.2 in the informal sector. Of the 3.4 jobs in the formal sector, 0.8 would have been for high and skilled labour, 1.7 for semi-skilled labour and 0.9 for low or unskilled labour. The effect on employment creation in 2015 would have been lower than that in 2007. Total employment in 2007 would have been 9.3 jobs created of which 7.7 jobs would have been in the formal sector and 1.6 jobs in the informal sector. Of the 7.7 jobs in the formal sector, 1.8 would have been for high and skilled labour, 3.9 for semi-skilled labour and 3.4 for low or unskilled labour.
- Economic effect on total output would have been R2.9 million in 2007 (R2.7 m in 2015); gross value added: R1.2 million in 2007 (R1.1 m in 2015); income in the form of compensation of employees: R569 000 in 2007 (R564 000 in 2015), but the income to shareholders (GOS) would have been R619 000 in 2007 (R532 000 in 2015) and imports R442 000 in 2007 (R431 000 in 2015). These results show that for every R1 injected in the South African economy, the effect was low for compensation of employees pre-recession, at workers' disadvantage. In 2015, after the recession, the situation has changed, and the impact is now low for GOS, at a disadvantage to the capital owners.

Model 2: Tax forward and backward linkage coefficients

The second set of simulation results focuses on supply-side tax forward linkage coefficients and demand-side tax backward linkage coefficients effects for different sectors of the economy. Given a hypothetical R1 million increase in final demand, which economic sector would have yielded high tax multipliers? Simulation results in Table 2 reveal that the trade industry had high tax backward linkage coefficients and the finance industry had high forward linkage coefficients both in 2007 and 2015. So domestic wholesale and retail sales together with international trade should be targeted to stimulate tax generation in the South African economy.

Contrary to this study's findings, the study by Zaman et al. (2010) on the propagation effect of taxes in the Romanian investigated tax policy effects backward and forward for the years 2000 and 2006. They concluded that

TABLE 1: Overall trend analysis of generic multipliers for South Africa (2007–2015).

Multipliers: 2007 to 2015	Type I & II	2007	2008	2009	2010	2011	2012	2013	2014	2015
Fiscal multipliers										
Company tax: number of taxpayers	Type I	0.475	0.461	0.460	0.405	0.364	0.253	0.203	0.181	0.159
	Type II	0.781	0.750	0.777	0.685	0.622	0.458	0.362	0.326	0.290
Company tax: tax assessed (R million)	Type I	0.104	0.105	0.086	0.077	0.081	0.070	0.070	0.067	0.063
	Type II	0.172	0.170	0.146	0.131	0.139	0.125	0.125	0.121	0.114
VAT: number of vendors	Type I	0.405	0.461	0.328	0.278	0.244	0.188	0.170	0.156	0.149
	Type II	0.674	0.750	0.565	0.480	0.427	0.345	0.308	0.286	0.276
VAT: payments (R million)	Type I	0.129	0.105	0.129	0.122	0.121	0.106	0.105	0.106	0.104
	Type II	0.214	0.170	0.220	0.208	0.209	0.191	0.187	0.192	0.190
PAYE tax (R million)	Type I	0.081	0.093	0.111	0.117	0.126	0.114	0.116	0.123	0.126
	Type II	0.133	0.152	0.188	0.199	0.218	0.203	0.205	0.219	0.228
SBC tax: number of taxpayers	Type I	0.066	0.069	0.072	0.068	0.066	0.052	0.048	0.045	0.041
	Type II	0.108	0.111	0.122	0.114	0.112	0.096	0.086	0.081	0.074
SBC Tax: tax assessed (R million)	Type I	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Type II	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001
Employment multipliers										
Total employment (number)	Type I	9.358	8.769	8.380	7.233	6.843	5.382	5.086	4.763	4.711
	Type II	15.472	14.362	14.233	12.326	11.770	9.847	9.172	8.726	8.720
Total formal employment (number)	Type I	7.754	6.783	6.392	5.603	5.242	4.201	3.897	3.590	3.476
	Type II	12.885	11.180	10.933	9.606	9.061	7.612	6.977	6.530	6.392
Formal employment: skilled (number)	Type I	1.812	1.642	1.556	1.368	1.289	1.034	0.966	0.905	0.858
	Type II	3.019	2.710	2.665	2.353	2.236	1.882	1.737	1.653	1.586
Formal employment: semi-skilled (number)	Type I	3.916	3.427	3.236	2.842	2.668	2.104	1.943	1.784	1.714
	Type II	6.430	5.583	5.472	4.815	4.563	3.797	3.462	3.228	3.134
Formal employment: low skilled (number)	Type I	2.026	1.714	1.600	1.393	1.285	1.064	0.988	0.901	0.903
	Type II	3.436	2.887	2.796	2.438	2.262	1.933	1.778	1.649	1.672
Informal employment (number)	Type I	1.605	1.986	1.988	1.630	1.601	1.180	1.189	1.173	1.235
	Type II	2.587	3.183	3.300	2.720	2.709	2.234	2.195	2.196	2.329
Other multipliers										
Gross fixed capital formation	Type I	0.305	0.345	0.337	0.294	0.292	0.257	0.269	0.271	0.270
	Type II	0.509	0.571	0.575	0.504	0.505	0.457	0.475	0.485	0.488
Fixed capital stock	Type I	3.608	3.786	3.979	3.736	3.641	3.221	3.237	3.308	3.322
	Type II	6.046	6.288	6.862	6.452	6.337	5.757	5.737	5.929	6.024
Gross value added	Type I	1.210	1.205	1.271	1.256	1.263	1.131	1.117	1.113	1.120
	Type II	2.008	1.984	2.169	2.141	2.170	2.021	1.975	1.995	2.032
GOS or mixed income	Type I	0.619	0.619	0.651	0.639	0.636	0.566	0.549	0.536	0.532
	Type II	1.026	1.017	1.107	1.083	1.086	1.012	0.971	0.961	0.967
Taxes less subsidies on products	Type I	0.142	0.126	0.124	0.128	0.138	0.131	0.134	0.136	0.141
	Type II	0.247	0.218	0.224	0.229	0.249	0.233	0.236	0.241	0.253
Imports	Type I	0.442	0.480	0.379	0.381	0.408	0.421	0.448	0.445	0.431
	Type II	0.762	0.825	0.676	0.676	0.730	0.739	0.779	0.780	0.761
Income and output multipliers										
Income multiplier	Type I	0.569	0.568	0.598	0.594	0.605	0.544	0.547	0.554	0.564
	Type II	0.947	0.938	1.024	1.020	1.046	0.972	0.966	0.993	1.021
Output multiplier	Type I	2.958	2.960	3.050	3.004	2.962	2.758	2.742	2.736	2.733
	Type II	5.023	5.003	5.335	5.248	5.222	4.934	4.860	4.910	4.960

Type I, Direct and indirect effect; Type II, Economy-wide effect; VAT, value-added tax; PAYE, pay as you earn; SBC, small business corporation; GOS, gross operating surplus.

the industries with universal vocation, serving all the other industries of the national economy, like electricity, gas, water, education and public administration, were characterised by a strong tax effect. As mentioned earlier, apart from PAYE tax, most tax multipliers in all sectors were high in 2007 prior to the recession and were low in 2015 after the recession. For example, using backward tax multipliers as in Table 2, a hypothetical R1 million increase in final demand would have resulted in an economy-wide yield of R70 000 PAYE tax from the agriculture industry in 2007 compared with R111 000 in 2015. Value-added tax payments in agriculture would have a yield of R164 000 in 2007 and 135 000 in 2015.

Model 3: Effect of a 5% increase in exogenous variables on different taxes and other endogenous variables

The third set of results presents four different scenarios that assessed, over the period 2007–2015, the effect of a 5% increase in exogenous variables, such as exports (Scenario 1), government spending (Scenario 2), household consumption expenditure (Scenario 3) and total investment (Scenario 4) on endogenous variables (such as taxes, employment, gross domestic fixed investment, compensation of employees GOS, taxes less subsidies on products, fixed capital stock, and imports). In all four scenarios, simulation results presented in

TABLE 2: Comparing tax backward and forward sector tax multipliers in 2007 and 2015.

Coefficients	Company tax: number of taxpayers	Company tax: tax assessed (R million)	VAT: number of vendors	VAT: payments (R million)	PAYE tax (R million)	SBC tax: number of taxpayers	SBC tax: tax assessed (R million)
Tax backward coefficients (2007 – tax multipliers)							
Agriculture	0.409	0.064	1.094	0.164	0.070	0.064	0.001
Mining	0.164	0.115	0.138	0.093	0.077	0.022	0.000
Manufacturing	0.193	0.067	0.187	0.074	0.034	0.033	0.000
Energy	0.230	0.097	0.170	0.087	0.060	0.037	0.001
Construction	0.763	0.100	0.605	0.200	0.101	0.138	0.002
Trade	3.490	0.605	2.920	0.760	0.365	0.623	0.006
Transport	0.565	0.156	0.450	0.169	0.084	0.091	0.001
Finance	1.030	0.194	0.785	0.251	0.185	0.105	0.001
Government	0.360	0.065	0.289	0.090	0.084	0.048	0.001
Tax forward coefficients (2007 – tax multipliers)							
Agriculture	0.338	0.064	0.746	0.128	0.058	0.052	0.001
Mining	0.209	0.100	0.173	0.090	0.068	0.029	0.000
Manufacturing	0.308	0.097	0.307	0.111	0.056	0.049	0.001
Energy	0.218	0.081	0.167	0.077	0.053	0.032	0.000
Construction	0.588	0.092	0.471	0.159	0.082	0.101	0.001
Trade	0.704	0.130	0.583	0.161	0.083	0.117	0.001
Transport	0.485	0.119	0.391	0.136	0.071	0.076	0.001
Finance	0.846	0.158	0.644	0.204	0.149	0.089	0.001
Government	0.309	0.060	0.249	0.079	0.065	0.040	0.001
Tax backward coefficients (2015 – tax multipliers)							
Agriculture	0.213	0.059	0.475	0.135	0.111	0.053	0.001
Mining	0.057	0.056	0.053	0.066	0.094	0.014	0.000
Manufacturing	0.067	0.035	0.063	0.051	0.046	0.020	0.000
Energy	0.075	0.039	0.053	0.089	0.101	0.022	0.000
Construction	0.382	0.066	0.226	0.157	0.138	0.130	0.002
Trade	1.719	0.586	1.627	0.979	0.842	0.567	0.008
Transport	0.200	0.108	0.171	0.146	0.156	0.057	0.001
Finance	0.354	0.134	0.329	0.235	0.309	0.069	0.001
Government	0.133	0.037	0.098	0.069	0.181	0.031	0.001
Tax forward coefficients (2015 – tax multipliers)							
Agriculture	0.169	0.054	0.330	0.110	0.099	0.043	0.001
Mining	0.070	0.052	0.064	0.067	0.088	0.018	0.000
Manufacturing	0.113	0.057	0.113	0.084	0.081	0.032	0.001
Energy	0.061	0.032	0.047	0.067	0.077	0.017	0.000
Construction	0.243	0.056	0.159	0.115	0.104	0.078	0.001
Trade	0.209	0.075	0.198	0.125	0.114	0.064	0.001
Transport	0.145	0.071	0.129	0.103	0.111	0.039	0.001
Finance	0.279	0.108	0.262	0.187	0.245	0.054	0.001
Government	0.103	0.034	0.083	0.059	0.121	0.024	0.000

VAT, value-added tax; PAYE, pay as you earn; SBC, small business corporation; SUT, supply and use tables.

Table 3 are consistently aligned with those shown in the first and second sets of results in terms of declining multipliers over the period under review. Another finding is that a 5% increase in all exogenous variables has a higher economy-wide effect on imports than it has on other endogenous variables. For instance, in the first scenario, a 5% increase in exports leads to a 5.08% increase in imports. In the second scenario, a 5% increase in household consumption expenditure leads to a 10.03% increase in imports. In the third scenario, a 5% increase in government spending leads to a 1.69% increase in imports. In the last scenario, a 5% increase in investment leads to a 3.78% increase in imports. Results of the low effect in the third scenario (5% increase in government spending) are in line with prior expectations, in the sense that the bulk (75%) of government spending (on education, health and social welfare) has little effect on imports. Moreover, an increasing demand for goods and services by households (in the second scenario) triggers a high demand for production and intermediate inputs. Firms react by importing final goods or intermediate inputs to satisfy the demand.

Consequently, the second scenario, which dealt with a 5% increase in household expenditure, would ultimately yield a higher multiplier effect than the other three scenarios. For example, when household spending rises by 5%, most taxes (company tax, VAT, PAYE tax and SBC taxes) increase by over 7%, compared to 3% in scenario 1 with a 5% increase in exports, resulting in a total employment rise of about 6%, more specifically among semi-skilled labour at 6.9%. Amazingly, GOS rises by 1 percentage point above the compensation of employees, which implies that the increase in household consumption expenditure benefits more shareholders than it does workers. In all four scenarios, a 5% increase in all exogenous variables yielded higher employment multipliers for semi-skilled workers than for skilled workers, low-skilled and unskilled workers, and workers in formal and informal sectors. Most semi-skilled

TABLE 3: Impact of a 5% increase in exogenous variables: The four scenarios.

Scenario	Exports								
	2007	2008	2009	2010	2011	2012	2013	2014	2015
Scenario 1: 5% increase in exports									
Companies Tax: Number of tax payers	3.37	3.74	3.02	3.04	3.21	2.65	2.73	2.78	2.76
Companies Tax: Tax assessed (R million)	4.11	4.76	3.78	3.77	4.07	3.62	3.78	3.73	3.63
VAT Tax: Number of vendors	3.53	3.74	3.18	3.23	3.44	2.97	3.04	3.10	3.08
VAT Tax: Payments (R million)	3.76	4.76	3.37	3.41	3.64	3.22	3.31	3.38	3.30
PAYE Tax (R million)	3.61	3.90	3.10	3.08	3.20	2.88	2.90	2.98	2.94
SBC Tax: Number of taxpayers	3.26	3.59	2.97	2.99	3.17	2.51	2.58	2.60	2.58
SBC Tax: Tax assessed (R million)	3.35	3.73	3.07	3.06	3.24	2.75	2.81	2.87	2.84
Employment (Number): Total	3.12	3.36	2.76	2.77	2.94	2.40	2.43	2.41	2.43
Employment (Number): Formal: Total	3.15	3.40	2.78	2.78	2.95	2.52	2.56	2.57	2.60
Employment (Number): Formal: Skilled	2.75	3.03	2.44	2.43	2.56	2.13	2.14	2.15	2.17
Employment (Number): Formal: Semi-skilled	3.47	3.79	3.13	3.15	3.34	2.86	2.90	2.92	2.94
Employment (Number): Formal: low-skilled	2.93	3.05	2.46	2.47	2.62	2.31	2.36	2.36	2.43
Employment (Number): Informal	2.96	3.22	2.70	2.74	2.92	1.95	1.99	1.93	1.97
Gross fixed capital formation	3.86	4.40	3.73	3.76	3.97	3.79	3.81	3.92	3.81
Fixed capital stock	3.68	4.11	3.39	3.42	3.62	3.40	3.47	3.60	3.56
Gross value added	3.50	3.89	3.17	3.14	3.35	3.01	3.05	3.11	3.05
Compensation of employees	3.13	3.48	2.86	2.85	3.01	2.73	2.78	2.82	2.82
GOS / mixed income	3.86	4.30	3.50	3.44	3.71	3.31	3.35	3.44	3.32
Taxes less subsidies on products	4.12	4.59	3.81	3.89	4.19	4.11	4.23	4.27	4.29
Imports	4.72	5.24	4.42	4.47	4.75	4.85	4.99	5.08	5.08
Scenario 2: 5% increase in household expenditure									
Companies Tax: Number of tax payers	9.31	9.01	9.45	8.97	9.08	7.81	7.58	7.44	7.44
Companies Tax: Tax assessed (R million)	9.75	9.29	9.98	9.57	9.68	8.97	8.86	8.71	8.73
VAT Tax: Number of vendors	9.48	9.01	9.76	9.45	9.59	8.60	8.43	8.27	8.27
VAT Tax: Payments (R million)	9.49	9.29	9.84	9.50	9.67	8.80	8.57	8.48	8.42
PAYE Tax (R million)	9.36	9.02	9.35	8.86	8.85	8.24	7.99	7.92	7.84
SBC Tax: Number of taxpayers	8.47	8.14	8.76	8.37	8.51	6.92	6.75	6.57	6.57
SBC Tax: Tax assessed (R million)	8.76	8.48	9.09	8.62	8.78	7.69	7.38	7.24	7.25
Employment (Number): Total	7.78	7.40	7.91	7.58	7.66	6.37	6.19	5.95	6.05
Employment (Number): Formal: Total	7.88	7.49	7.95	7.62	7.67	6.69	6.52	6.34	6.45
Employment (Number): Formal: Skilled	7.50	7.30	7.61	7.21	7.26	6.27	6.06	5.88	5.95
Employment (Number): Formal: Semi-skilled	8.31	7.97	8.57	8.21	8.29	7.14	6.97	6.79	6.90
Employment (Number): Formal: Low-skilled	7.45	6.83	7.20	6.96	6.98	6.28	6.16	5.97	6.16
Employment (Number): Informal	7.26	7.07	7.76	7.42	7.61	5.23	5.14	4.81	4.97
Gross fixed capital formation	9.00	8.81	9.54	9.16	9.13	8.58	8.30	8.15	8.09
Fixed capital stock	9.20	8.97	9.53	9.17	9.18	8.64	8.39	8.30	8.31
Gross value added	8.28	7.98	8.49	8.05	8.10	7.31	7.08	6.99	7.00
Compensation of employees	7.62	7.39	7.83	7.50	7.52	6.79	6.61	6.50	6.56
GOS / mixed income	8.92	8.54	9.14	8.58	8.70	7.83	7.56	7.51	7.47
Taxes less subsidies on products	9.47	9.06	9.77	9.75	9.70	9.96	9.75	9.57	9.61
Imports	9.72	9.21	10.13	10.12	10.00	10.34	10.13	10.01	10.03
Scenario 3: 5% increase in government expenditure									
Companies Tax: Number of tax payers	2.25	2.24	2.64	2.61	2.67	1.78	1.82	1.82	1.80
Companies Tax: Tax assessed (R million)	2.11	2.01	2.50	2.53	2.56	1.81	1.82	1.83	1.84
VAT Tax: Number of vendors	2.15	2.24	2.56	2.56	2.63	1.78	1.81	1.80	1.79
VAT Tax: Payments (R million)	2.13	2.01	2.58	2.60	2.67	1.84	1.85	1.85	1.85
PAYE Tax (R million)	2.43	2.53	2.97	2.98	3.07	2.28	2.31	2.33	2.32
SBC Tax: Number of taxpayers	1.98	1.95	2.37	2.36	2.43	1.55	1.58	1.56	1.55
SBC Tax: Tax assessed (R million)	2.04	2.02	2.43	2.45	2.59	1.77	1.83	1.78	1.79
Employment (Number): Total	2.20	2.24	2.66	2.66	2.74	1.97	1.99	1.99	1.95
Employment (Number): Formal: Total	2.29	2.35	2.76	2.77	2.84	2.13	2.15	2.16	2.13
Employment (Number): Formal: Skilled	2.62	2.70	3.11	3.10	3.19	2.44	2.47	2.48	2.45
Employment (Number): Formal: Semi-skilled	2.06	2.08	2.51	2.51	2.58	1.82	1.84	1.85	1.82
Employment (Number): Formal: Low-skilled	2.40	2.50	2.90	2.90	2.98	2.38	2.39	2.40	2.36
Employment (Number): Informal	1.74	1.85	2.30	2.26	2.37	1.40	1.49	1.47	1.48
Gross fixed capital formation	2.26	2.23	2.66	2.62	2.64	1.96	2.00	2.00	2.01
Fixed capital stock	2.47	2.49	2.90	2.90	2.94	2.19	2.20	2.20	2.17

Table 3 continues on next page →

TABLE 3 (Continues...): Impact of a 5% increase in exogenous variables: The four scenarios.

Scenario	Exports								
	2007	2008	2009	2010	2011	2012	2013	2014	2015
Scenario 3: 5% increase in government expenditure									
Gross value added	2.34	2.33	2.76	2.77	2.83	2.13	2.14	2.14	2.13
Compensation of employees	2.44	2.47	2.87	2.87	2.95	2.27	2.29	2.29	2.26
GOS / mixed income	2.22	2.18	2.64	2.66	2.69	1.97	1.98	1.97	1.97
Taxes less subsidies on products	1.90	1.82	2.18	2.23	2.21	2.01	2.04	2.05	2.02
Imports	1.68	1.58	1.99	2.07	2.03	1.68	1.71	1.72	1.69
Scenario 4: 5% increase in Gross Fixed Capital Investment									
Companies Tax: Number of tax payers	2.86	3.25	3.42	3.04	3.04	2.50	2.59	2.57	2.60
Companies Tax: Tax assessed (R million)	2.96	3.38	3.56	3.09	2.99	2.60	2.77	2.74	2.69
VAT Tax: Number of vendors	2.92	3.25	3.39	3.02	2.96	2.49	2.56	2.54	2.57
VAT Tax: Payments (R million)	3.04	3.38	3.54	3.11	3.05	2.61	2.69	2.67	2.67
PAYE Tax (R million)	2.74	3.02	3.08	2.67	2.57	2.19	2.23	2.21	2.22
SBC Tax: Number of taxpayers	2.94	3.25	3.47	3.08	3.08	2.52	2.64	2.62	2.64
SBC Tax: Tax assessed (R million)	3.04	3.33	3.60	3.11	3.00	2.52	2.62	2.62	2.59
Employment (Number): Total	2.56	2.75	2.85	2.51	2.47	1.97	2.01	1.98	2.02
Employment (Number): Formal: Total	2.50	2.71	2.80	2.46	2.40	1.98	2.03	1.98	2.02
Employment (Number): Formal: Skilled	2.12	2.37	2.43	2.11	2.06	1.65	1.66	1.62	1.65
Employment (Number): Formal: Semi-skilled	2.81	3.07	3.19	2.80	2.75	2.27	2.33	2.29	2.31
Employment (Number): Formal: Low-skilled	2.30	2.39	2.44	2.16	2.10	1.78	1.84	1.80	1.84
Employment (Number): Informal	2.86	2.91	3.05	2.73	2.74	1.94	1.97	1.95	2.02
Gross fixed capital formation	2.69	3.05	3.20	2.84	2.75	2.42	2.46	2.43	2.40
Fixed capital stock	2.55	2.90	3.03	2.67	2.58	2.25	2.30	2.30	2.31
Gross value added	2.51	2.82	2.94	2.55	2.46	2.09	2.14	2.15	2.15
Compensation of employees	2.31	2.60	2.70	2.37	2.29	1.96	2.02	2.02	2.04
GOS / mixed income	2.72	3.05	3.17	2.74	2.64	2.23	2.27	2.30	2.28
Taxes less subsidies on products	3.44	3.85	4.01	3.70	3.55	3.32	3.49	3.47	3.48
Imports	3.59	3.93	4.14	3.82	3.65	3.57	3.75	3.79	3.78

VAT, value-added tax; PAYE, pay as you earn; SBC, small business corporation; GOS, gross operating surplus; SUT, supply and use tables.

workers are in the middle-income class so an initiative that causes a shock in any of the exogenous variables will have a greater effect on the middle class than on the lower and upper classes. Finally, investment has an economy-wide multiplying effect on itself. In the fourth scenario, a 5% increase in gross fixed capital investment leads to a 2.4% increase in investment.

Model 4: A full range of 43 employment multipliers

The last set of findings is presented in a static SUT model calibrated for the 2015 reference year. Table 4 presents empirical labour results exhaustively under 43 different employment multipliers, depicting the number of jobs to be created with a hypothetical R1 million increase in final demand. Put differently, this scenario reveals the areas in which jobs will be created in the South African economy given a shock in exogenous variable that increases final demand by R1 million. The economy-wide effect (Type II) on employment multipliers is summarised:

- Gender disparity is observed with 5.2 jobs for men against 4.5 jobs for their female counterparts.
- Sluggish youth employment disadvantaged at 3.9 jobs against 5.7 jobs for adults, implying that the pace of fighting youth unemployment will persistently remain slow.
- The economy will create more jobs for workers with less than secondary (3.2 jobs) and secondary completed (3.0 jobs) than for workers with tertiary education (1.9 jobs). These employment multipliers pose a huge challenge for a knowledge-based economy geared toward the fourth industrial revolution. Low employment multipliers amongst workers with tertiary education can affect innovation and development negatively.
- More jobs are created in the formal economy (6.6 jobs) than in the informal sector (1.6 jobs). This is commendable since employment in the formal sector is more sustainable than in the informal sector.
- Spatial distribution of employment multipliers reflects areas with more economic activities, namely Gauteng with 3.1 jobs, KwaZulu-Natal with 1.6 jobs and the Western Cape with 1.4 jobs. Gauteng has the potential to remain an economic hub of the country. The high employment multiplier in Gauteng is one of the main reasons why more people migrate to the province. Other reasons may be attributed to the high urbanisation rate.
- There is a correlation between a high urbanisation rate and employment rate. This is revealed by employment multipliers in urban areas (7.3 jobs) being higher than those in the rural areas (2.3 jobs).
- Since it was established earlier that the South Africa economy creates more jobs for people with less than secondary education, this observation implies that more workers will hold low occupations in their working place. Thus, employment multipliers by occupation are high for workers in elementary occupations (1.7 jobs), sales and

TABLE 4: Detailed employment multipliers for South Africa (2015).

Employment multipliers (RSA – 2015): Type I and Type II multipliers	Initial effect	First round	Direct effect	Indirect effect	Direct and indirect effect	Induced effect	Economy-wide effect
1. Employment – Male	1.119	0.523	1.642	1.573	3.215	2.001	5.217
2. Employment – Female	0.869	0.383	1.252	1.156	2.407	2.066	4.473
3. Employment – Youth	0.797	0.373	1.171	1.131	2.301	1.605	3.907
4. Employment – Adult	1.190	0.533	1.723	1.598	3.321	2.462	5.783
5. Employment by education – No schooling	0.050	0.021	0.070	0.063	0.133	0.110	0.243
6. Employment by education – Less than primary	0.150	0.061	0.211	0.187	0.397	0.309	0.706
7. Employment by education – Primary completed	0.084	0.035	0.119	0.107	0.225	0.176	0.401
8. Employment by education – Less than secondary	0.661	0.307	0.967	0.917	1.885	1.339	3.224
9. Employment by education – Secondary completed	0.623	0.300	0.922	0.896	1.818	1.202	3.020
10. Employment by education – Tertiary	0.397	0.172	0.569	0.525	1.094	0.882	1.976
11. Employment – Formal	1.380	0.632	2.012	1.901	3.913	2.696	6.609
12. Employment – Informal	0.334	0.162	0.496	0.519	1.015	0.603	1.618
13. Employment – Agriculture	0.111	0.047	0.158	0.119	0.277	0.345	0.621
14. Employment – Domestic workers	0.163	0.065	0.228	0.190	0.417	0.424	0.841
15. Employment – Western Cape	0.291	0.133	0.424	0.393	0.818	0.626	1.444
16. Employment – Eastern Cape	0.174	0.073	0.247	0.224	0.471	0.360	0.831
17. Employment – Northern Cape	0.038	0.015	0.053	0.046	0.099	0.077	0.176
18. Employment – Free State	0.102	0.044	0.146	0.131	0.277	0.217	0.494
19. Employment – KwaZulu-Natal	0.322	0.144	0.466	0.438	0.904	0.678	1.581
20. Employment – North West	0.118	0.048	0.166	0.146	0.312	0.215	0.527
21. Employment – Gauteng	0.630	0.308	0.938	0.924	1.862	1.264	3.126
22. Employment – Mpumalanga	0.148	0.072	0.220	0.215	0.435	0.302	0.737
23. Employment – Limpopo	0.163	0.069	0.232	0.212	0.444	0.329	0.774
24. Employment –Urban areas	1.497	0.702	2.199	2.109	4.308	3.047	7.355
25. Employment – Non-Urban	0.490	0.205	0.695	0.620	1.314	1.021	2.335
26. Employment – Manager	0.161	0.000	0.161	0.164	0.324	0.157	0.482
27. Employment – Professional	0.098	0.079	0.177	0.166	0.342	0.274	0.617
28. Employment – Technician	0.184	0.042	0.225	0.198	0.424	0.357	0.781
29. Employment – Clerk	0.211	0.079	0.290	0.290	0.580	0.441	1.022
30. Employment – Sales and services	0.311	0.102	0.413	0.397	0.810	0.537	1.347
31. Employment – Skilled agriculture	0.012	0.154	0.166	0.160	0.326	0.345	0.671
32. Employment – Craft and related trade	0.246	0.006	0.251	0.220	0.471	0.175	0.646
33. Employment – Plant and machine operator	0.166	0.085	0.251	0.250	0.501	0.292	0.793
34. Employment – Elementary	0.471	0.091	0.562	0.525	1.087	0.674	1.761
35. Employment – Domestic worker	0.128	0.217	0.346	0.290	0.636	0.697	1.332
36. Employment – Skilled labour	0.443	0.120	0.563	0.528	1.091	0.789	1.879
37. Employment – Semi-skilled labour	0.945	0.426	1.371	1.317	2.688	1.790	4.478
38. Employment – Low skilled labour	0.599	0.309	0.908	0.815	1.723	1.371	3.094
39. EPWP – Male	0.015	0.005	0.021	0.016	0.036	0.028	0.065
40. EPWP – Female	0.029	0.008	0.037	0.026	0.063	0.060	0.123
42. EPWP – Youth	0.017	0.006	0.023	0.018	0.041	0.038	0.079
43. EPW28.P – Adult	0.027	0.007	0.034	0.023	0.058	0.049	0.107

EPWP, Expanded Public Work; SUT, supply and use tables.

services workers (1.4 jobs), domestic workers (1.3 jobs) and clerks (1.0 jobs) compared with workers in managerial positions (0.4 jobs).

- The study also looked at employment multipliers within the EPWP. Contrary to earlier findings with a higher employment multiplier among men than among women, the EPWP employment multipliers, although negligible (less than one job), are somewhat higher among women than among their male counterparts. However, they remain higher among adults than among the youth.

Conclusion, policy interventions and recommendation

This study went further than the traditional IO model by considering the most recent dynamic supply and use framework, and micro-simulation models to measure the impact of exogenous final demand on selected fiscal, labour and macroeconomic variables. It provided the performance and trends analysis of tax multipliers, growth and employment multipliers, and other generic multipliers for South Africa for the period 2007 to 2015. The methodology used to develop the SUT is in line with the most recent 2008 SNA and international best practices.

In terms of the research finding, the study had four objective and results were presented in a model per each objective. One of the most important observations from the first model was the significant decline in the tax multipliers, GDP and output multipliers, employment multipliers and other generic multipliers over the 2007–2015 period. This finding implies that during the post-recession era, the effect of the

average R1 invested in the economy, although positive, yielded a smaller return in terms of tax revenue, job creation and economic growth. At sector level, the results show that the inter-industry links and industry-consumer links have weakened. At policy level, this could exacerbate the low growth that has persisted during the post-recession period. Low growth is correlated to low revenue generation and fiscal unsustainability.

The second set of results showed that apart from PAYE tax, all other tax multipliers declined over the period under review. This implies at a policy level that the recent fiscal austerity measures being implemented in South Africa may be prolonged for a little while which, if not addressed, could affect service delivery for poor households and delay the quest for all-inclusive, equitable and sustainable economic growth envisaged in the National Development Plan and South African Vision 2030. In terms of backward tax multipliers, simulation results showed that the trade sector had the highest VAT multipliers compared with other sectors.

The third set of simulations were presented in four different policy scenarios. The results showed that the scenario with policy interventions that seek to stimulate more household consumption expenditure yields high economy-wide growth, employment and tax multipliers than the other three scenarios with strategic policies interventions that seek to stimulate either export, government spending or investment. This result confirms that South Africa's economy is rather more consumption driven than export driven.

The fourth set of results quantifies the areas in which jobs will be created given a shock in exogenous variables. It reveals gender disparities, fewer jobs for the youth, compared to adults, fewer jobs in informal than formal sectors, fewer jobs in rural than urban areas. More jobs will be created: (1) for people with less than secondary school education than people with other education levels, (2) for people with elementary occupations than for people in other occupations, (3) for semi-skilled workers than for skilled, low-skilled or unskilled workers, and (4) in Gauteng than in other provinces.

Overall, the findings derived from this study could be used for strategic plans in the country. Empirical results are appropriate for policy interventions, such as fiscal policy (using tax multipliers), labour policy (using employment multipliers), poverty and development policy (using income multipliers), investment policy (using investment multipliers), trade policy (using export multipliers), growth and industrial policy (output multipliers, gross value added multipliers, GDP multipliers, and GOS multipliers), small, medium and micro-sized enterprises policy (using SBS tax multipliers), and so on. Findings from this article could be used to inform South Africa's National Development Plan, Vision 2030 and other national strategic plans. For future work, the model used in this study will be converted into a social accounting matrix which will be used for the construction of a CGE model for South Africa.

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The authors have declared that no competing interest exists.

Authors' contributions

All authors contributed equally to this work.

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