working paper
2019-07

The Impact of Fiscal Policy on Income Distribution in Tanzania:
A Computable General Equilibrium Analysis

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April 2019

PAGE
policy analysis on growth and employment
IDRC CRDI
pep
UKaid

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Abstract

The Tanzanian government has established a goal to transform the country into a middle-income and semi-industrialized state by 2025. To promote this transformation, the government exempted the Value Added Tax on capital commodities in FY 2017-2018 as a way to promote utilization of these commodities by manufacturing industries and generate growth, employment, and increased incomes. This study analyzes the impact of a reduction in Value Added Tax on capital commodities (electricity, vehicles, machinery, and equipment) under two different closure rules: (1) fixed governmental expenditures and flexible governmental savings (2) flexible governmental expenditures and fixed governmental savings. Under the first regime, government savings declined and industries that depended heavily on government investments suffered. In the second, output increased for all industrial sectors, leading to a decrease in average unemployment. Real consumption increased for all but the richest household categories.

JEL: C68, E62, H50, E64
Keywords: Fiscal Policy, Government Budget, Household Income, CGE Modelling, Social Accounting Matrix

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Acknowledgements

This research work was carried out with financial and scientific support from the Partnership for Economic Policy (PEP) (www.pep-net.org) and with funding from the Department for International Development (DFID) of the United Kingdom (or UK Aid) and the Government of Canada through the International Development Research Center (IDRC). Authors are grateful to Dr. Martin Henseler and Prof. Helene Maisonnave for technical support and for their valuable comments and suggestions.

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I. Introduction

Within recent decades, government fiscal reforms in spending and taxation aimed at stabilizing and sustaining economic growth and reducing poverty, especially in developing countries, have attracted heightened attention (IMF, 2015; UNCTAD/TDR, 2012). Along these lines, the government of Tanzania began serious efforts to reform fiscal policy and intervenes in the economy more than twenty years ago, and these efforts continue. The result of Tanzanian reforms, however (e.g., macroeconomic stability, increased revenue, and a rising revenue share), have begun to appear only in the last decade (Bevan, 2010). The fiscal reforms implemented since independence can be grouped into chronological periods:

- 1961 to 1966 (Post-Independence): Characterized by market economy with economic policies that favored private-sector development;
- 1967 to 1985 (Socialism/Nationalization): Focus changed from market-led economy to state-led economy;
- 1985 to 2005: Country adopted a number of economic reforms;
- 2005 to present: Efforts to accelerate economic growth and reduce poverty put into place.

Over the years, these reforms contributed to macroeconomic stability, steady economic growth, and increased government revenues (KPMG, 2017), among other effects. In 2016, the World Bank reported an average growth in gross domestic product (GDP) of 7% over the preceding decade; a slight decline to 6.6% occurred in 2016. This rate of growth surpasses the rate in Sub-Saharan Africa (4.4%), making Tanzania one of the region's fastest-growing economies. These growth rates have not translated into substantial improvements in living standards for a large majority of the population, however. Although the poverty rate declined from 28.2% in 2012 to 26.9% in 2016 (World Bank, 2016), the absolute number of poor remains high because the population has grown substantially. Poverty reduction, productivity increase, and the creation of decent jobs, therefore, are goals that remain to be achieved.

The economic growth that has taken place falls below the targets established in the Tanzania Development Vision (TDV) 2025 plan, whose goal was a high, good-quality standard of living for all. Nor is Tanzania's economic growth in line with the second National Five-Year Development Plan (FYDP II) 2016-2017-2020/21, which was intended to foster industrialization and human

development (KPMG, 2017). Because TDV and FYDP objectives have not been reached, further policy reforms and interventions are required to improve the country's economic situation.

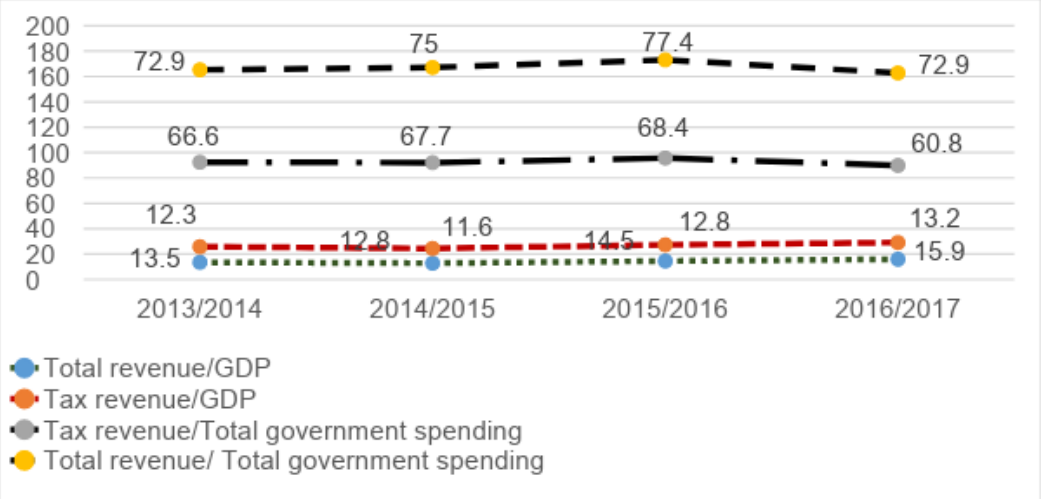
Over the last six decades, computable general equilibrium (CGE) models have increasingly been used to evaluate fiscal reforms with a focus on tax policy in a range of countries (see Kehoe et al., 1988, e.g.). A CGE approach for tax analysis was first applied by Harberger (1962) and was subsequently used widely by Shoven and Whalley (1972) and by Ballard et al. (1985a). A number of studies (e.g., Shoven & Whalley, 1984; Ballard, Shoven & Whalley, 1985b; and Gottfried & Wiegard, 1991) applied CGE models specifically to the welfare effects of VAT systems in developed countries.

We followed this practice in our investigation of the economic impact and pro-poor implications of indirect tax reform through the imposition of a Value Added Tax (VAT) in Tanzania. Although Levin (2001, 2005) successfully applied CGE models to Tanzania to evaluate the effects of indirect taxes on household income, and Kaliba (2006) used them to analyze the impact of indirect taxes on commodity markets, our CGE model is based upon updated data that reflect current economic realities in Tanzania. Specifically, our CGE model simulates the effects of a transition to a VAT regime on the whole economy, and on such significant economic variables as prices, production, macroeconomic indicators, and income distribution. Policy makers can use these findings to make informed decisions regarding fiscal policy.

1.1. Taxes and Government Expenditure: Levels and Compositions

As noted above, various fiscal reforms have been implemented in Tanzania in recent decades, resulting in improved domestic revenue collection and the achievement of the government's economic policy objectives (Osoro, 1994; IMF, 2015 a,b). Figure 1 shows the fiscal indicators of the national budget for the last four years.

Figure 1: Breakdown of Fiscal Indicators in Tanzania, in Percent



Sources: Computed by authors from data on taxes and GDP obtained from IMF country reports: N15/175 - 2015, N16/253 - 2016, N17/180-2018 and NBS (2017): Tanzania Tax Statistics Report 2015/16.

As the figure indicates, the ratio of both tax revenue and total revenue to nominal GDP increased in Tanzania, particularly in FY 2016-2017. These ratios have, however, varied in recent years:

Between fiscal years 2013 and 2017, the tax-to-GDP ratio was relatively low (on average, 12.5%) compared to the average rate of 15% for the East African region recommended by the IMF (IMF, 2018). This ratio indicates that Tanzania does not bear a high enough tax burden. Given Tanzania's low tax-to-GDP ratio, the government has room to raise the ratio to address deficiencies in the budget and to finance development.

In FY 2016-2017 the ratio at which government expenditures were financed by taxes decreased as compared to 2016-2017, as did the expenditure share financed by total revenue. The reason for this is that government expenditures have been more volatile than revenue in the period of analysis.

The analysis of the tax structure in Tanzania reveals that the government budget relies on indirect taxes (particularly the VAT) more than on direct taxes as a revenue source (Table 1). The government of Tanzania introduced two VAT rates in 1998 (FY 1998-1999). The first, the VAT standard rate, stood at 20% on imported goods and local supply commodities until FY 2009-2010, at which point it was lowered to 18%. The government now imposes a VAT on a different set of goods and services every year. The second, the zero rate, applied to exports.

The contribution of excise and import duties to tax revenue is low compared to that of the VAT. Excise and import duties account for 16.9% and 7.1%, respectively, on average (Table 1). In other Sub-Saharan African countries whose economies are similar to Tanzania's, the contribution of

excise and import duties to national revenue is higher: 22.5% and 14.4% respectively, in Kenya, for example. (ICPA, 2016). Tanzania could also generate substantially more tax revenue from indirect taxes—specifically from a VAT and from import and excise duties.

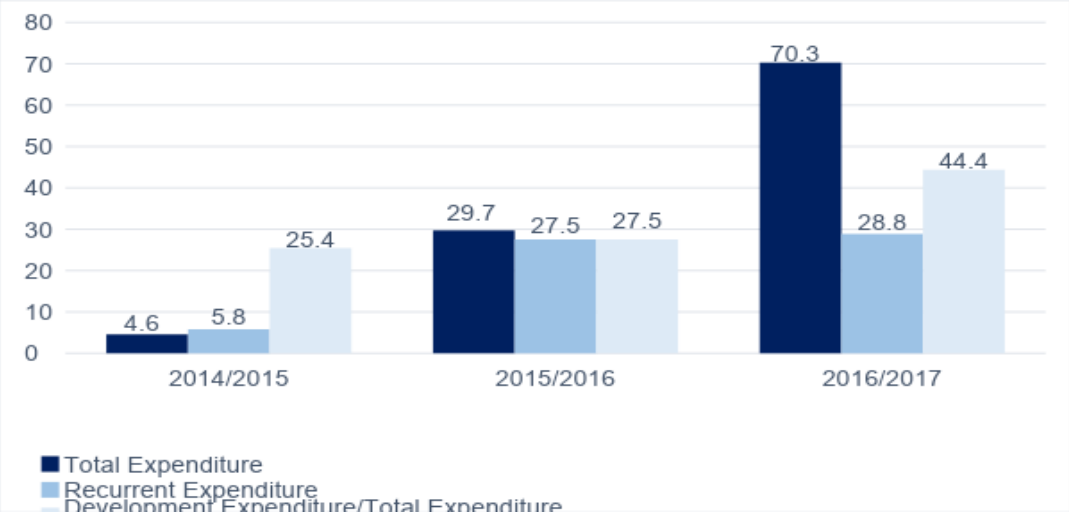
Table 1: Tax Structure in Tanzania by Broad Categories, Selected Years, in Percent

Fiscal indicators/Fiscal year	2013/2014	2014/2015	2015/2016	2016/2017
Direct taxes as a share of tax revenue	40.7	37.6	37.8	36.8
Direct taxes as a share of nominal GDP	5.1	4.4	4.8	4.9
Indirect taxes as a share of tax revenue	47.3	49.5	47.7	48.2
Indirect taxes as a share of nominal GDP	5.8	5.7	6.1	6.37
Import duties as a share of tax revenue	7.5	7.9	6.8	6.5
Import duties as a share of nominal GDP	0.9	0.9	0.9	0.9
Value-added tax as a share of tax revenue	23.6	24.7	23.4	24.4
Value-added tax as a share of nominal GDP	2.9	2.9	3.1	3.2
Excises as a share of tax revenue	16.2	16.9	17.4	17.3
Excises as a share of nominal GDP	2.1	2.1	2.2	2.3
Other taxes as a share of tax revenue	12.1	12.9	14.6	14.7
Other taxes as a share of nominal GDP	1.5	1.5	1.9	1.9

Calculations based upon tax and GDP data obtained from IMF country reports: N15/175-2015, N16/253-2016, N17/180-2018, and NBS (2017): Tanzania Tax Statistics Report 2015/16.

Recent fiscal reforms in Tanzania have resulted in alterations in taxes and government spending, including increased spending for development. The government allocates its spending in two main areas: recurring components and development (Figure 2). Recurring expenses represent the costs of day-to-day operations (salaries, rent, etc.) while spending for development finances the construction of roads, schools, and water infrastructure, among other projects.

Figure 2: Breakdown of Tanzanian Government Spending, Percent Change from Baseline FY 2013-2014



Sources: Computed by authors from data on taxes and GDP obtained from IMF country reports: N15/175 - 2015, N16/253 - 2016, N17/180-2018 and NBS (2017): Tanzania Tax Statistics Report 2015/16.

A look at government spending shows that, between FY 2014-2015 and FY 2016-2017, total spending increased by almost 70%. The proportion of recurrent and development spending fluctuated significantly during that same period but grew consistently. For instance, between FY 2014-2015 and FY 2015-2016, recurrent expenditures grew by 21%. Development spending increased from less than 30% of all government expenditures in FY 2014 to 2016 to 44% in FY 2016-2017 (Figure 1). The government's main focus recently has been to develop infrastructure, which has led to the construction of new airports and roads and investments in power-generation projects such as the Stiegler's Gorge Hydroelectric Power Station and the standard gauge railway.

Regarding the distribution of recurrent expenditures (Table 2), the share of government spending represented by education, water, energy, roads, and agriculture all rose from 35.6% in FY 2008-2009 to 55.9% in FY 2014-2015. Health spending decreased significantly as a share of government expenditures—from a ratio of 13.6% in FY 2008-2009 to 7.9% in FY 2014-2015—while expenditures for energy, water, agriculture, and roads increased.

Table 2: Government Spending by Sector (Percent of Total Government Spending)

Years	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016
Education	18.0	17.1	18.7	18.3	21.2	21.0	19.6	17.4
Health	13.6	8.7	9.1	8.1	9.6	9.4	8.7	7.9
Water	2.5	2.8	2.3	1.9	4.5	2.8	4.3	3.3
Energy	1.3	1.6	2.9	4.8	5.2	7.2	7.8	5.5
Roads	9.4	13.4	11.1	14.7	11.6	13.4	12.9	10.6
Agriculture	4.2	5.6	4.8	4.8	4.0	4.5	3.0	5.4
Total	49.2	49.1	48.9	52.6	56.2	58.4	56.3	50.1

Source: Data from MoFDP (2011, 2013) and URT (2016) and calculations by authors.

1.2. Poverty Profile and Income Inequality

Fiscal policy is a key instrument the state can deploy to reduce poverty and more equitably distribute income. Equitable doesn't mean equal distribution of income, but rather refers to a distribution that is "fair," though the concept of "fair" is subjective. As Lindert, Skoufias, and Shapiro (2006) pointed out, moreover, low-income households are more vulnerable to fiscal policy changes and economic shocks than are rich households. Empirical evidence demonstrates that people in more equitable societies are generally happier (Alesina et al., 2004), healthier (Wilkinson,

2006), and less prone to crime (Blau & Blau, 1982). Reducing income inequality and poverty, therefore, remain crucial to resolving a range of social problems in Tanzania (Jerve & Ofstad, 2005; Mkenda, Luvanda & Ruhinduka, 2010; Atkinson & Lugoa, 2010; and Matotay, 2014).

In empirical studies, scholars generally use such measures as the Gini coefficient, Kuznets ratio, or the size distribution of income to analyze income inequality. In our effort to measure income inequality in Tanzania, we used individual or size distribution and the Kuznets ratio.

The individual or size distribution of income is the measure most used by analysts. It deals with the total income received by individuals or household groups. One method is to divide the population into quintiles (fifths) or deciles (tenths) by income and to then determine what proportion of total national income each income group receives.

The Kuznets ratio has often been used as a measure of the degree of inequality between high- and low-income household groups, using the ratio of the top quintile to the bottom two quintiles (top 20% to bottom 40%) as a measure of income inequality.

Rising income inequality is one of Tanzania's most important socioeconomic problems. The country's Gini index increased from 0.34 in 1991 to 0.37 in 2007, then dropped to 0.34 in 2012 (URT, 2014). Income inequality is still very marked in urban areas because of the gap between high-income, private-sector earners and low-income earners who migrated from rural areas to find higher-paid work. Migrant workers still receive most of their income from land capital and crops in rural areas, however.

Tanzania's Gini coefficient is below both the Sub-Saharan African average of 0.451 and the average for low-income countries of 0.40 (Bhorat, et. al., 2016). In 2012, Tanzania's Gini index was higher than that of most developing countries, including Algeria (0.353), Laos (0.367), and Benin (0.365). It was, however, lower than that of a number of LAC, including Colombia (0.529) and Honduras (0.561) and of such African countries as Rwanda (0.513) and Uganda (0.410).

Additional policy reforms are needed to reduce poverty and improve income inequality in Tanzania. Typically, however, fiscal reforms impose differential costs on and provide unequal benefits across income groups, creating benefits for some while imposing hardship and loss on others.

II. Literature Review

Much of the literature on indirect taxation is oriented to the optimal combination of direct and indirect taxes. The study of optimal-commodity taxation was pioneered by Ramsey (1927). The Ramsey theory considered a one-consumer economy and addressed methods of increasing government revenues through indirect taxes in order to reduce welfare losses. Ramsey's results were interpreted to mean that optimal indirect tax rates had to be applied in such a way that the proportional reduction in compensated demand was uniform for all commodities. Ramsey's conclusions provided a persuasive argument for non-uniform commodity taxation, and Corlett and Hague (1953) and Meade (1955) later made additional contributions to the Ramsey rule.

The introduction of a VAT in many countries in the early 1970s attracted considerable attention to the theory of optimal indirect taxation among economists. The Ramsey model was modified to the many-person economy and adopted as a fundamental study by Diamond and Mirrlees (1971a, 1971b). The Diamond-Mirrlees theory, whose implications for fiscal policy are notable, stated that the government could levy indirect taxes at different rates when production in the economy was optimal.

Today, the theory of differentiated commodity taxes is generally accepted, but the sense that governments do not have the information they need to determine optimal tax rates on specific goods and services is also widespread; on administrative grounds, then, the case can be made for uniform commodity taxation. Another prominent study that focused on optimal indirect taxation was Atkinson and Stiglitz (1976) who analyzed the role of differential commodity taxes alongside progressive income tax as part of a redistributive tax system.

Over past decades, most countries have reformed their fiscal policies, primarily by adopting a Value Added Tax. Currently, a VAT exists in more than 160 countries, and about 80% of African countries have introduced this system of taxation (Gerard & Naritomi, 2018). Moreover, most developing countries in Africa continue to reform their tax systems with specific reference to VATs. As a result, a number of studies have analyzed and identified the effects of a VAT through CGE modelling.

Emini (2000) examined the gap between the short- and long-run effects of the implementation of a VAT in Cameroon. Ajakaiye (1999) analyzed the impact of a VAT on sector-based and macroeconomic indicators in Nigeria using a CGE model to suggest ways to minimize

adverse effects. Auriol and Warelters (2012) studied thirty-eight African countries and introduced the informal economy into their simple CGE model. They examined the marginal cost of public funds and found the VAT to be the least costly tax. Several CGE studies focused on South Africa and considered VAT policy and other fiscal parameters (Go et al., 2004; Erero, 2015; and Mabugu et al., 2013). Extensive discussions on the exemption and zero-rating of VAT and effects on the economy can be found in Alderman and del Ninno (1999), Matovu et al. (2009), and Munoz and Cho (2003).

Levin (2001, 2005) is the only writer to have specifically addressed the effect of a switchover to a VAT regime on poverty in Tanzania, though indirect taxation was also discussed by Fjeldstad (1995), FIAS (2006), and Fjeldstad et al. (2018). Levin (2001) conducted a tax-incidence analysis among different household groups and used a CGE model to project additional tax-revenue in Tanzania under two conditions: leaving the tax rate unchanged and raising the tax rate. Levin's findings suggested that poorer households indirectly paid a relatively larger share of import duties and that the income tax rate was initially high among poorer households, then fell and rose as households become richer.

Levin (2005) implemented an empirical CGE model for Tanzania to evaluate the indirect effects of broadening the VAT base. His results showed that VAT-broadening should initially be done in the manufacturing and service sectors rather than in the agricultural sector. Nonfood commodities are purchased disproportionately by the better-off, so that taxation of them would be progressive. Taxing food-products, on the other hand, would hurt the poor.

In order to establish the impact of tools of indirect taxation on production in both the domestic and export markets, Kaliba (2006) built a CGE model for Tanzania. Kaliba hoped to determine a tax rate that would not affect government revenues and respective Pareto efficiency but would reduce the price of production relative to import prices. In order to increase production for domestic and export markets and for prices to drop, Kaliba found, lower tax rates were necessary.

III. Methodology and Data

3.1. The PEP 1-1 Standard Model

CGE models are the standard method for analyzing the efficiency of a variety of economic policies (Bourguignon, De Melo & Suwa, 1991; Gunning & Keyser, 1993), and they are appropriate for our study because they are capable of capturing relationships among various segments of the economy (production, factors of production, exports, and imports) and agents (households, firms, government, and the rest of the world). We used a static PEP 1-1 standard CGE model (Decaluwé et al., 2013), to examine the short- to medium-term effects of a decrease in the VAT rate on households and on the overall economy. We modified the standard PEP 1-1 CGE model to account for unemployment in Tanzania (Appendix A1).

In the PEP 1-1 Model, producers aim to maximize profit to the extent their production technology allows. We adopted a small-country assumption in which producers are price takers. The structure of production in each industry was nested, and we used a Leontief function to combine value added and total intermediate consumption. Composite labour and capital made up the added value while aggregate intermediate consumption consisted of various goods and services.

Produced commodities are either consumed domestically or exported depending on the prices in the domestic and export markets. Producers' decision are guided by the elasticity of transformation in the Constant Elasticity of Transformation (CET) function, a measure of an industry's flexibility in responding to price changes. Consumers may also purchase either domestic or imported commodities subject to their budgets. We assumed that consumers had a Stone-Geary utility function and not the Cobb-Douglas function normally reported in the literature, which allowed them to substitute commodities depending on price changes.

Apart from households whose income consisted of remuneration from factors of production and transfers from other agents, PEP 1-1 Model also incorporated government, firms, and the rest of the world. Household savings was a linear function of disposable income which ensured that the marginal propensity to save was different from the average propensity to save. By this, the PEP 1.1 Model differs from other models which assume that savings is a fixed proportion of disposable income and eliminate the possibility of misleading results during parameter calibrations on negative savings. The government draws its income from a variety of taxes imposed on households, firms,

products, and production. Other sources of income include transfers from the rest of the world and dividends from capital. The labour-market segment of the model was modified to include unemployment as described below.

3.2. Modeling the Labour Market

Various CGE models take the existence of unemployment into account, but the approaches are basically two. The first considers the option of modeling the unemployment-wage relationship explicitly as one of the equations (Cicowiez, Decaluwé & Nabli, 2017; Maisonnave, Decaluwé & Chitiga, 2009). In the second, collective bargaining is invoked and implemented in the CGE context (Agénor et. al, 2007; Agénor & Aynaoui, 2003).

We modelled the labour market without considering trade unions because unions cover only about 27% of formal employees (ILFS, 2015). Secondly, the main function of the unions is to consult regularly with the government to try to improve working conditions, which has no significant impact on the functioning of the labour market.

One of the assumptions of the PEP 1-1 CGE Model is full-employment in the labour market. Although unemployment does not seem to fit a general equilibrium framework, we introduced the rate of involuntary unemployment in order to make the model a more realistic picture of the Tanzanian economy (Appendix A2). The PEP 1-1 Model was extended to include endogenous unemployment through a wage curve (Cicowiez, Decaluwé & Nabli, 2017). We chose this modeling approach to represent trade-offs between unemployment and wage rate.

3.3. The Model Data Base

3.3.1. Introduction to Tanzania's Social Accounting Matrix (SAM)

We used Tanzania's 2015 Social Accounting Matrix (SAM), developed by International Food Policy Research Institute (IFPRI) researchers Randriamamonjy and Thurlow (2017), for this study.

3.4. Production Structure by Sector

The SAM for Tanzania consists of seventy distinct sectors and sixty-eight commodities that have been aggregated into fifty-five sectors and fifty-six commodities. Out of these, twenty-five sectors are agricultural, nineteen are industrial, and eleven are services. Tanzanian economic sectors are shown in Appendix A3. The service sector contributes about 44.4% of the GDP—the highest of all—while agriculture and industry represent 30.3% and 25.3%, respectively. The industrial sub-sector is the main contributor to the GDP within the construction sector and accounts for about 15.7% of the GDP.

We introduce here the term "capital commodities." This term comprises vehicles, machinery, and electrical and transportation equipment that is used in final goods production. Capital commodities also include infrastructure items such as the supply of electricity, gas, and steam. The capital commodities sector contributes about 1.3% to the GDP; resultantly, tax reforms that target capital commodities would have economy-wide effects in Tanzania.

3.5. Factors of Production

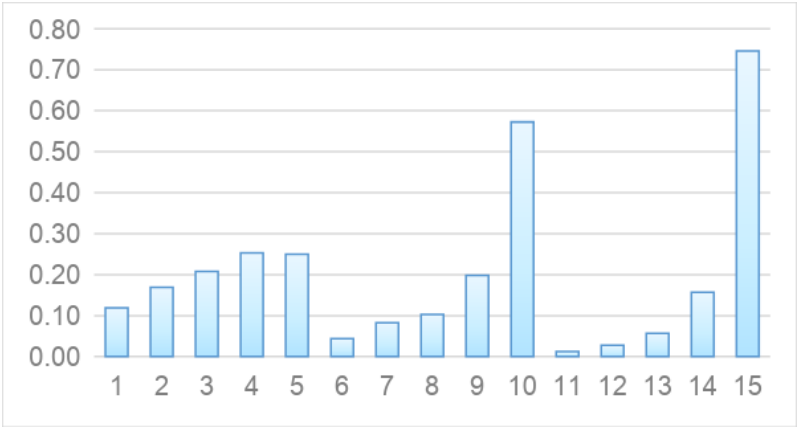
The SAM represents three factors of production: labour, capital, and land. Labour is categorized into four types of workers based on education level and disaggregated by rural and urban areas. The first group consists of workers with no formal schooling, the second group is labour with a lower primary education (0 to grade 4), the third refers to workers with a medium education (grades 5 to 11), and the fourth group includes workers who are highly educated (grade 12, college certificates, and university degrees). Capital is divided into four subcategories: crops, livestock, mining, and other. The share of factors of production in the total value of all sectors is presented in Appendix A4.

3.6. Agents

The SAM differentiates four agents: Households, Firms, Government, and Rest of the World. There are fifteen household categories, disaggregated by geographical location and income group and divided into national per-capita-expenditure quintiles. Figure 1 shows disposable-income distribution in each household group disaggregated by geographical location. The bottom two

quintiles represent the 40% of households with the lowest incomes, while the income of the top 20% is the highest. A common measure of income inequality that can be derived from Figure 3 is the ratio of the incomes received by the top 20% and the bottom 40% of the population, also referred to as the Kuznets ratio. In our case, this inequality ratio equals about 2.3 for rural farm households, 13.2 for rural non-farm households, and 59.1 for urban households.

Figure 3: Disposable-income-share distribution across rural and urban household groups



Calculations based on the 2015 SAM for Tanzania (Randriamamonjy & Thurlow, 2017)

The Table in Appendix A5 provides household income by six sources: wage, land returns, returns to capital (from crops and livestock), transfers from government, dividends (firms), and foreign transfers (remittances). Rural households that engaged in crop production or raised livestock received most of their income from capital and land, which are major factors of production in rural Tanzania. Rural non-farm households received a significant share of their income from public transfers, dividends, and foreign transfers. For poor households, labour income accounted for less than 20% of income.

The modified SAM represents the sources of government revenue, including taxes paid by economic agents, tariffs, and transfer payments (Table 3).

Most government income came from indirect taxes (42.1%): VAT and excise duties and other indirect taxes. Direct tax income (personal income taxes and corporate taxes) contributed 25.9% to total revenue, while import tariffs contributed 6.6%, and transfers from the Rest of the World (ROW) contributed 18.1%. Transfers to the government by households and firms accounted for 1.5% and 5.6%.

Table 3: Structure of Government Revenue, in Percent

Account	%
Transfers from Firms	5.6
Transfers from Households	1.5
Direct Taxes	25.9
Indirect Taxes	42.1
Import Tariffs	6.6
Transfers from ROW	18.1
Total	**100**

Calculations based on the 2015 SAM for Tanzania (Randriamamonjy & Thurlow, 2017)

In the modified 2015 SAM, indirect taxes were disaggregated by three accounts: VAT, excise duties, and other taxes (Table 4). The VAT share of total indirect taxes was 73.2%, excise duties stood at 18.6%, and other taxes were 8.2%.

Table 4: Structure of Indirect Taxes, in Percent

Account	%
VAT	73.2
Excise duties	18.6
Other taxes	8.2
Total Indirect taxes	**100**

Calculations based on the 2015 SAM for Tanzania (Randriamamonjy & Thurlow, 2017)

Analysis of government income demonstrates that Tanzania relies heavily on indirect taxes (particularly on VAT) as a source of income. Indirect taxes, therefore, and especially VAT, could be the main tool of fiscal-policy reform aimed at raising government revenue. Ultimately, these funds might be reallocated to reduce poverty and inequality.

In order to provide more detailed information regarding indirect taxes (the VAT rate, specifically), we present the effective VAT rate extrapolated by sector from the taxes-on-products information in the SAM. The effective rates are given in Appendix A6. The effective VAT rate for capital commodities before the simulation was 11.8%.

Table 5 shows the government's spending structure. Most government funds (85.3%) are spent on commodities in such social sectors as public administration, health, and education. Some government expenditures in this area are increasing (education and public administration, for instance), and some are decreasing (health, for example; see Table 4). About 7.9% of total government income is used to support firms in the form of subsidies. Government transfers to poor and rich households account for 1.9%. Only 2.1% of government expenditure is directed to investment programs, and the rest of the world (ROW) receives about 2.8%.

Table 5: Structure of Government Spending on Each Commodity, in Percent

Sources of the government spending	Government spending
Government investment (Public savings)	2.1
Government spending to ROW	2.8
Government spending on commodities	85.3
Government subsidies to Firms	7.9
Government transfers to households	1.9
Total	**100**

Calculations based on the 2015 SAM for Tanzania (Randriamamonjy & Thurlow, 2017)

When current income is analyzed, the biggest share of payments to the RoW comes from imports (91.2%). This fact confirms that the Tanzanian economy strongly depends on the external economy. Less than 10% of RoW income is attributable to household transfers and government payments to foreign residents and institutions (Table 6).

Table 6: Income Accruing to the ROW

Sources of Transfers	Import	Households' transfers to foreign residents	Government transfers to rest of world	Total Current Transfers from the RoW
Percentage (%)	91.2	7.2	1.6	100

Calculations based on the 2015 SAM for Tanzania (Randriamamonjy & Thurlow, 2017)

3.7. Closure rules and Simulation Scenarios

3.7.1. Scenario background

According to the Tanzania Development Vision (TDV) 2025 plan, the government is taking active steps to foster industrialization in order to bring the contribution to GDP of the industrial sector to 40% by 2025.The budget for FY 2017-2018 is anchored to the 2025 TDV. The government's priorities include interventions for fostering economic growth and industrial development and creating a conducive business environment.

Part of the initiative for industrial development is a VAT exemption on capital goods with the objective of reducing the cost of intermediate inputs and imported raw materials used in production. The VAT exemption on capital goods applies to edible oil, textiles, leather, and the pharmaceutical industries (including veterinary). The measure could promote utilization of these goods—by industry in particular—and may therefore promote the growth, employment, savings, and investment necessary to improve general welfare. The VAT exemption targets the promotion

of manufacturing and processing but reduces government tax income and, thus, the funds available for development programs against poverty and income inequality.

As the 2015 SAM reports, producer goods were one of the main contributors to Tanzania's GDP. Therefore, we simulated a 10% reduction in the VAT rate on capital commodities alone rather than exempting them completely. Our simulated scenarios addressed the following research questions: (1) What are the effects of only a partial reduction of the VAT rate on capital commodities? (2) Can a partial reduction in the VAT rate on capital commodities produce an economic benefit without a major loss of tax income to the government?

3.7.2. Scenario Assumptions

The effects of a 10% decrease of VAT rate on capital commodities were analyzed under two different closure rules. These closures allowed the model to adjust to two different macro-economic reactions and adapt to resulting losses in governmental income; the government could adjust either savings or expenditures.

Simulation Scenario 1: 10% decrease in VAT rate on capital commodities under varying government savings and fixed government expenditure.

The first scenario analysed the effects of a 10% decrease in VAT rate on capital commodities. Flexible government savings allows a decrease in government revenue to be reflected in decreased savings and thus increases government deficit. This means that the government could increase its level of borrowing to cover for inadequate tax receipts but would then be required to repay those debts in future.

Simulation Scenario 2: 10% decrease in VAT rate on capital commodities under fixed government savings and varied government expenditure.

The second scenario analysed the same effects of 10% decrease in VAT rate on capital commodities but under a different closure rule than in Simulation Scenario 1. This closure rule implied that the expected decrease in government income (due to a decrease in tax collection) would not reduce government savings. Instead the government could adapt to the losses by reducing expenditures.

3.7.3. Closure Rules

Regarding world trade, we assumed that world prices were fixed, and we considered Tanzania a small, price-taker country. Depending on variations in the foreign savings account, the real exchange rate was assumed to be flexible—that is, it could appreciate or depreciate—and the current account balance was considered exogenous. Further, we assumed that capital was fully employed and was mobile across sectors and activities. Unemployment existed in each segment of the labour market, and the labour supply was endogenous. Labour demand, employment, and wages could vary after a shock, but wage differentials were fixed at their initial level. The scenarios differed in assumptions regarding government savings and expenditures.

IV. Simulation Results

4.1. Macroeconomic effects

Table 7 shows that a 10% decrease in VAT on capital commodities in both scenarios reduced the consumer price index by 0.1%, total government receipts from indirect taxes by 1.3%, and total government receipts from VAT by 1.7%. This decrease negatively affects total government income by 0.5% in Simulation 1 and by 0.6% in Simulation 2. While holding government expenditures fixed in Simulation 1, the loss of income reduces government savings by 26.4%, thus increasing the deficit. This reduction is relatively high because the base value for government savings was very small; any negative shock thus strongly affected this variable. In Simulation 2, government savings were fixed, and the decrease in government income reduced government expenditures by 0.7%.

Table 7: Impact on Macroeconomic Variables, Percentage Changes

Macroeconomic indicators	Simulation 1	Simulation 2
Total government income	-0.5	-0.6
Total government receipts of Indirect taxes on commodities	-1.3	-1.3
Total government receipts of VAT on commodities	-1.7	-1.7
Real current government expenditures	+0.1	-0.5
Current government expenditures	Fixed	-0.7
Government savings	-26.4	Fixed
Firms savings	-0.03	-0.06
Households savings	-0.03	-0.02
Total Investment	-0.3	-0.1

GDP at base prices	-0.03	-0.1
Real GDP at base prices	+0.04	-0.01
Real GDP at market prices	-0.02	-0.1
Consumer price index	-0.1	-0.1
Unemployment rate	+0.1	-0.03

Note: Calculations by authors.

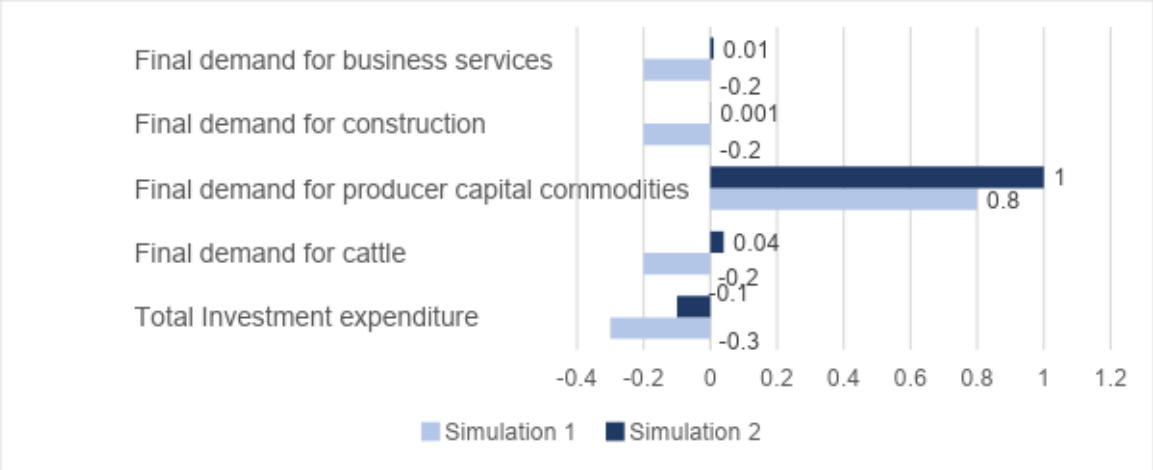
With a 10% reduction in VAT rate on capital commodities, total investment declined in both simulations. This resulted in the reduction in GDP at base prices by 0.03% in Simulation 1 and by 0.1% in Simulation 2. As a result of the 0.1% drop in the consumer price index in both simulations, the real GDP at base prices increased by 0.04% in Simulation 1 and declined by 0.01% in Simulation 2.

Simulating a wage-rate reduction, unemployment increased by 0.1% in Simulation 1. The reason for the increased unemployment rate was as follows: driven by a drop-in government savings, the government reduced investment in construction; as a result, the total output of the construction sector declined, reducing the demand for labour in a sector that employs large numbers of workers.

Reduced government income lowered total investments by 0.3% in Simulation 1 and by 0.1% in Simulation 2. In Simulation 1, the decline in investments was mainly caused by a decrease in public savings that resulted from declining government revenue. In contrast, when government savings were fixed, total investments in Simulation 2 were determined by the savings of firms and households. Those savings decreased by 0.06% for firms and by 0.02% for households, and total investment expenditure in the economy fell as a result.

The decrease in governmental investment expenditures in Simulation 1 lowered the demand for the commodities cattle, construction, and business services by 0.2%. The final demand for capital commodities increased by 0.8% because of a relatively higher decrease in the consumer price index following the reduction in the VAT rate (Figure 4). The effects on final demand for commodities were more positive in Simulation 2. A drop in the price of producer goods leads to increased production which, in turn, leads to increased final demand.

Figure 4: Total Investment and the Final Demand for Commodities



Note: Calculations by authors.

4.2. Impact on Prices and Trade

In both simulations, a reduced VAT rate decreased the domestic and import prices of producer goods by 1.2% and 1.1%, respectively. Similarly, for other commodities, the decrease in domestic prices was higher than the decrease in import prices, which made domestic goods more attractive and increased domestic demand for capital commodities by 0.8% in Simulation 1 and by 0.9% in Simulation 2 (Appendix A7, A8).

Similarly, as the price of imports decreased in Simulation 1, the import of some commodities increased (e.g., producer goods, manufactured products, metal, and some agricultural commodities such as tobacco, wheat, flower, and other crops). In Simulation 2, the increase in imports was smaller and applied only to few sectors: oil, gas, beverages, metals, and capital commodities (Appendix A7, A8).

With the current account balance fixed in both simulations, the increase in imports in some sectors was financed by a decrease in imports in others and an increase in exports. In Simulation 1, imports decreased in twenty-four sectors compared to thirty-five sectors in Simulation 2, including cereals, vegetables, fruit, cattle, poultry, mining, dairy, food, non-metals, transportation, and financial, business, and other services.

The increase in exports was a result of real depreciation which arose from the small-country assumption (international prices were fixed), making export commodities cheaper. Thus, in Simulation 1 and 2, an increase in exports was noted in relevant commodities across all sectors

(Appendix A7, A8). Generally, domestic prices of all commodities decreased more in Simulation 2, while imports prices decreased more in Simulation 1. Given that international prices were fixed, the increase in exports and the decrease in imports was the result of a reduction in the VAT rate on capital commodities and lower prices.

4.3. Effects on Production

Total output increased in fifty-three sectors in Simulation 1, with a significant increase of 0.7% in capital commodities. The only sector in which output decreased was construction (-0.18%) (Appendix 9). There, the 10% reduction in VAT reduced government income, which led to a decrease in final demand for commodities from the construction sector.

In Simulation 2 (Appendix A10) some sectors were more affected than others. Because of the decrease in government expenditures (0.7%) and in total intermediate consumption, the output of the public sectors fell significantly and, therefore, demand for labour was reduced considerably. These sectors are highly labour-intensive (Appendix A1), so employment decreases to compensate when output drops.

Other sectors (water and meat processing) are highly capital intensive. Given that wages declined more than did the rent of capital, more labour was demanded in these sectors and the domestic commodity price decreased.

4.4. Effects on the Factor Market

The 10% VAT decrease on capital commodities depressed wages and capital return for all sectors (Appendix A11, A12). In Simulation 1, the decrease in the wage rate increased labour demand in all sectors except construction where a drop in total output led to a fall in capital and labour demand.

Given the high degree of substitutability between the production factors (labour and capital), the decrease in capital demand in nineteen, less capital-intensive sectors was due to increased labour demand (Appendix A11).

In Simulation 2, a decrease in wage rate increased the demand for workers in most sectors except those that were less labour-intensive (e.g., cattle and raw milk). The decline in the wage rate

increased labour demand because labour becomes relatively cheaper compared to capital. In most sectors, moreover, the wage rate decreased more than did the return of capital. Therefore, demand for capital declined in twenty-nine sectors due to a decrease in return of capital (Appendix A12). The decrease of total output in five sectors (cattle, raw milk, public administration, education, and health) caused a decrease in demand for labour and capital despite the decrease in wages and return of capital.

Unemployment increased for all labour categories in Simulation1 because of a 0.15% decrease in demand for labour in construction, which employs the highest share of labour (labour represented 74.1% of the factors of production in construction; see explanation in Appendix A3). In Simulation 2, on the other hand, the unemployment rate increased only for uneducated and less-educated households in both rural and urban areas (Table 8). The reason is that workers in these households are mostly employed in agriculture (cattle and raw milk) and in governmental sectors in which total production decreased (in industries that employed skilled and highly skilled workers, conversely, production increased). These unemployment results were robust for different values of wage elasticity and elasticity of substitution for composite labour (Appendix A13).

Table 8: Unemployment Rate for Different Labour Categories (Simulations 1 and 2)

labour	Unemployment rate	
	Simulation 1	Simulation 2
flab-rn	0.10	0.05
flab-rp	0.06	0.04
flab-rs	0.10	-0.04
flab-rt	0.07	-0.10
flab-un	0.04	0.01
flab-up	0.03	0.02
flab-us	0.08	-0.11
flab-ut	0.05	-0.12

Note: flab-rn—uneducated rural households; flab-rp—rural households with primary education; flab-rs—rural households with secondary education; flab-rt—rural households with tertiary education; flab-un—uneducated urban households; flab-up—urban households with primary education; flab-rs—urban households with secondary education; flab-rt—urban households with tertiary education.

Note: Calculations by authors.

4.5. Effect on Household Income

Both simulations resulted in a reduction of household labour, capital, transfers, and total incomes. VAT reduction on capital commodities had a small, negative impact on nominal income in Simulation 1. In Simulation 2, rural farm households (compared to other household groups) were less affected by the decrease in the VAT rate on capital commodities (Appendix A14). Moreover, the consumer price index decreased more than did nominal income (Table 7), thereby increasing household purchasing power and, potentially, easing poverty. In fact, the analysis of income-share distribution among household groups and the income inequality ratio corroborated the poverty reduction in Simulation 2 (Appendix A15, A16). For example, the income shares of the bottom 40% of households increased, reducing the income-inequality ratio. A drop-in household income for both rural and urban areas reduced wages in labor-intensive sectors where there was decreased production, further producing a decrease in labour demand and an increase in unemployment.

4.6. Effect on Household Consumption Spending

Both simulations resulted in changes in nominal household consumption, demonstrating that households benefit less from a VAT reduction on capital commodities. Capital commodities are not consumed directly by households, so a relative decrease in commodity prices is of greater benefit to manufacturers. Thus, manufacturers increase their intermediate consumption of capital commodities (Appendix A9, A10). The consumer price index fell by 0.1% in both simulations (Table 7), positively affecting each household's real consumption. This was not true for non-farm rural and urban households with the highest incomes, however (Appendix A9); their income depended more on the wage rate, which decreased more than it did in other household groups. Also, these households received part of their income from return on capital which decreased for all sectors (Appendix A17).

V. Conclusion and Policy Implications

The two simulation scenarios analyzed in this study showed different effects on household budgets and on the economy as a whole. In the first simulation, a 10% reduction in the VAT on

capital commodities, with flexible government savings, was less beneficial to the macro-economy and more favourable to household budgets. The results showed a decline in investment, a reduction in the GDP, and an increase in unemployment for all labour categories. Driven by reduced final demand from government, the labour-intensive construction sector reduced both production and demand for labour, thus increasing the unemployment rate. Under flexible government savings, consequently, a reduction in the VAT on capital commodities would slow economic growth and impede government efforts to reduce poverty and income inequality.

The second simulation, in which the VAT rate on capital commodities was reduced while government savings remained fixed, was promising in improving the real consumption of poor and medium-income households. A decline in government spending negatively affected the output of the government, livestock, and services sectors. The results also showed that, despite a marginal reduction of investment in the economy, total output and exports increased in the industrial sector and led to an average decrease in the unemployment rate. Households with secondary and tertiary education benefited more from this reduction in unemployment than did other households because their members were employed in sectors whose total output rose.

Overall, the results of the simulations showed that, standing alone, the reduction of the VAT on capital commodities had only a small redistributive effect on inequality and poverty. While reductions in the VAT on producer goods can be effective as an industry-specific subsidy, then, they are not an instrument of income redistribution or poverty alleviation. VAT reductions might be tied to commitments by industries to develop compensation measures that would ensure that the benefits of VAT reduction would reach consumers, employees, suppliers, and the economy as a whole. These might include (a) passing on at least 50% of the VAT reduction in the form of lower prices; (b) creating an agreed-upon number of new jobs; (c) providing social services to the community, or other measures.

The importance of the manufacturing and construction sectors in Tanzania's economy today means that a VAT rate reduction under fixed government savings is more beneficial than one in which government savings are flexible. Therefore, the vision of establishing an industrialized economy in Tanzania through a reduction of the VAT on capital commodities is potentially attainable.

Policy makers should take note: modelling shows that a VAT reduction with fixed government saving could boost growth and require little or no rewriting of tax laws or creation of

new collection mechanisms. Similarly, lower VAT payments on items such as capital goods could stimulate spending in other areas of the economy in line with the vision for Tanzanian industrialization. Finally, Tanzania's tax system faces a range of long-term challenges, and a VAT rate cut could help make the system more growth-supporting. If that were the case, tax revenues would be sustained over time and (as one example) could be channeled into poverty-alleviation measures.

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Appendices

Appendix A1: Equations in Model

Production

1. $$VA_j = v_j XST_j$$
2. $$CI_j = io_j XST_j$$
3. $$VA_j = B_j^{VA}[\beta_j^{VA} LDC_j^{-\rho_j^{VA}} + (1-\beta_j^{VA}) KDC_j^{-\rho_j^{VA}}]^{-\frac{1}{\rho_j^{VA}}}$$
4. $$LDC_j = \left[\frac{\beta_j^{VA}}{1-\beta_j^{VA}} \frac{RC_j}{WC_j}\right]^{\sigma_j^{VA}} KDC_j$$
5. $$LDC_j = B_j^{LD}\left[\sum_l \beta_{l,j}^{LD} LD_{l,j}^{-\rho_j^{LD}}\right]^{-\frac{1}{\rho_j^{LD}}}$$
6. $$LD_{l,j} = \left[\frac{\beta_{l,j}^{LD} WC_j}{WTI_{l,j}}\right]^{\sigma_j^{LD}} \left(B_j^{LD}\right)^{\sigma_j^{LD}-1} LDC_j$$
7. $$KDC_j = B_j^{KD}\left[\sum_k \beta_{k,j}^{KD} KD_{k,j}^{-\rho_j^{KD}}\right]^{-\frac{1}{\rho_J^{KD}}}$$
8. $$KD_{k,j} = \left[\frac{\beta_{k,j}^{KD} RC}{RTI_{k,j}}\right]^{\sigma_j^{KD}} \left(B_j^{KD}\right)^{\sigma_j^{KD}-1} KDC_j$$
9. $$DI_{i,j} = aij_{i,j} CI_j$$

Income and Savings

Households

10. $$YH_h = YHL_h + YHK_h + YHTR_h$$
11. $$YHL_h = \sum_l \lambda_{h,l}^{WL}\left(W_l \sum_j LD_{l,j}\right)$$
12. $$YHK_h = \sum_k \lambda_{h,k}^{RK}\left(\sum_j R_{k,j} KD_{k,j}\right)$$
13. $$YHTR_h = \sum_{ag} TR_{h,ag}$$
14. $$YDH_h = YH_h - TDH_h - TR_{gvt,h}$$
15. $$CTH_h = YDH_h - SH_h - \sum_{agng} TR_{agng,h}$$
16. $$SH_h = PIXCON^{\eta} sh0_h + sh1_h YDH_h$$

Businesses

17. $$YF_f = YFK_f + YFTR_f$$

18. $$YFK_f = \sum_k \lambda_{f,k}^{RK} \left(\sum_j R_{k,j} KD_{k,j} \right)$$

19. $$YFTR_f = \sum_{ag} TR_{f,ag}$$

20. $$YDF_f = YF_f - TDF_f$$

21. $$SF_f = YDF_f - \sum_{ag} TR_{ag,f}$$

Government

22. $$YG = YGK + TDHT + TDFT + TPRODN + TPRCTS + YGTR$$

23. $$YGK = \sum_k \lambda_{gvt,k}^{RK} \left(\sum_j R_{k,j} KD_{k,j} \right)$$

24. $$TDHT = \sum_h TDH_h$$

25. $$TDFT = \sum_f TDF_f$$

26. $$TPRODN = TIWT + TIKT + TIPT$$

27. $$TIWT = \sum_{l,j} TIW_{l,j}$$

28. $$TIKT = \sum_{k,j} TIK_{k,j}$$

29. $$TIPT = \sum_j TIP_j$$

30. $$TPRCTS = TICT + TIMT + TIXT$$

31. $$TIEDCT = \sum_i TIEDC_i$$

32. $$TIVATCT = \sum_i TIVATC_i$$

33. $$TIOTCT = \sum_i TIOTC_i$$

34. $$TICT = TIEDCT + TIVATCT + TIOTCT$$

35. $$TIMT = \sum_i TIM_i$$

36. $$TIMT = \sum_i TIM_i$$

37. $$TIXT = \sum_i TIX_i$$

38. $$YGTR = \sum_{agng} TR_{gvt,agng}$$

39. $$TDH_h = PIXCON^{\eta} ttdh0_h + ttdh1_h YH_h$$

40. $$TDF_f = PIXCON^{\eta} ttdf0_f + ttdf1_1 YFK_f$$

41. $$TIW_{l,j} = ttiw_{l,j} W_l LD_{l,j}$$

42. $$TIK_{k,j} = ttik_{k,j} R_{k,j} KD_{k,j}$$

43. $$TIP_j = ttip_j PP_j XST_j$$

44. $$TIEDC_i = tedc_i\left[\left(PL_i + \sum_{ij} PC_{ij} tmrg_{ij,i}\right)DD_i + \left((1+ttim_i)PWM_i e + \sum_{ij} PC_{ij} tmrg_{ij,i}\right)IM_i\right]$$

45. $$TIVATC_i = tvatc_i\left[\left(PL_i + \sum_{ij} PC_{ij} tmrg_{ij,i}\right)DD_i + \left((1+ttim_i)PWM_i e + \sum_{ij} PC_{ij} tmrg_{ij,i}\right)IM_i\right]$$

46. $$TIOTC_i = totc_i\left[\left(PL_i + \sum_{ij} PC_{ij} tmrg_{ij,i}\right)DD_i + \left((1+ttim_i)PWM_i e + \sum_{ij} PC_{ij} tmrg_{ij,i}\right)IM_i\right]$$

47. $$TIM_i = ttim_i PWM_i eIM_i$$

48. $$TIX_i = ttix_i\left(PE_i + \sum_{ij} PC_{ij} tmrg^X_{ij,i}\right)EXD_i$$

49. $$SG = YG - \sum_{agng} TR_{agng,gvt} - G$$

Rest of the World

50. $$YROW = e\sum_i PWM_i IM_i + \sum_k \lambda^{RK}_{row,k}\left(\sum_j R_{k,j} KD_{k,j}\right) + \sum_{agd} TR_{row,agd}$$

51. $$SROW = YROW - \sum_i PE_i^{FOB} EXD_i - \sum_{agd} TR_{agd,row}$$

52. $$SROW = -CAB$$

Transfers

53. $$TR_{agng,h} = \lambda^{TR}_{agng} YDH_h$$

54. $$TR_{gvt,h} = PIXCON^{\eta} tr0_{gvt,h} + tr1_{gvt,h} YH_h$$

55. $$TR_{ag,f} = \lambda^{TR}_{ag,f} TDF_f$$

56. $$TR_{agng,gvt} = PIXCON^{\eta} TR^0_{agng,gvt}$$

57. $$TR_{agd,row} = PIXCON^{\eta} TR^0_{agd,row}$$

Demand

58. $$PC_i C_{i,h} = PC_i C^{MIN}_{i,h} + \gamma^{LES}_{i,h}\left(CTH_h - \sum_{ij} PC_{ij} C^{MIN}_{ij,h}\right)$$

59. $$GFCF = IT - \sum_i PC_i VSTK_i$$

60. $$PC_i INV_i = \gamma_i^{INV} GFCF$$

61. $$PC_i CG_i = \gamma_i^{GVT} G$$

62. $$DIT_i = \sum_j DI_{i,j}$$

63. $$MRGN_i = \sum_{ij} tmrg_{i,ij} DD_{ij} + \sum_{ij} tmrg_{i,ij} IM_{ij} + \sum_{ij} tmrg^X_{i,ij} EXD_{ij}$$

Producer Supplies of Products and International Trade

64. $$XST_j = B_j^{XT}\left[\sum_i \beta_{j,i}^{XT} XS_{j,i}^{\rho_j^{XT}}\right]^{\frac{1}{\rho_j^{XT}}}$$

65. $$XS_{j,i} = \frac{XST_j}{\left(B_j^{XT}\right)^{1+\sigma_j^{XT}}}\left[\frac{P_{j,i}}{\beta_{j,i}^{XT} PT_j}\right]^{\sigma_j^{XT}}$$

66. $$XS_{j,i} = B_{j,i}^{X}\left[\beta_{j,i}^{X} EX_{j,i}^{\rho_{j,i}^{X}} + \left(1-\beta_{j,i}^{X}\right)DS_{j,i}^{\rho_{j,i}^{X}}\right]^{\frac{1}{\rho_{j,i}^{X}}}$$

67. $$EX_{j,i} = \left[\frac{1-\beta_{j,i}^{X}}{\beta_{j,i}^{X}}\frac{PE_i}{PL_i}\right]^{\sigma_{j,i}^{X}} DS_{j,i}$$

68. $$EXD_i = EXD_i^o\left(\frac{ePWX_i}{PE_i^{FOB}}\right)^{\sigma_i^{XD}}$$

69. $$Q_i = B_i^M\left[\beta_i^M IM_i^{-\rho_i^M} + \left(1-\beta_i^M\right)DD_i^{-\rho_i^M}\right]^{\frac{1}{\rho_i^M}}$$

70. $$IM_i = \left[\frac{\beta_i^M}{1-\beta_i^M}\frac{PD_i}{PM_i}\right]^{\sigma_i^M} DD_i$$

Prices

71. $$PP_j = \frac{PVA_j VA_j + PCI_j CI_j}{XST_j}$$

72. $$PT_j = \left(1+ttip_j\right)PP_j$$

73. $$PCI_j = \frac{\sum_i PC_i DI_{i,j}}{CI_j}$$

74. $$PVA_j = \frac{WC_j LDC_j + RC_j KDC_j}{VA_j}$$

75. $$WC_j = \frac{\sum_l WTI_{l,j} LD_{l,j}}{LDC_j}$$

76. $$WTI_{l,j} = W_l\left(1+ttiw_{l,j}\right)$$

77. $$RC_j = \frac{\sum_k RTI_{k,j} KD_{k,j}}{KDC_j}$$

78. $$RTI_{k,j} = R_{k,j}\left(1+ttik_{k,j}\right)$$

79. $$R_{k,j} = RK_k$$

80. $$PT_j = \frac{\sum_i P_{j,i} XS_{j,i}}{XST_j}$$

81. $$P_{j,i} = \frac{PE_i EX_{j,i} + PL_i DS_{j,i}}{XS_{j,i}}$$

82. $$PE_i^{FOB} = \left(PE_i + \sum_{ij} PC_{ij} tmrg_{ij,i}^{X} \right)\left(1 + ttix_i\right)$$

83. $$PD_i = \left(1 + (tedc_i + tvatc_i + totc_i)\right)\left(PL_i + \sum_{ij} PC_i tmrg_{ij,i} \right)$$

84. $$PM_i = \left(1 + (tedc_i + tvatc_i + totc_i)\right)\left(\left(1 + ttim_i\right) ePWM + \sum_{ij} PC_{ij} tmrg_{ij,i} \right)$$

85. $$PC_i = \frac{PM_i IM_i + PD_i DD_i}{Q_i}$$

86. $$PIXGDP = \sqrt{\frac{\sum_j \left(PVA_j + \frac{TIP_j}{VA_j} \right) VA_j^O}{\sum_j \left(PVA_j^O VA_j^O \right)} \frac{\sum_j \left(PVA_j VA_j + TIP_j \right)}{\sum_j \left(PVA_j^O + \frac{TIP_j^O}{VA_j^O} \right) VA_j}}$$

87. $$PIXCON = \frac{\sum_i PC_i \sum_h C_{i,h}^O}{\sum_{ij} PC_{ij}^O \sum_h C_{ij,h}^O}$$

88. $$PIXINV = \prod_i \left(\frac{PC_i}{PC_i^O} \right)^{\gamma_i^{INV}}$$

89. $$PIXGVT = \prod_i \left(\frac{PC_i}{PC_i^O} \right)^{\gamma_i^{GVT}}$$

Equilibrium

90. $$Q_i = \sum_h C_{i,h} + CG_i + INV_i + VSTK_i + DIT_i + MRGN_i$$

91. $$\sum_j LD_{l,j} = LS_l$$

92. $$\sum_j KD_{k,j} = KS_k$$

93. $$IT = \sum_h SH_h + \sum_f SF_f + SG + SROW$$

94. $$\sum_j DS_{j,i} = DD_i$$

95. $$\sum_j EX_{j,i} = EXD_i$$

Where

CI_j : Total intermediate consumption of industry j

VA_j : Value added of industry j

XST_j : Total aggregate output of industry j

io_j : Coefficient (Leontief - intermediate consumption)

v_j : Coefficient (Leontief - value added)

KDC_j : Industry j demand for composite capital

LDC_j : Industry j demand for composite labour

B_j^{VA} : Scale parameter (CES - value added)

β_j^{VA} : Share parameter (CES- value added)

ρ_j^{VA} : Elasticity parameter (CES - value added); -1< ρ_j^{VA} <∞

RC_j : Rental rate of industry j composite capital

WC_j : Wage rate of industry j composite labour

σ_j^{VA} : Elasticity of transformation (CES - value added); 0< σ_j^{VA} <∞

$KD_{k,j}$: Demand for type k capital by industry j

$LD_{l,j}$: Demand for type l labour by industry j

$RTI_{k,j}$: Rental rate paid by industry j for type k capital, including capital taxes

$WTI_{l,j}$: Wage rate paid by industry j for type l labour, including payroll taxes

B_j^{KD} : Scale parameter (CES - composite capital)

B_j^{LD} : Scale parameter (CES - composite labour)

$\beta_{k,j}^{KD}$: Share parameter (CES - composite capital)

$\beta_{l,j}^{LD}$: Share parameter (CES - composite labour)

ρ_j^{KD} : Elasticity parameter (CES - composite capital); -1< ρ_j^{KD} <∞

ρ_j^{LD} : Elasticity parameter (CES - composite labour); -1< ρ_j^{LD} <∞

σ_j^{KD} : Elasticity of substitution (CES - composite capital); 0< σ_j^{KD} <∞

σ_j^{LD} : Elasticity of substitution (CES - composite labour); 0< σ_j^{LD} <∞

$DI_{i,j}$: Intermediate consumption of commodity i by industry j

$aij_{i,j}$: Input- output coefficient

YH_h : Total income of type h households

YHK_h : Capital income of type h households

YHL_h : Labour income of type h households

$YHTR_h$: Transfer income of type h households

$R_{k,j}$: Rental rate of type k capital in industry j

$TR_{h,ag}$: Transfers from agent ag to type h households

W_l: Wage rate of type l labour

$\lambda^{RK}_{h,k}$: Share of type k capital income received by type h households

$\lambda^{WL}_{h,l}$: Share of type l labour income received by type h households

CTH_h: Consumption budget of type h households

$PIXCON$: Consumer price index

SH_h: Savings of type h households

TDH_h: Income taxes of type h households

YDH_h: Disposable income of type h households

η: Price elasticity of indexed transfers and parameters

$sh0_h$: Intercept (type h households' savings)

$sh1_h$: Slope (type h households' savings)

$agng$: Index of non-government agents

YF_f: Total income of type f businesses

YFK_f: Capital income of type f businesses

$YFTR_f$: Transfer income of type f businesses

SF_f: Savings of type f businesses

TDF_f: Income taxes of type f businesses

YDF_f: Disposable income of type f businesses

$TDFT$: Total government revenue from business income taxes

$TDHT$: Total government revenue from household income taxes

$TIEDC_i$: Government revenue from excise duties on product i

$TIVATC_i$: Government revenue from VAT on product i

$TIOTC_i$: Government revenue from other taxes on product i

$TICT$: Total government receipts if indirect taxes on commodities

$TIK_{k,j}$: Government revenue from taxes on type k capital used by industry j

$TIKT$: Total government revenue from taxes on capital

TIM_i: Government revenue from import duties on product i

$TIMT$: Total government revenue from import duties

TIP_j: Government revenue from taxes on industry j production

$TIPT$: Total government revenue from production taxes

$TIW_{l,j}$: Government revenue from payroll taxes on type l labour in industry j

$TIWT$: Total government revenue from payroll taxes

TIX_i: Government revenue from export taxes on product i

$TIXT$: Total government revenue from export taxes

$TPRCTS$: Total government revenue from taxes on products and imports

$TPRODN$: Total government revenue from other taxes on production

YG : Total government income

YGK : Government capital income

$YGTR$: Government transfer income

$ttdf0_f$: Intercept (income taxes of type f businesses)

$ttdf1_1$: Marginal income tax rate on type f businesses

$ttdh0_h$: Intercept (income taxes of type h households)

$ttdh1_h$: Marginal income tax rate of type h households

PP_j : Industry j unit cost, including taxes directly related to the use of capital and labour but excluding other taxes on production

$ttik_{k,j}$: Tax rate on type k capital used in industry j

$ttip_j$: Tax rate on the production of industry j

$ttiw_{l,j}$: Tax rate on type l worker compensation in industry j

DD_i : Domestic demand for commodity i produced locally

e : Exchange rate; price of foreign currency in terms of local currency

EX_i : Quantity of product i exported

IM_i : Quantity of product i imported

PE_i : Price received for exported commodity i (excluding export taxes)

PL_i : Price of local product i (excluding all taxes on products)

PWM_i : World price of imported product i (expressed in foreign currency)

$tedc_i$: Excise duty rate on commodity i

$tvatc_i$: VAT rate on commodity i

$totc_i$: Other tax rate on commodity i

$ttim_i$: Rate of taxes and duties on imports of commodity i

$ttix_i$: Export tax rate on exported commodity i

$tmrg_{ij,i}$: Rate of margin ij applied to commodity i

$tmrg^X_{ij,i}$: Rate of margin ij applied to export of commodity i

SG : Government savings

G : Current government expenditures on goods and services

CAB: Current account balance

PE_i^{FOB}: FOB price of exported product i

$SROW$: Rest of the world savings

$YROW$: Rest of the world income

$\lambda_{ag,agj}^{TR}$: Share parameter (transfer functions)

$tr0_{gvt,h}$: Intercept (transfers by type h households to government)

$tr1_{gvt,h}$: Marginal rate of transfers by type h households to government

$C_{i,h}$: Consumption of commodity i by type h households

$C_{i,h}^{MIN}$: Minimum consumption of commodity i by type h households

PC_i: Purchaser price of composite commodity i (including all taxes and margins)

$\gamma_{i,h}^{LES}$: Marginal share of commodity i in type h household consumption budget

$GFCF$: Gross fixed capital formation

INV_i: Final demand of commodity i for investment purposes

IT: Total investment expenditures

$VSTK_i$: Inventory change of commodity i

γ_i^{INV}: Share of commodity i in total investment expenditures

CG_i: Public consumption of commodity i (volume)

γ_i^{GVT}: Share of commodity i in total current public expenditures

DIT_i: Total intermediate demand for commodity i

$MRGN_i$: Demand for commodity i as a trade or transport margin

$XS_{j,i}$: Industry j production of commodity i

B_j^X: Scale parameter (CET-total output)

$\beta_{j,i}^{XT}$: Share parameter (CET-total output)

ρ_j^{XT}: Elasticity parameter (CET-total output); $1<\rho_j^{XT}<\infty$

$P_{j,i}$: Basic price of industry j's production of commodity i

σ_j^{XT}: Elasticity of transformation (CET- total output); $0<\sigma_j^{XT}<\infty$

$DS_{j,i}$: Supply of commodity i by sector j to the domestic market

$B_{j,i}^X$: Scale parameter (CET- exports and local sales)

$\beta_{j,i}^X$: Share parameter (CET- exports and local sales)

$\rho^{X}_{j,i}$: Elasticity parameter (CET- exports and local sales); 1< $\rho^{X}_{j,i}$ <∞

$\sigma^{X}_{j,i}$: Elasticity of transformation (CET- exports and local sales); 0< $\sigma^{X}_{j,i}$ <∞

EXD_i : World demand for exports of product i

PE^{FOB}_i : FOB price of exported commodity i (in local currency)

PWX_i : World price of exported product i (expressed in foreign currency)

σ^{XD}_i : Price- elasticity of the world demand for exports of product i

Q_i : Quantity demanded of composite commodity i

B^{M}_i : Scale parameter (CES- composite commodity)

β^{M}_i : Share parameter (CES- composite commodity)

ρ^{M}_i ; Elasticity parameter (CES- composite commodity); -1< ρ^{M}_i <∞

PD_i : Price of local product i sold on the domestic market (including all taxes and margins)

PM_i : Price of imported product i (including all taxes and margins)

σ^{M}_i : Elasticity of substitution (CES - composite commodity); 0< σ^{M}_i <∞

PT_j : Basic price of industry j 's output

PCI_j : Intermediate consumption price index of industry j

RK_k : Rental rate of type k capital (if capital is mobile)

$PIXGDP$: GDP Deflator

$PIXGVT$: Public expenditures price index

$PIXINV$: Investment price index

LS_l : Supply of type l labour

KS_k : Supply of type k capital

Appendix A2: Modeling the Labour Market

Initially, we added the endogenous variable UN (number of unemployed people) to the labour-supply equation. In so doing, the equilibrium condition for the labour market (equation 1) was adjusted.

$$LS_l = \left(\sum_j LD_{j,l}\right) + UN_l \qquad (1)$$

where

LS_l was labour supply by a specific type of worker;

$LD_{j,l}$ was labour demand for a particular type of worker denoted by l within a specific sector j;
A_l was the number of people in the economy who are unemployed by type of worker.

Thus, we can replace the number of unemployed people in the economy with an unemployment rate. This can be presented as follows in Equation 2:

$$LS_l = \frac{(\Sigma_j LD_{j,l})}{1-UNR_l} \qquad (2)$$

Finally, a wage curve equation was introduced and presented in Equation 3:

$$W_l = A_l UNR_l^{\varepsilon_l} PIXCON \qquad (3)$$

where

W_l was the wage rate of a specific type of worker;
A_l was a level parameter;
UNR_l was the unemployment rate by type of worker
ε_l was wage elasticity with respect to unemployment, with a value of -0.1;-0.09; and -0.01 which were obtained at the range of 10% and -10% of the original value.
$PIXCON$ stands for the consumer price index.

Appendix A3: Production Structure by Sector

Activity	Domestic production, % of total	GDP at base prices, % of total
Agriculture	**19.0**	**30.3**
Maize	2.2	3.1
Sorghum and millet	0.3	0.4
Rice	1.1	1.3
Wheat and barley	0.0	0.1
Other cereals	0.0	0.0
Pulses	1.2	2.3
Groundnuts	0.5	0.7
Other Oil seeds	0.3	0.8
Cassava	0.8	1.3
Other roots	0.9	1.3
Vegetables	1.0	1.5
Sugar cane	0.1	0.2
Cotton and fibre	-	0.1
Fruits and nuts	2.1	3.8
Cash crops (Aggregated: Cocoa, coffee and tobacco)	0.1	0.3
Tea leaves	-	0.0
Cut flowers	0.0	0.1

Other crops	-	0.1
Cattle	2.4	3.3
Raw milk	1.6	2.4
Small ruminants	0.4	0.5
Poultry	0.4	0.5
Other livestock	0.2	0.2
Forestry	1.6	3.6
Fishing	1.8	2.5
Industry	**32.8**	**25.3**
Coal and other mining (Aggregated: Coal, lignite, and other mining)	1.0	2.1
Meat processing	0.1	0.1
Fish and seafood processing	0.1	0.1
Fats and vegetable processing (Aggregated: Fats, oils, fruits, and vegetable processing)	0.0	0.3
Dairy	0.1	0.0
Grain milling	1.2	1.4
Sugar refining	0.7	0.7
Other foods	0.4	0.3
Animal feed	0.0	0.0
Luxury foodstuff (Aggregated: Beverage and tobacco processing)	0.7	1.5
Paper, fiber, and leather products (Aggregated: Paper products and publishing, textiles, foot wear and leather, clothing and wood products)	0.1	0.4
Other chemicals (Aggregated: Chemicals including petroleum, fertilizer, and pesticides)	0.4	0.4
Non-metal minerals	0.3	0.3
Metal and metal products	0.0	0.1
Other manufacturing		0.2
Capital commodities (Aggregated: Electricity, gas and steam, electric equipment, machinery, vehicles and transportation equipment)	0.8	1.3
Water supply and sewage	0.3	0.3
Construction	26.4	15.7
Services	**48.2**	**44.4**
Wholesale and retail trade	13.1	12.3
Transportation and storage	6.4	4.9
Accommodation and food services	1.8	1.2
Information and communication	2.7	2.4
Finance and insurance	2.8	2.8
Real estate activities	2.1	3.0
Business services	6.9	5.1
Public administration	6.8	6.8
Education	2.6	2.9
Health and social work	1.6	1.6
Other services	1.3	1.3
Total	**100**	**100**

Calculations based on the 2015 SAM for Tanzania (Randriamamonjy & Thurlow, 2017)

Appendix A4: Contribution of Production factors by Sector, Values Added, by percent

	Labour	Capital	Land	Total
Agriculture	**37.4**	**32.9**	**29.7**	**100**
Maize	17.1	10.1	72.8	100
Sorghum and millet	12.5	8.3	79.2	100
Rice	16.5	34.4	49.1	100
Wheat and barley	19.9	37.3	42.9	100
Other cereals	19.3	37.3	43.4	100
Pulses	37	23	40	100
Groundnuts	36	27.8	36.2	100
Other Oil seeds	34.2	31.3	34.4	100
Cassava	48.9	9.4	41.7	100
Other roots	63.6	8.1	28.3	100
Vegetables	32.2	18.9	48.9	100
Sugar cane	40.8	36.5	22.8	100
Cotton and fibers	49.7	35.1	15.2	100
Fruits and nuts	36	24.8	39.2	100
Cash crops (Aggregated: Cocoa, coffee and tobacco)	45.4	32.7	22	100
Tea leaves	50.7	34.8	14.5	100
Cut flowers	26.7	18.2	55	100
Other crops	26.8	18.4	54.8	100
Cattle	34	66	-	100
Raw milk	39.6	60.4	-	100
Small ruminants	42.1	57.9	-	100
Poultry	31.7	68.3	-	100
Other livestock	40.3	59.7	-	100
Forestry	80.6	19.4	-	100
Fishing	54.5	45.5	-	100
Industry	**23.9**	**76.1**	-	100
Coal and other mining (Aggregated: Coal, lignite and other mining)	12.5	87.5	-	100
Other mining	22.3	77.7	-	100
Meat processing	2.8	97.2	-	100
Fish and seafood processing	24.2	75.8	-	100

Fats and vegetable processing (Aggregated: Fats, oils, fruits, and vegetable processing)	6.2	93.8	-	100
Dairy	11	89	-	100
Grain milling	19.1	80.9	-	100
Sugar refining	8.8	91.2	-	100
Other foods	16.6	83.4	-	100
Animal feed	27.2	72.8	-	100
Luxury foodstuff (Aggregated: Beverage and tobacco processing)	17.5	82.5	-	100
Paper, fiber and leather products (Aggregated: Paper products and publishing, textiles, foot wear and leather, clothing and wood products)	33.1	66.9	-	100
Other chemicals (Aggregated: Chemicals including petroleum, fertilizer and pesticides)	15.4	84.6	-	100
Non-metal minerals	18.2	81.8	-	100
Metal and metal products	25.9	74.1	-	100
Other manufacturing	18.8	81.2	-	100
Capital commodities (Aggregated: Electricity, gas and steam, electric equipment, machinery, vehicles and transportation equipment)	55.7	44.3	-	100
Water supply and sewage	44.7	55.3	-	100
Construction	74.1	25.9	-	100
Services	**62.2**	**37.8**	-	100
Wholesale and retail trade	63.1	36.9	-	100
Transportation and storage	41.5	58.5	-	100
Accommodation and food services	53.7	46.3	-	100
Information and communication	23.8	76.2	-	100
Finance and insurance	39.6	60.4	-	100
Real estate activities	7.4	92.6	-	100
Business services	94.5	5.5	-	100
Public administration	96.6	3.4	-	100
Education	97.2	2.8	-	100
Health and social work	97.3	2.7	-	100
Other services	69.7	30.3	-	100

Calculations based on the 2015 SAM for Tanzania (Randriamamonjy & Thurlow, 2017)

Appendix A5: Income Sources by Household Category: Rural and Urban Households with and without Crop and/or Livestock Incomes, by Percent

Household categories	Wage	Land returns	Capital income from crops	Capital income from livestock	Public transfers	Firm transfers (dividends)	Foreign transfers
Rural households with crop and/or livestock incomes	**100**	**100**	**100**	**100**	**100**	**100**	**100**
hhd-f1	12	14.2	14.2	11.9	5.5	9.2	3.2
hhd-f2	17.5	18.9	18.8	15.3	10.2	15.5	12.7
hhd-f3	20.3	20.8	20.8	24.2	19.8	27.7	15.5
hhd-f4	25.9	23.6	23.6	24.4	27.7	27.2	26.8
hhd-f5	24.3	22.5	22.6	24.2	36.7	20.4	41.8
Rural households without crop and/or livestock incomes	**100**	**-**	**-**	**-**	**100**	**100**	**100**
hhd-n1	4.5	-	-	-	2.1	2.5	1
hhd-n2	8.4	-	-	-	5.6	12.8	3.2
hhd-n3	10.2	-	-	-	8.8	21.4	6.5
hhd-n4	19.8	-	-	-	20.1	23.8	11.2
hhd-n5	57.1	-	-	-	63.4	39.5	78
Urban households with or without crop and/or livestock incomes	**100**	**100**	**100**	**100**	**100**	**100**	**100**
hhd-u1	1.3	9.0	9.0	2.1	0.2	1.2	0.1
hhd-u2	2.7	9.9	9.9	4.9	1.7	4.6	0.7
hhd-u3	5.8	15.4	15.4	14.7	3.5	7.3	3
hhd-u4	15	22.2	22.2	21.6	16.4	18.1	8.6
hhd-u5	75.1	43.3	43.4	56.8	78.1	68.8	87.5

Notes: hhd-f1—poor rural farm households with lowest income; hhd-f2—poor rural farm households with low income; hhd-f3 -rural farm households with medium income; hhd-f4— rural farm households with high income; hhd-f5—rural farm households with highest income; hhd-n1—poor rural non-farm households with lowest income; hhd-n2—poor rural non-farm households with low income; hhd-n3—rural non-farm households with medium income; hhd-n4—rural non-farm households with high income; hhd-n5—rural non-farm households with highest income; hhd-u1—poor urban households with lowest income; hhd-u2—poor urban households with low income; hhd-u3—urban households with medium income; hhd-u4—urban households with high income; hhd-u5—urban households with highest income.

Calculations based on the 2015 SAM for Tanzania (Randriamamonjy & Thurlow, 2017)

Appendix A6: Effective VAT Rate across Sectors

Sectors	Effective VAT rate
Cut flowers	0.002
Coal and other mining (Aggregated: Coal, lignite and other mining)	0.008
Meat processing	0.005
Fish and seafood processing	0.063
Fats and vegetable processing (Aggregated: Fats, oils, fruits, and vegetable processing)	0.506
Dairy	0.018
Grain milling	0.104
Sugar refining	0.2
Other foods	0.098
Luxury foodstuff (Aggregated: Beverage and tobacco processing)	0.138
Paper, fiber and leather products (Aggregated: Paper products and publishing, textiles, foot wear and leather, clothing and wood products)	0.125
Other chemicals (Aggregated: Chemicals including petroleum, fertilizer and pesticides)	0.05
Non-metal minerals	0.094
Metal and metal products	0.062
Other manufacturing	0.044
Capital commodities (Aggregated: Electricity, gas and steam, electric equipment, machinery, vehicles and transportation equipment)	0.118
Water supply and sewage	0.0001
Construction	0.009
Wholesale and retail trade	0.0001
Transportation and storage	0.004
Accommodation and food services	0.032
Information and communication	0.055
Business services	0.009
Other services	0.007

Calculations based on the 2015 SAM for Tanzania (Randriamamonjy & Thurlow, 2017)

Appendix A7: Impact on Prices and Volumes (Simulation 1)

Commodities	Price change %				Volume change %				
	domestic	imports	producer	exports	domestic demand	imports	domestic supply	exports	Total output
Maiz	-0.04	-0.01	-0.03	-0.02	0.04	-0.02	0.04	0.05	0.04
Csorg	-0.03	-	-0.03	-	0.04	-	0.04	-	0.04
Crice	-0.04	-0.02	-0.03	-0.03	0.04	-0.01	0.04	0.05	0.04
Cwhea	-0.05	-0.02	-0.03	-0.04	0.11	0.06	0.11	0.09	0.11
Cocer	-0.06	-	-0.03	-0.03	0.05	-	0.05	0.06	0.06
Cpuls	-0.06	-0.02	-0.05	-0.03	0.04	-0.05	0.04	0.07	0.05
Cgnut	-0.05	0.00	-0.04	-	0.03	-0.06	0.03	-	0.03
Coils	-0.04	0.00	-0.04	-0.05	0.13	0.06	0.13	0.10	0.12
Ccass	-0.07	-	-0.06	-	0.04	-	0.04	-	0.04
Croot	-0.08	-	-0.07	-0.05	0.04	-	0.04	0.09	0.04
Cvege	-0.07	-0.04	-0.04	-0.03	0.04	-0.01	0.04	0.06	0.04
Csugr	-0.07	-	-0.06	-	0.07	-	0.07	-	0.07
Ccott	-0.11	-	-0.16	-0.14	0.22	-	0.22	0.28	0.28
Cfrui	-0.05	-0.01	-0.05	-0.03	0.04	-0.05	0.04	0.06	0.04
Ctoba	-0.07	-0.04	-0.05	-0.06	0.12	0.06	0.12	0.11	0.12
Cteal	-0.11	-0.08	-0.16	-0.11	0.13	0.07	0.13	0.22	0.21
Cflwr	-0.07	-0.05	-0.03	-0.03	0.07	0.04	0.07	0.07	0.07
Cocrp	-0.08	-0.07	-0.03	-0.04	0.08	0.05	0.08	0.07	0.07
Ccatt	-0.05	0.00	-0.05	-0.04	0.04	-0.06	0.04	0.07	0.04
Cmilk	-0.06	-	-0.05	-	0.04	-	0.04	-	0.04
Csmlr	-0.06	-	-0.06	-	0.05	-	0.05	-	0.05
Cpoul	-0.06	0.01	-0.06	-	0.10	-0.01	0.10	-	0.10
Coliv	-0.06	-	-0.06	-0.05	0.07	-	0.07	0.09	0.07
Cfore	-0.11	-0.02	-0.11	-0.05	-0.01	-0.18	-0.01	0.11	0.06
Cfish	-0.07	-	-0.07	-0.05	0.05	-	0.05	0.10	0.05
Ccoil	-	-0.01	-	-	-	0.10	-	-	-
Cngas	-	-0.01	-	-	-	0.10	-	-	-
Comin	-0.14	-0.01	-0.14	-0.06	-0.06	-0.31	-0.06	0.11	0.04

Cmeat	-0.07	-0.02	-0.06	-0.06	0.12	0.02	0.12	0.12	0.12
Cfsea	-0.10	-0.05	-0.10	-0.08	0.14	0.03	0.14	0.17	0.16
Cfoil	-0.08	-0.05	-0.06	-0.06	0.11	0.05	0.11	0.11	0.11
Cdair	-0.09	0.00	-0.09	-0.07	0.11	-0.07	0.11	0.14	0.11
Cgmll	-0.08	-0.05	-0.06	-0.05	0.07	0.02	0.07	0.09	0.07
Csref	-0.08	-0.04	-0.07		0.07	-0.01	0.07	-	0.07
Cfood	-0.09	-0.02	-0.09	-0.07	0.10	-0.03	0.10	0.14	0.11
Cfeed	-0.08	-0.02	-0.08	-0.05	0.05	-0.08	0.05	0.11	0.06
Cbeve	-0.07	-0.05	-0.05	-0.06	0.14	0.08	0.14	0.12	0.13
Cpapr	-0.12	-0.07	-0.16	-0.10	0.09	-0.02	0.09	0.20	0.18
Cchem	-0.09	-0.02	-0.09	-0.06	0.08	-0.06	0.08	0.13	0.1
Cnmet	-0.17	-0.04	-0.21	-0.12	0.07	-0.20	0.07	0.25	0.14
Cmetl	-0.14	-0.01	-0.14	-0.14	0.27	0.01	0.27	0.28	0.28
Coman	-0.10	-0.04	-0.10	-0.08	0.13	0.02	0.13	0.16	0.13
celec	-1.2	-1.1	-0.19	-0.30	0.82	0.51	0.82	0.60	0.73
Cwatr	-0.07	-	-0.07	-	0.06	-	0.06	-	0.06
Ccons	-0.08	-	-0.08	-	-0.18	-0.35	-0.18	-	-0.18
Ctrad	-0.10	-	-0.10	-	0.06	-	0.06	-	0.06
Ctran	-0.07	-	-0.07	-0.05	0.07	-0.08	0.07	0.10	0.07
Chotl	-0.12	-	-0.12	-0.10	0.17	-0.07	0.17	0.20	0.19
Ccomm	-0.18	-	-0.18	-	0.10	-	0.10	-	0.10
Cfsrv	-0.08	-	-0.08	-0.05	0.03	-0.13	0.03	0.09	0.03
Creal	-0.05	-	-0.05	-	0.08	-	0.08	-	0.08
Cbsrv	-0.10	-	-0.10	-0.06	0.04	-0.15	0.04	0.12	0.05
Cpadm	-0.11	-	-0.11	-0.08	0.11	-0.11	0.11	0.16	0.11
Ceduc	-0.10	-	-0.10	-	0.09	-	0.09	-	0.09
Cheal	-0.12	-	-0.12	-	0.11	-	0.11	-	0.11
Cosrv	-0.09	-	-0.09	-0.06	0.07	-0.11	0.07	0.12	0.07

Note: Calculations by authors.

Appendix A8: Impact on Prices and Volumes (Simulation 2)

Commodities	Price change %				Volume change %				
	domestic	imports	producer	Exports	domestic demand	imports	domestic supply	exports	Total output
cmaiz	-0.09	-0.01	-0.09	-0.05	0.01	-0.16	0.01	0.09	0.01
csorg	-0.09	-	-0.09	-	0.00	-	0.00	-	0.00
crice	-0.09	-0.02	-0.09	-0.05	0.01	-0.13	0.01	0.09	0.01
cwhea	-0.10	-0.03	-0.09	-0.07	0.11	-0.03	0.11	0.15	0.12
cocer	-0.11	-	-0.11	-0.06	0.00	-	0.00	0.11	0.04
cpuls	-0.12	-0.02	-0.12	-0.06	0.01	-0.18	0.01	0.12	0.04
cgnut	-0.10	0.00	-0.10	-	0.00	-0.19	0.00	-	0.00
coils	-0.10	0.00	-0.10	-0.09	0.18	-0.02	0.18	0.19	0.18
ccass	-0.11	-	-0.11	-	0.01	-	0.01	-	0.01
croot	-0.12	-	-0.12	-0.06	0.01	-	0.01	0.12	0.01
cvege	-0.11	-0.05	-0.10	-0.05	0.01	-0.11	0.01	0.10	0.01
csugr	-0.11	-	-0.11	-	0.01	-	0.01	-	0.01
ccott	-0.13	-	-0.20	-0.17	0.27	-	0.27	0.34	0.34
cfrui	-0.11	-0.02	-0.11	-0.06	0.01	-0.17	0.01	0.11	0.03
ctoba	-0.12	-0.05	-0.11	-0.09	0.11	-0.02	0.11	0.17	0.15
cteal	-0.14	-0.10	-0.24	-0.14	0.08	-0.01	0.08	0.28	0.26
cflwr	-0.12	-0.06	-0.12	-0.08	0.07	-0.04	0.07	0.15	0.13
cocrp	-0.13	-0.08	-0.14	-0.09	0.07	-0.03	0.07	0.18	0.17
ccatt	-0.14	0.00	-0.14	-0.07	-0.01	-0.29	-0.01	0.13	-0.01
cmilk	-0.14	-	-0.14	-	-0.01	-	-0.01	-	-0.01
csmlr	-0.14	-	-0.14	-	0.03	-	0.03	-	0.03
cpoul	-0.14	0.00	-0.14	-	0.01	-0.27	0.01	-	0.01
coliv	-0.13	-	-0.13	-0.08	0.05		0.05	0.16	0.06
cfore	-0.14	-0.03	-0.14	-0.07	0.01	-0.21	0.05	0.15	0.09
cfish	-0.10	-	-0.10	-0.05	0.01		0.01	0.10	0.01
ccoil	-	-0.01	-	-	-	0.15	-	-	-
cngas	-	-0.01	-	-	-	0.15	-	-	-
comin	-0.08	-0.01	-0.07	-0.05	0.06	-0.07	0.01	0.10	0.08
cmeat	-0.12	-0.02	-0.12	-0.03	-0.13	-0.32	0.06	0.05	-0.12
cfsea	-0.14	-0.06	-0.15	-0.10	0.09	-0.07	-0.13	0.19	0.16

cfoil	-0.12	-0.06	-0.12	-0.08	0.10	-0.02	0.09	0.17	0.16
cdair	-0.12	0.00	-0.12	-0.07	0.03	-0.20	0.10	0.14	0.03
cgmll	-0.11	-0.07	-0.10	-0.05	0.00	-0.10	0.03	0.10	0.02
csref	-0.10	-0.05	-0.09	-	0.01	-0.11	0.01	-	0.01
cfood	-0.12	-0.03	-0.11	-0.06	0.02	-0.15	0.02	0.13	0.03
cfeed	-0.12	-0.02	-0.12	-0.06	0.01	-0.18	0.01	0.12	0.01
cbeve	-0.10	-0.06	-0.08	-0.07	0.11	0.02	0.11	0.14	0.12
cpapr	-0.14	-0.08	-0.19	-0.12	0.09	-0.03	0.09	0.24	0.21
cchem	-0.10	-0.03	-0.09	-0.08	0.14	-0.00	0.14	0.16	0.15
cnmet	-0.18	-0.04	-0.22	-0.15	0.16	-0.12	0.16	0.30	0.21
cmetl	-0.15	-0.01	-0.15	-0.15	0.30	0.03	0.30	0.30	0.30
coman	-0.11	-0.05	-0.09	-0.05	0.02	-0.08	0.02	0.10	0.04
celec	-1.23	-1.07	-0.20	-0.32	0.89	0.56	0.89	0.65	0.79
cwatr	-0.09	-	-0.09	-	-0.02		-0.02	-	-0.02
ccons	-0.10	-	-0.10	-	0.00	-0.14	0.00	-	0.00
ctrad	-0.12	-	-0.13	-	0.05		0.05	-	0.05
ctran	-0.09	-	-0.09	-0.06	0.05	-0.20	0.05	0.12	0.06
chotl	-0.17	-	-0.17	-0.12	0.12	-0.23	0.12	0.24	0.19
ccomm	-0.20	-	-0.20	-	0.04	-	0.04	-	0.04
cfsrv	-0.10	-	-0.10	-0.06	0.04	-0.17	0.04	0.12	0.04
creal	-0.07	-	-0.07		0.04	-	0.04	-	0.04
cbsrv	-0.12	-	-0.12	-0.06	0.00	-0.24	0.00	0.12	0.01
cpadm	-0.13	-	-0.13	0.07	-0.53	-0.79	-0.53	-0.13	-0.53
ceduc	-0.13	-	-0.13	-	-0.38	-	-0.38	-	-0.38
cheal	-0.15	-	-0.15	-	-0.31	-	-0.31	-	-0.31
cosrv	-0.11	-	-0.11	-0.05	-0.03	-0.25	-0.03	0.10	-0.02

Note: Calculations by authors.

Appendix A9: Total Aggregate Output, Value Added, Price of Value Added, Intermediate Consumption, and Intermediate Consumption Price Index of Composite Industries (Simulation 1)

Activity	Output	Intermediate consumption	Value added	Intermediate price consumption	Value price	added
aelec	0.73	0.73	0.73	-0.44	0.79	
acons	-0.18	-0.18	-0.18	-0.08	0.002	

Note: Calculations by authors.

Appendix A10: Total Aggregate Output, Value Added, Price of Value Added, Intermediate Consumption, and Intermediate Consumption Price Index of Composite Industries (Simulation 2)

Activity	Output	Intermediate consumption	Value added	Intermediate price consumption	Value added price
acatt	-0.01	-0.01	-0.01	-0.08	-0.08
amilk	-0.01	-0.01	-0.01	-0.08	-0.08
ameat	-0.12	-0.12	-0.12	-0.15	-0.15
awater	-0.02	-0.02	-0.02	-0.11	-0.11
acons	0.00	0.00	0.00	-0.09	-0.09
absrv	0.01	0.01	0.01	-0.10	-0.10
apadm	-0.53	-0.53	-0.53	-0.13	-0.13
aeduc	-0.38	-0.38	-0.38	-0.18	-0.18
aheal	-0.31	-0.31	-0.31	-0.12	-0.12
aosrv	-0.02	-0.03	-0.03	-0.12	-0.12
aelec	0.79	0.79	0.79	-0.45	-0.45

Note: Calculations by authors.

Appendix A11: Effects on Factors of Production (Simulation 1)

Activity	Capital demand	Labour demand	Return of capital	Wage
apuls	-0.01	0.14	-0.01	-0.11
agnut	-0.03	0.12	0.00	-0.11
acass	-0.03	0.12	-0.01	-0.11
aroot	-0.05	0.10	-0.01	-0.11
avege	-0.01	0.14	-0.01	-0.11
afrui	-0.01	0.14	-0.02	-0.11
acatt	0.00	0.13	-0.02	-0.11
amilk	-0.01	0.12	-0.02	-0.11
asmlr	-0.01	0.12	-0.03	-0.11
afore	-0.04	0.09	-0.03	-0.11
afish	-0.01	0.11	-0.03	-0.11
Acons	-0.27	-0.15	-0.03	-0.11
Atrad	-0.01	0.11	-0.03	-0.11
Afsrv	-0.02	0.10	-0.03	-0.11
Absrv	-0.07	0.05	-0.03	-0.11
Apadm	-0.01	0.11	-0.03	-0.11
Aeduc	-0.03	0.10	-0.03	-0.11
Aheal	0.00	0.12	-0.03	-0.11
Aosrv	-0.02	0.10	-0.01	-0.11

Note: Calculations by authors.

Appendix A12: Effects on Factors of Production (Simulation2)

Activity	Capital demand	Labour demand	Return of capital	Wage
Amaiz	-0.01	0.09	-0.08	-0.14
Asorg	-0.01	0.08	-0.08	-0.14

Arice	-0.01	0.09	-0.07	-0.14
Agnut	-0.03	0.07	-0.07	-0.14
Acass	-0.03	0.06	-0.08	-0.14
Aroot	-0.05	0.05	-0.08	-0.14
Avege	-0.02	0.08	-0.08	-0.14
Asugr	-0.04	0.07	-0.07	-0.14
Afrui	-0.01	0.09	-0.08	-0.14
Acatt	-0.01	-0.02	-0.15	-0.14
Amilk	-0.01	-0.02	-0.15	-0.14
Afore	-0.01	0.12	-0.05	-0.14
Afish	-0.06	0.08	-0.05	-0.14
Ameat	-0.12	0.02	-0.05	-0.14
Agmll	0.00	0.13	-0.05	-0.14
Asref	-0.01	0.13	-0.05	-0.14
Afeed	-0.02	0.11	-0.05	-0.14
Aelec	0.72	0.85	-0.05	-0.13
Awatr	-0.07	0.05	-0.05	-0.13
Acons	-0.10	0.04	-0.05	-0.14
Atrad	-0.04	0.10	-0.05	-0.14
Afsrv	-0.01	0.11	-0.05	-0.13
Absrv	-0.11	0.01	-0.05	-0.13
Apadm	-0.64	-0.52	-0.05	-0.13
Aeduc	-0.49	-0.37	-0.05	-0.13
Aheal	-0.43	-0.31	-0.05	-0.13
Aosrv	-0.12	0.02	-0.05	-0.14

Note: Calculations by authors.

Appendix A13: Sensitivity Analysis

The sensitivity analysis in this study consisted of testing different values for important model parameter assumptions related to unemployment. Two model parameters—wage elasticity and elasticity of substitution for composite labour—were varied to understand the robustness of the model.

Three values of wage elasticity, ε_l found in the wage curve equation, were tested.

$$W_l = A_l UNR_l^{\varepsilon_l} PIXCON$$

These values were -0.1 (the original value used in the model), -0.09, and -0.01, all of which were obtained at the range of 10% and -10% of the original value.

Three values for elasticity of substitution for composite labour at the range of 10% and -10% of the original value were also tested.

Table A13 presents the results of the sensitivity analysis for unemployment rate by type of worker. For both parameters, the results were the same and no variability was observed. This means that the model results are robust for different elasticity values. If, however, the sign of the observed variation had changed or the result had been too large or too small, then we could have concluded that the unemployment rate was sensitive to the parameters in question.

Table A13: Sensitivity Analysis Results for Unemployment Rate by Type of Worker.

	Unemployment rate	
labour	Simulation 1	Simulation 2
flab-rn	0.10	0.05
flab-rp	0.06	0.04
flab-rs	0.10	-0.04
flab-rt	0.07	-0.10
flab-un	0.04	0.01
flab-up	0.03	0.02
flab-us	0.08	-0.11
flab-ut	0.05	-0.12

Notations: flab-rn—uneducated rural households; flab-rp—rural households with primary education; flab-rs—rural households with secondary education; flab-rt—rural households with tertiary education; flab-un—uneducated urban households; flab-up—urban households with primary education; flab-rs—urban households with secondary education; flab-rt—urban households with tertiary education.

Appendix A14: Impact on Household Incomes

	Simulation 1				Simulation 2			
Households	Total Income	Labour income	Capital income	Transfer income	Total Income	Labour income	Capital income	Transfer income
hhd-f1	-0.01	-0.03	-0.01	-0.04	-0.10	-0.10	-0.10	-0.07
hhd-f2	-0.02	-0.03	-0.01	-0.04	-0.10	-0.10	-0.09	-0.07

hhd-f3	-0.02	-0.03	-0.01	-0.04	-0.10	-0.11	-0.10	-0.07
hhd-f4	-0.02	-0.02	-0.01	-0.04	-0.10	-0.12	-0.10	-0.06
hhd-f5	-0.02	-0.02	-0.01	-0.04	-0.11	-0.12	-0.10	-0.06
hhd-n1	-0.03	-0.03	-	-0.04	-0.10	-0.11	-	-0.06
hhd-n2	-0.03	-0.03	-	-0.04	-0.10	-0.11	-	-0.06
hhd-n3	-0.03	-0.03	-	-0.04	-0.11	-0.11	-	-0.07
hhd-n4	-0.03	-0.03	-	-0.04	-0.13	-0.14	-	-0.06
hhd-n5	-0.02	-0.02	-	-0.04	-0.17	-0.19	-	-0.06
hhd-u1	-0.05	-0.06	-0.01	-0.04	-0.12	-0.13	-0.08	-0.07
hhd-u2	-0.05	-0.06	-0.01	-0.04	-0.11	-0.13	-0.09	-0.06
hhd-u3	-0.05	-0.06	-0.01	-0.04	-0.12	-0.14	-0.10	-0.06
hhd-u4	-0.05	-0.05	-0.01	-0.03	-0.12	-0.16	-0.10	-0.06
hhd-u5	-0.04	-0.05	-0.01	-0.04	-0.15	-0.19	-0.10	-0.06

Note: Calculations by authors.

Appendix A15: Total Income Share Distribution Across Household Groups

	Income share (Based period)	Income share Simulation-1	vary	Income share Simulation-2	Vary
hhd-f1	0.11899	0.11899	0.00000107	0.11900	0.00000654
hhd-f2	0.16886	0.16886	-0.00000038	0.16887	0.00000801
hhd-f3	0.20780	0.20780	-0.00000110	0.20780	0.00000343
hhd-f4	0.25331	0.25331	-0.00000068	0.25331	-0.00000564
hhd-f5	0.25103	0.25104	0.00000109	0.25102	-0.00001234
hhd-n1	0.04221	0.04221	-0.00000292	0.04223	0.00001922
hhd-n2	0.08032	0.08032	-0.00000515	0.08036	0.00003498
hhd-n3	0.09999	0.09998	-0.00000672	0.10003	0.00004130
hhd-n4	0.19816	0.19816	-0.00000107	0.19820	0.00004192
hhd-n5	0.57931	0.57933	0.00001587	0.57917	-0.00013742
hhd-u1	0.01204	0.01204	-0.00000018	0.01204	0.00000340
hhd-u2	0.02643	0.02643	-0.00000107	0.02644	0.00000785
hhd-u3	0.05519	0.05519	-0.00000253	0.05521	0.00001372
hhd-u4	0.15582	0.15582	-0.00000191	0.15585	0.00003079
hhd-u5	0.75052	0.75052	0.00000569	0.75046	-0.00005575

Appendix A16: Income Inequality Ratio (Kuznets Ratio) Across Households Disaggregated by Geographical Location

	Income inequality ratio (Based period)	Income inequality ratio Simulation 1	Vary	Income inequality ratio Simulation 2	Vary
Rural farm HH	2.278568416	2.278558231	-1.01851E-05	2.278356757	-0.00021
Rural non-Farm HH	13.80375732	13.80507876	0.00132	13.79429233	-0.00956
Urban HH	62.36176458	62.36314939	0.00139	62.33956888	-0.02222

Appendix A17: Impact of Household Spending on Consumption

Households	Simulation 1		Simulation 2	
	Consumption	Real consumption	Consumption	Real consumption
hhd-f1	-0.02	0.08	-0.10	0.04
hhd-f2	-0.02	0.08	-0.10	0.04
hhd-f3	-0.02	0.08	-0.10	0.04
hhd-f4	-0.02	0.08	-0.10	0.04
hhd-f5	-0.02	0.08	-0.11	0.03
hhd-n1	-0.03	0.07	-0.10	0.04
hhd-n2	-0.03	0.07	-0.10	0.03
hhd-n3	-0.03	0.07	-0.11	0.03
hhd-n4	-0.03	0.07	-0.13	0.01
hhd-n5	-0.02	0.08	-0.17	-0.03
hhd-u1	-0.05	0.06	-0.12	0.02
hhd-u2	-0.05	0.05	-0.11	0.02
hhd-u3	-0.05	0.05	-0.12	0.02
hhd-u4	-0.05	0.06	-0.12	0.01
hhd-u5	-0.04	0.06	-0.15	-0.01

Note: Calculations by authors.