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Should aid in Uganda be repurposed to super-size social cash transfers? An application of a Dynamic Computable General Equilibrium Model

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Should aid in Uganda be repurposed to super-size social cash transfers?

An application of a Dynamic Computable General Equilibrium Model

**Wilson Asiimwe
Jacob Ulrich
Susan Kavuma
Bruno Yawe**



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SECO  Socio-Economic Research Centre

Department of Social Sciences and Business, Roskilde University

Universitetsvej 1, 4000 Roskilde, Denmark

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ABSTRACT

The major international humanitarian donors and aid organisations have raised concerns about the efficiency and effectiveness of targeting Official Development Assistance. Although the 2016 Grand Bargain committed to shifting a quarter of the aid funds to the local actors, performance has remained low. By 2021 less than one percent of the humanitarian aid was being allocated to local actors. Though recent scholars have postulated that redirecting aid funds to local actors might be beneficial, there is limited quantitative literature to support this proposal, especially for the case of Uganda. Based on this background, this paper uses a Dynamic Computable General Equilibrium model to assess the macroeconomic impacts of shifting aid funds from traditional spending architecture to direct cash transfers for households in Uganda.

The findings reveal that shifting aid funds to local actors (households) provides macroeconomic benefits to the economy and generates spillover effects to non-recipient households and other economic agents. Financing the cash transfers by reducing allocations to government and so-called 'Non-Profit Institutions Service Households' increases tax revenues, household incomes and savings. However, employment and economic growth decline as the actual appreciation of the exchange rate reduces international competitiveness. The decline in economic growth is driven by a decline in industry and service sector GDP as agricultural GDP increases. The alternative scenario of financing social cash transfers by reducing the overheads of offshore aid is the most effective in improving economic growth, household incomes, government tax returns, employment and household savings and investment. International humanitarian donors and aid organisations are urged to consider re-directing aid funds from the overseas overhead costs to local actors through direct SCT to vulnerable households. This will improve household welfare, investment and employment and accelerate economic growth.

AUTHORS

Mr Wilson Asiimwe is a Senior Economic Modeller at the Ministry of Finance, Planning and Economic Development Uganda. He is also a Research Fellow at the Macroeconomic and Financial Management Institute for Eastern and Southern Africa (MEFMI, Zimbabwe); where he tutors short-term courses in Macroeconomic Modelling. He holds a Master's degree in Development and Natural Resource Economics from the Norwegian University of Life Sciences, Norway. He also holds an Msc in Financial Engineering from WorldQuant University, USA and a Bachelor of Economics degree from Makerere University (Uganda). He has 13+ years of experience in CGE and macroeconomic modelling of social protection, climate change and fiscal policy.

Jacob Ulrich is a PhD fellow at Roskilde University and has a master's degree in International Affairs from Columbia University. He is a practitioner with +25 years of experience working with development and aid management in more than 30 countries worldwide.

Dr. Susan Namirembe Kavuma is a Senior Lecturer in the Department of Policy and Development Economic of the School of Economics at the College of Business and Management Science (COBAMS), Makerere University. She has served the University since 2006, lecturing and supervising research for undergraduate and post-graduate students. She has a PhD in Economics from the University of Nottingham, United Kingdom (2015) and was a Postdoctoral Research Fellow at the University of Cambridge under the Cambridge Africa Partnership for Research Excellence (CAPREx) programme in 2017. She is a Research Fellow at the Environment for Development Initiative Makerere University. Susan has authored and co-authored several research papers in peer reviewed Journals. She has peer-reviewed publications in the African Development Review Journal.

Dr. Bruno L. Yawe is an Associate Professor at the College of Business and Management Science (COBAMS), Makerere University. He holds a PhD in Economics and Master's degree in Economics from the University of Dar es Salaam, Tanzania. He has 20+ years in teaching economics at Makerere University. He has also served as a Senior Research Fellow at Environment for Development and also capacity building of institutions like Uganda Management Institute (UMI), National University of Rwanda, Kenya School of Monetary Studies, Uganda Institute of Banking and Financial Services and many more.

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Should aid in Uganda be repurposed to super-size social cash transfers? An application of a Dynamic Computable General Equilibrium Model

1. Introduction

Social cash transfers (SCTs) have emerged as the cost-effective policy option in supporting household welfare especially in the age of COVID-19. The rapid adoption of SCTs financed by donor aid, manifests what Gentilini (2022) calls “the largest scale-up in history”. In 2016, the major international humanitarian donors and aid organisations signed an agreement to increase the proportion of Official Development Assistance (ODA) to local actors. This so-called ‘Grand Bargain’¹ was signed during the 2016 World Humanitarian Summit. The goal of the agreement was to devise ways to ensure that humanitarian aid reaches those who are in need. This was planned to be financed by reducing the current allocation of aid funds to administration and overhead costs. To implement this agreement effectively, the signatories designed 51 shared commitments to guide their actions and also came up with ways to improve the efficiency of the delivery of the aid funds (EU, 2023). In addition, the Grand Bargain committed to shifting a quarter of the aid fund to local actors. However, by 2021 less than one percent of the humanitarian aid had been allocated to local actors (Venton et al., 2022). Though recently scholars have postulated that redirecting aid funds to local actors might be beneficial (ibid.), there is limited evidence to support this claim, especially in the case of Uganda.

In Uganda, supporting households by means of SCT has been identified as one of the key policy measures for alleviating poverty and increasing labour productivity. Public policy in Uganda is currently facing the challenge of high poverty rates and persistently high levels of income inequality among Ugandan households. This has forced the government to devise policy measures like social protection to eliminate the obstacles to poverty alleviation. GOU (2020) shows, that the 3rd National Development Plan (NDP III) identified low coverage of social protection as one of the reasons for low labour productivity, and it envisages the use of social protection to reduce poverty and inequality across the country. The government expects this policy measure to expedite achieving the first Sustainable Development Goal (SDG 1), ‘end poverty’.

Re-directing ODA, to pay for direct cash transfers to households, is in line with the government policies of improving labour productivity and alleviating poverty and income inequality using social protection. The question remains of whether to finance SCT through cuts in the allocations to traditional local actors or reducing overseas overhead budgets. This calls for a quantitative assessment to capture the economy-wide effects on the Ugandan economy. It is against this background that the paper uses a Computable General Equilibrium (CGE) model to assess whether aid in Uganda should be repurposed to super-size SCT.

¹ The Grand Bargain refers to the agreement between large donors and humanitarians to improve the efficiency and effectiveness of humanitarian action by increasing the portion of the aid money that reaches local people in need. (<https://interagencystandingcommittee.org/content/grand-bargain-hosted-iasc>)

The main objective of this paper is to assess the macroeconomic impacts of ODA financed scaling of SCT in Uganda. The assessment focuses on the impacts on demand, consumption, labour market participation, employment, economic growth, tax gains/losses and competitiveness.

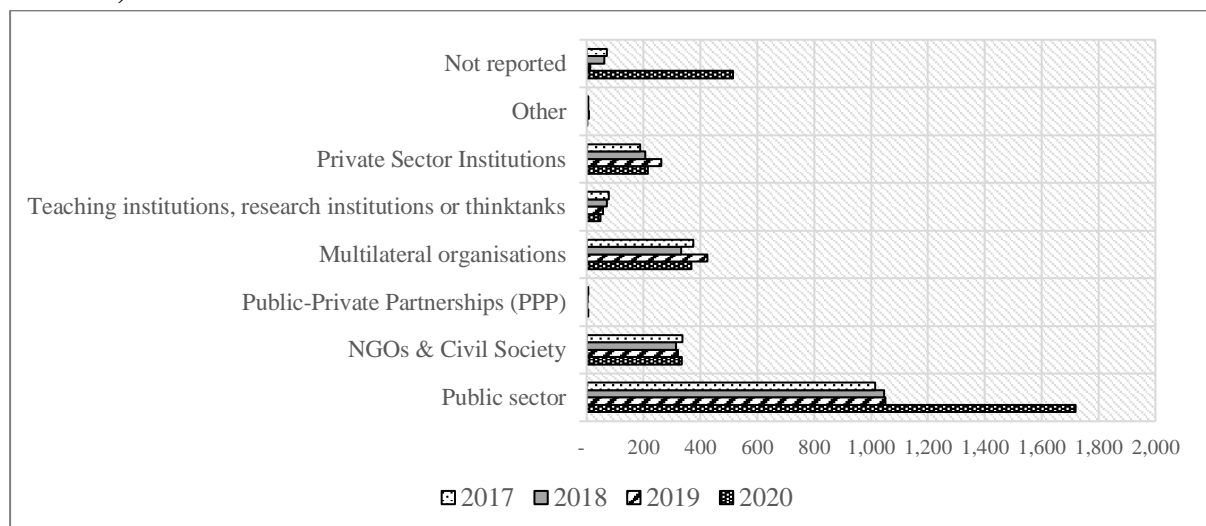
1.1 Background

To address the objectives of this study, we classify the population by age group and map it on to the structure of the households in the model. With regard to households, we define the structure of their sources of income and consumption patterns. The paper uses the donor aid data from the Organisation for Economic Co-operation and Development (OECD), a Ugandan population census (UBOS, 2014) and household incomes and consumption, based on the 2016/17 Social Accounting Matrix (SAM). These are discussed in sub-sections 1.1.1; 1.1.2; 1.1.3 and 1.1.4 respectively.

1.1.1 Aid disbursements to Uganda

The OECD database shows, that in 2020 Uganda received aid amounting to USD 3,208 million, of which USD 1,718 million was disbursed to the public sector and USD 334 million to non-governmental organisations (NGOs) and civil society. This includes both grants and loans from official donors. Figure 1 shows that the leading destination of donor aid is public administration (about 54 percent) and that NGOs and civil society received about 10 percent. The disbursements for 2017 – 2019 are shown in Figure 1.

Figure 1. Trends in aid from the international donor community to Uganda (USD millions)

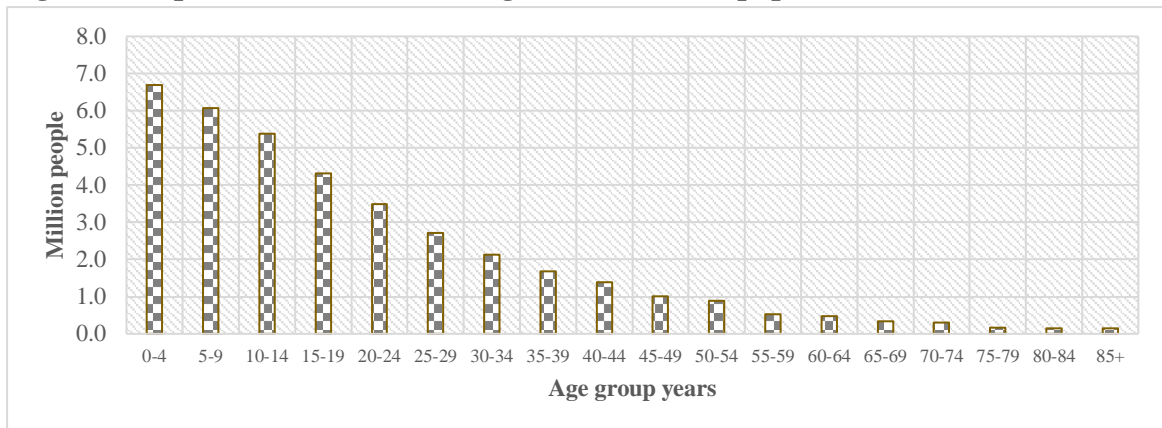


Source: OECD database.

1.1.2 Population classification

Uganda’s population data shows that the country is endowed with a young population. About 59 percent of the population is below 20 years of age, 76 percent below 30 years of age, and 92 percent below 50 years of age. Only 4 percent of the population is above 60 years of age. These data are shown in Figure 2.

Figure 2. Population structure for Uganda as of 2014 population census

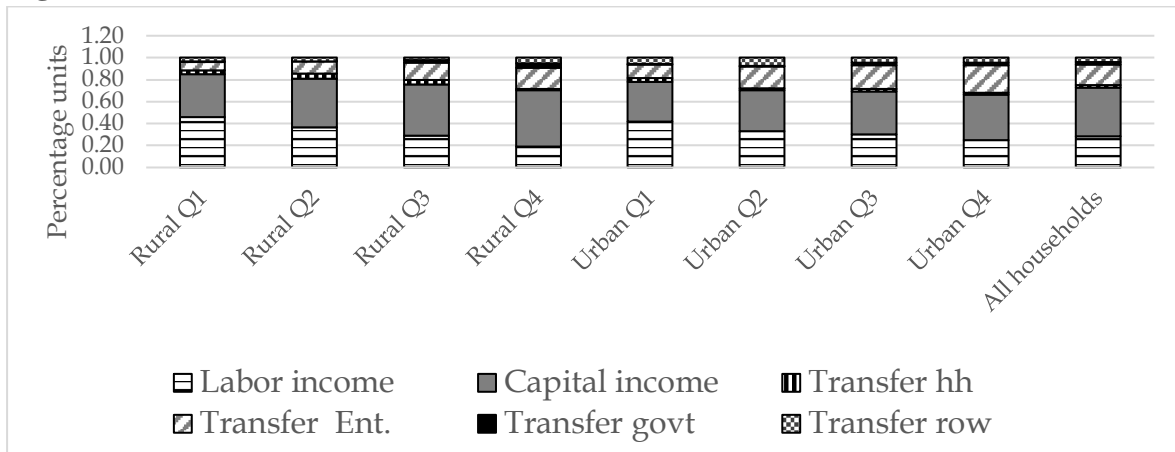


Source: UBOS, Census, 2014

1.1.3 Structure of household incomes and transfers

The structure of households in Uganda is key to the incidence of the direct SCT of foreign aid. We derive the structure of households from the 2016/17 SAM. Figure 3 shows that on average labour and capital, incomes account for 72 percent of total household incomes. However, there are distributive differences across households. The income structure shows that poor households largely depend on income from labour, whereas wealthier households depend on income from capital. This is because richer households have relatively more access to dividends from enterprises than poorer households. Furthermore, the relative dependence of urban households on transfers from the rest of the world is higher than that for rural households. These data are shown in Figure 3.

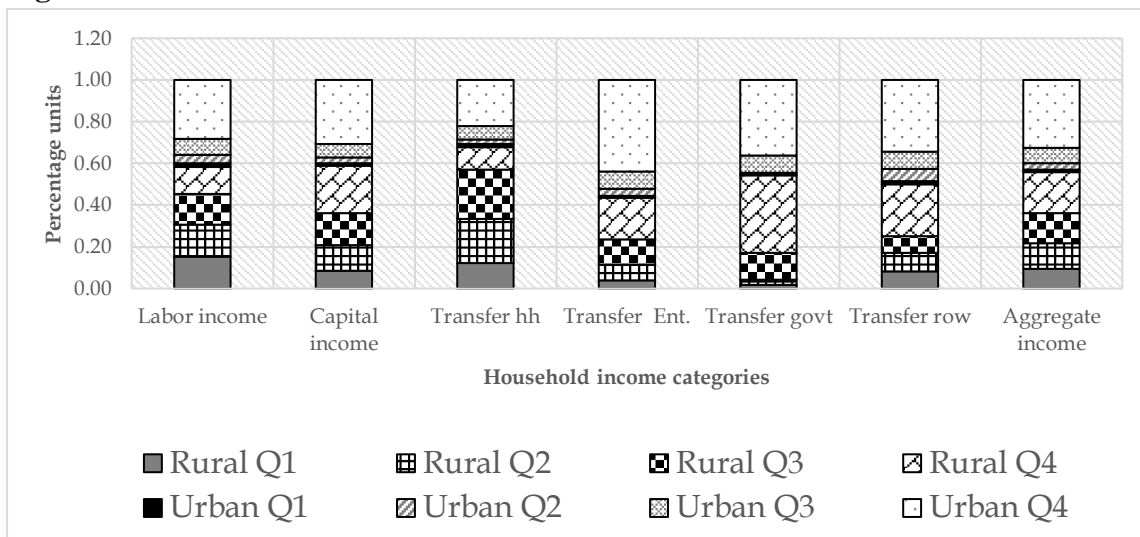
Figure 3. Sources of income sources for rural and urban households



Source: own computations using 2016/17 Social Accounting Matrix

With regard to the distribution of incomes across households, Figure 4 shows that nationally the richer households (quartile 4) account for 52 percent of total household income, whereas the extremely poor (quartile 1) account for only 11 percent. Figure 4 shows that 37 percent of government transfer incomes go to richer rural households, largely in the form of pension payments. In addition, about 34 percent of foreign transfer incomes and approximately 44 percent of dividends (transfers from enterprises) go to richer urban households. The income structure depicts inequalities in the distribution of incomes and transfers across households, with more bias toward the richer households. This shows that, to improve household welfare and reductions of income inequality, direct aid cash transfers should target poor households.

Figure 4. Distribution of incomes and transfers to households



Source: own computations using 2016/17 Social Accounting Matrix

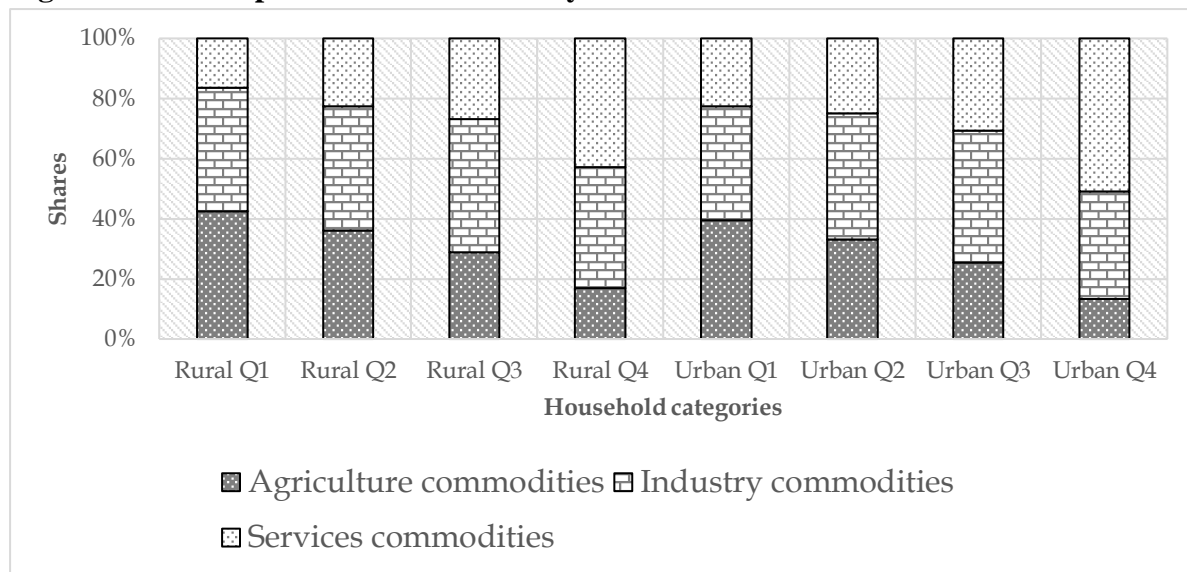
1.1.4 Structure of household consumption

The increase in foreign cash transfers to households is envisaged to increase household consumption. Thus, the impact on the economy is dependent on the type of households

receiving the cash transfer. We use the 2016/17 SAM to derive the patterns and the type of commodities consumed by each of the household categories. Figure 5 shows that agricultural commodities are largely consumed by poor households, irrespective of their location (rural or urban). In addition, richer households spend more on service commodities than poor households. These are consistent with *Engel law*², which states that household expenditure on food is inversely related to incomes (Byne and Capps, 1996, Cranfield et al., 1998). In general, households with low incomes spend more on food (agricultural commodities), though the share of incomes allocated to food decreases as incomes increase, while the share allocated to services like education, recreation and other services increases.

This implies that the allocation of foreign-aid cash transfers directly to poor households would mostly lead to increased consumption of food commodities. This would generate distributive benefits to factors employed in the agricultural sector. In addition, since the agricultural sector is more labour-intensive than other sectors, households supplying labour would be the biggest beneficiaries of the general equilibrium effects. Similarly, directing foreign SCT to richer households would have increasing effects on the consumption of services like education and recreation. The household consumption structure is shown in Figure 5.

Figure 5. Consumption of commodities by households



Source: own computations using 2016/17 SAM

2. Literature review

Economic theory shows that aid has trickle-down effects on economic development through several channels. Several scholars have discussed the theories of aid and economic development. First, Mikesell (1982) discusses the Rostow’s theory of development to have three stages, including a) the traditional social stage, b) the evolution of conditions for economic growth, and c) lastly, the take-off stage. Rostow’s theory suggests that

² *Engel law* explains that the consumption basket of poor households is largely dominated by food commodities and that this changes towards service commodities as the incomes of households increase. For details, see Cranfield et. al., (1998) and Byne et. al., (1996).

complementing domestic savings at the take-off stage with capital imports enhance investments to a level that would drive economic growth. The theory adds that large amounts of aid provide an opportunity to accelerate the effectiveness of the take-off stage and thus achieve self-sustaining economic growth. However, the theory used in this paper shows that maximizing the effectiveness of foreign aid requires that, programmes supported by aid should have direct impacts on production or productivity. Other economic theories like the Diamond Model show that a permanent increase in foreign aid per capita affects productivity, though the direction and magnitude of the impacts depend on the existing policies and production technology (Dalgaard et al., 2004). In addition, the Ramsey-Cass-Koopmans (RCK) theory discussed by Dalgaard et.al., (2014) shows that permanently directing foreign aid to households' consumption baskets has the potential to increase household per-capita consumption, though it would leave the steady state of capital per worker unaffected.

Empirical studies have linked cash transfers to the reduction of poverty, inequality, job creation, and improving the economic growth of developing economies. Hagen-Zanker et al. (2018) show that SCT would reduce monetary poverty, improve household nutrition, improve school attendance (though it had no impact on the quality of learning), improve household savings and reduce child labour. Concerning gender, scholars like Hagen-Zanker et al. (2016) found that cash transfers, given to households, improve women's decision-making abilities and increase school attendance for both girls and boys (with more attendance effects on boys), while female-headed households were found to increase productive investments more than their male counterparts.

Evans et al. (2021) conducted a study to examine the impact of SCT on education in Tanzania and found that they improve school participation by pupils. The results also showed that children from poor households are more likely to attend school if granted SCTs. In this regard, cash transfers increase the probability that primary school will be completed. The paper found that these benefits were intensified among students who were already performing better at school. Regarding poverty, the paper showed that SCTs were effective in eliminating constraints related to poverty. In addition, scholars like (Bastagli et al., 2016) found strong evidence that SCTs would reduce poverty, income inequality and vulnerability, while also improving the empowerment of the socially excluded.

Gelders and Athias (2019) conducted a quantitative assessment in Uganda on the impact of Uganda's senior citizen grant (SCG) on the well-being of older people and their families. Their findings showed that SCG increased the purchasing power and the rate of food intake among the recipients to at least two meals per day, as well as reducing their general poverty by about 19 percentage points. In addition, they found that cash transfers to the elderly enabled them to invest in productive assets like livestock. The study also reports that the SCG increased the duration (in years) of older people remaining economically active and also that some elderly quit paid labour activities for self-employment as the main source of livelihood. Children living with the elderly were found to benefit through increased education outcomes and a reduction in child labour. The paper concluded with a call for expansion of the investments in SCT schemes, as this would produce the overall benefit of a healthier skilled workforce through its effect on health and education. Merttens et al. (2016) also found similar results, namely that social protection schemes reduced poverty and improved household investment.

GOU (2020) developed Uganda's third National Development Plan (NDP III), which identified investment in social protection as one of the key measures to improve the country's labour productivity. In addition, the NDP III envisages using social protection to reduce poverty and inequality across the country. NDP III associates the elderly population (65+ years) with extreme poverty and vulnerability largely because of social exclusion, illiteracy and food insecurity. In addition, the SGDs, specifically SDG 1, focus on ending poverty in all its forms (UN, 2022). Scholars like Merttens et al. (2016), Hagen-Zanker et al. (2018) and Bastagli et al. (2016) have shown that giving SCTs to households has the potential to enable Uganda to achieve SDG 1, as well as the NDP III vision to improve the quality of life, productivity and investment.

Venton et al. (2022) call for funding to be shifted from international aid architecture to local individual actors. This will reduce the foreign aid spent on overheads like huge salaries and increase the benefits to local actors. The study reveals that a gradual scaling-up to 25 percent of the aid funds being shifted to local actors would lead to a saving of about USD 6.1 billion and a benefit to local actors accumulating to USD 183 billion over eight years. The benefits to local actors, like households, include improvements to economic inclusion, equity and sustainability. The paper concludes by advocating the need to reconceptualise the role of the intermediary and consider shifting the resources to the local actors.

Woodlard and Leibbrandt (2013) assessed the impact of unconditional transfers in South Africa and found positive effects of social security on human capital outcomes, reducing poverty and inequality. The paper argues that giving SCT directly to households would positively change the behaviour of their members, thus improving their welfare. Contrary to the findings of other scholars, this paper shows that cash transfers would stimulate labour migration, though in some cases serve as a disincentive among those of working age to look for work. This shows that, to maximise the benefits of SCT, targeting by age group is critical. The paper also argues that the benefits of grants to adults only surface when the adult is disabled or lives with a child or elderly person. The paper warns against the extension of cash transfers to the unemployed, as this would raise fiscal unsustainability issues. Instead, it advocates supportive labour market policies to complement SCTs.

Levine et al. (2009) argues that SCTs have strong positive effects in reducing the poverty of the poorest in Namibia. The paper also shows that transfers to households reduce income inequalities, though this effect is limited. The paper identifies two targeting errors, especially regarding child benefit in Namibia. First is the inclusion error of including children in non-poor households among the beneficiaries. Second is the exclusion error of excluding children from poor households from the list of beneficiaries. This indicates a need for an effective targeting programme before social cash transfer benefits are rolled out.

Heady et al. (2005) assessed the distributive impacts of social transfers in the European Union and revealed that countries that spend a larger share of their GDP on social protection yielded higher returns from the cash transfers to local actors. The other drivers of maximising these benefits include the distribution of these cash transfers among different households and the efficiency of targeting the relevant households.

Egger et al. (2022) used a CGE model to assess the effects of cash transfers in Kenya and revealed that giving SCTs to households has positive effects on household consumption and asset accumulation across households. In addition, the paper revealed that cash transfers have

spillover effects on non-recipient households and firms. This confirms the existence of the economy-wide general equilibrium effects of SCT. In addition, Yusuf (2018) used a static CGE model to assess the direct and indirect effects of cash transfers in Indonesia and found that social cash transfers financed by increasing value-added tax (VAT) reduced economic growth. Debora et al. (2018) found that the cash transfer programme has positive effects on employment and incomes, but smaller impacts on economic growth. With regard to tax collection, Branco (1994) shows that cash transfers increase labour incomes and thus the collection of taxes by the government.

Venton (2021) argues that less than one percent of the ODA in 2018 was received by local development actors. Venton shows that the signatories to the Grand Bargain had committed to spending on local organisation about 25 percent of total humanitarian aid. However, the outturn for 2018 was 0.4 percent. This shows the need for international donors to revise the aid architecture by shifting aid funds spent overseas to increase the portion allocated to local actors.

3. Method

3.1 The CGE Model

To assess the economy-wide impact of giving direct SCTs to households, a Recursive Dynamic CGE model was used. The same model was used by Egger et al. (2022) in Kenya, Yusuf (2018) in Indonesia and Debora et al. (2018) in Brazil to assess the effects of cash transfers, and they all revealed that cash transfers had economy-wide effects on households. The CGE model proved suitable for capturing the effects of foreign-aid direct transfers to households, largely because of its ability to evaluate the backward and forward linkages across productive sectors and the income distribution channels in the economy. This is key, as it relates domestic institutions to the productive sectors and the rest of the world.

The production function used in the model follows a Constant Elasticity of Substitution (CES) technology which reflects the substitutability of factors within Uganda’s productive sectors. A CES function was used to aggregate domestic production and imports into the composite supply of commodities to the domestic market, which is generally called the Armington function (Lofgren et al., 2002). The behaviour of the demand for household consumption is captured using the linear expenditure system that follows the Stone Geary utility function as discussed by Sadoulet and de Janvry (1995). This was chosen because of its ability to capture the minimum consumption segment that cannot fall and the segment of consumption that follows price adjustments. The labour categories are aggregated using the CES function and are assumed to be fully mobile in the model. The rest of the CGE model was built following Lofgren et al. (2002), Decaluwé et al. (2013), Nannyonjo and Asiimwe (2014) and Decaluwe et al. (1999). The production function for activity “a” (QA_a) is specified as:

$$QA_a = \alpha_a \prod_f QF_{fa}^{\beta_{fa}} \dots\dots\dots (1)$$

and this is expanded as

$$q = \alpha \theta_0 [\alpha (\theta_k k)^{-\rho} + (1 - \alpha) (\theta_l l)^{-\rho}]^{-1/\rho} \dots\dots\dots (2)$$

Where ρ is the transformation of the elasticity of substitution between capital and labour; then $\theta_0, \theta_k, \theta_l$ are efficiency parameters (neutral, capital-saving and labour-saving technologies). The CES elasticity transformation parameters are defined as:

$$\rho = \frac{1-\sigma}{\sigma}; = \frac{1}{\rho+1}; \text{ thus, } -1 < \rho < 0 \text{ for } \sigma > 1 \text{ and } 0 < \rho \text{ for } \sigma < 1 \text{ and } a > 0$$

Household consumption is captured by assuming that the rational consumer would maximise utility given the various prices and limited incomes or budget constraints. Thus, we define the consumer's utility (u) to be a function of a vector of commodities (q) and individual characteristics (z) subject to a budget constraint ($p'q = y$) where y is income and p is a vector of commodity prices. Thus, the consumer's objective function is to maximise utility from a vector of commodities (q) subject to a budget constraint. The *Lagrangian* equation for this specification is shown in Eq (3).

$$\text{Max}_{q,\lambda} u(q, z) + \lambda(y - p') \dots\dots\dots (3)$$

The solution from the first-order conditions of the above Eq (3) is a set of the n -demand equations depicted in Eq (4).

$$q_i = q_i(p, y, z), \quad i = 1, \dots, n. \dots\dots\dots (4)$$

Then we use the Linear Expenditure System (LES) derived from the Stone Geary utility function (Sadoulet and de Janvry, 1995) to capture consumption functions for each of the households. And this is pointwise separable, with c_i representing the minimum subsistence or consumption that cannot fall and b_i representing the marginal budget shares as shown in Eq (5).

$$u = \prod_{i=1}^n (q_i - c_i)^{b_i} \quad \text{or} \quad u = \sum_{i=1}^n b_i \ln(q_i - c_i) \quad \text{with} \quad \begin{cases} 0 < b_i < 1 \\ \sum_i b_i = 1 \\ q_i - c_i > 0 \end{cases} \dots\dots\dots (5)$$

Eq (4) yields the demand function depicted in equation (6).

$$p_i q_i = p_i c_i + b_i (y - \sum_j p_j c_j), \quad i = 1, \dots, n. \dots\dots\dots (6)$$

We model international trade assuming that foreign goods (imports) and domestic goods are imperfect substitutes. These are aggregated using an Armington function, which is a CES function in the formulation. The producer's decision to produce for the export and domestic market is captured using the Constant Elasticity of Transformation (CET), where XS is the total production of commodity i , EX is exports, D is the produce for domestic market, β_i^E is the share parameter and k_i^E is the elasticity parameter. This is demonstrated in Eq (7).

$$XS_i = B_i^E \left[\beta_i^E EX_i^{k_i^E} + (1 + \beta_i^E) D_i^{k_i^E} \right]^{\frac{1}{k_i^E}} \dots\dots\dots (7)$$

The model is built in two stages: the static model and the dynamic equations. Among the dynamic equations are capital stock (KD), whose accumulation equation follows investment (Ind) as shown in Eq (8). The investment function borrows from the approach proposed by Bourguignon et al. (1989) and Jung and Thorbecke (2003). The capital accumulation rate follows the ratio of the rate of return to capital to its respective user cost of capital. The user cost of capital ($U_{i,t}$) is approximated as the dual price of investment ($Pinv_t$) multiplied by the sum of depreciation (δ_i) and the real interest rate (ir) as shown in Eq (9).

$$KD_{i,t+1} = (1 - \delta)KD_{i,t} + Ind_{i,t} \dots\dots\dots (8)$$

$$U_{i,t} = Pinv_t(ir + \delta_i) \dots\dots\dots (9)$$

The foreign SCTs to households enter the circular flow of income through foreign transfers (TWH_h) to the household income equation (YH_h). Household income is defined as a function of income from skilled labour (QL_j), unskilled labour (NQL_j), agricultural capital (KD_{ag}), non-agricultural capital (KD_{nag}), transfers from the government (TG_h), transfers from the rest of the world (TWH_h) and dividend incomes from firms (DIV_h). The funds for transfer to households are assumed to be raised following two approaches: the first is by reducing the foreign aid allocations to government and non-government institutions like the Non-Profit Institutions Serving Households (NPISH); the second is by reducing allocations to the off-shore overhead costs for aid funds. The household income equation is defined in Eq (10).

$$YH_h = \lambda_h^{WQ} \cdot wq \sum_j QL_j + \lambda_h^{WQN} \cdot \sum_j NQL_j + \lambda_h^R \sum_{nag} r_{nag} KD_{nag} + \lambda_h^L \cdot \sum_{ag} r_{ag} KD_{ag} + P_{index}TG_h + P_{index}TH_{h,hj} + P_{index}TWH_h + DIV_h \dots\dots\dots (10)$$

Linking the model to the SAM is shown in Appendix 6.3. The rest of the model equations are shown in Appendix 6.5.

3.2 Simulation design

To build the simulations that compute the distributive general equilibrium effects of giving SCTs to households requires re-classification of the population by the target age groups and determining the size of the grant for each of the simulations. In 2016, the Ministry of Gender, Labour and Social Development (MoGLSD), in collaboration with UNICEF and the Economic Policy Research Centre (EPRC), conducted a study that explored the options for investing in social protection (GOU, 2016). The study found that a child-support grant equivalent to 20 percent of average monthly household expenditure would be efficient in reducing poverty. According to the 2016/17 Uganda National Household Survey (UBOS, 2018), household monthly expenditure was estimated to average UGX 339,263 and this would imply a monthly child support grant of UGX 67,853.

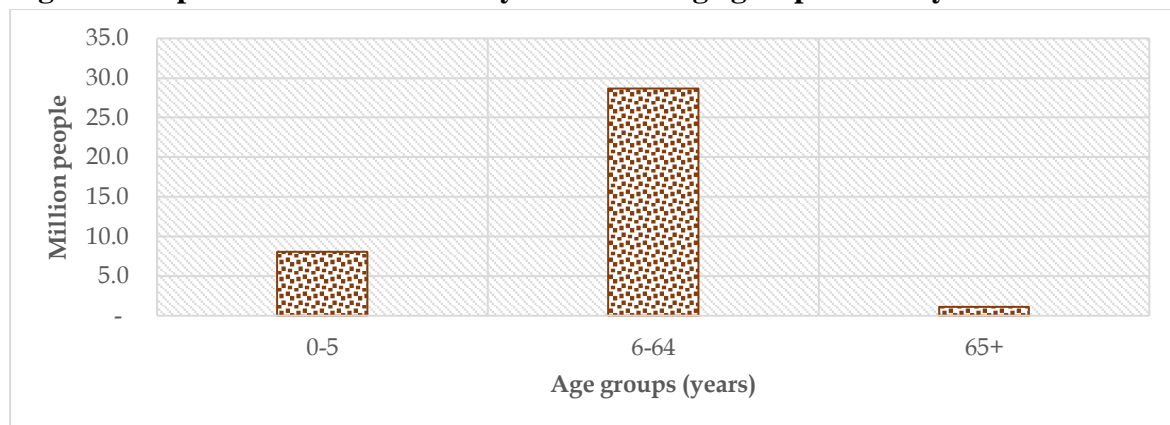
In addition, in June 2022 the MoGLSD published an article on the government’s plan to increase the senior citizen grant from the current monthly payment of UGX 25,000 to UGX

35,000 (Nilepost, 2022). This affirms the findings of the study by UK-AID (2012), which proposed increasing the elderly support grant from UGX 25,000 to an amount between UGX 35,000 and UGX 50,000. To maximise the benefits, we target the vulnerable age categories to avoid the criticism of Woodlard and Leibbrandt (2013), who argue that cash transfers to unemployed persons of working age would raise fiscal unsustainability problems and also cause the disincentive of discouraging the working-age population from looking for work. Heady et al. (2005) also shows that effective targeting increases the benefits of SCT. Thus, in this study, we target vulnerable age groups and implement these into three simulative scenarios:

- a) *Scenario 1*: Cash transfer of UGX 35,000 to Ugandans above 65+ years of age.
- b) *Scenario 2*: Cash transfer of UGX 67,853 to children below 5 years of age living in poor households.
- c) *Scenario 3*: Similar to scenario 1, but financing is raised by reducing allocations of aid funds to off-shore overhead costs.

Scenarios 1 and 2 assume that cash transfers to households are financed by reducing aid allocations to government and NPISH, following the ratio adopted from the OECD database, which shows that an average of 50.7 percent of donor aid was disbursed to the public sector between 2017 and 2020. Scenario 3 replicates scenario 1 but is financed by reducing allocations of aid funds to off-shore overhead costs. Implementation of these scenarios requires generating the population size for each of the two age groups. First, children living in poor households in the poorest quartile and are five years of age or younger; and secondly elderly Ugandans who are aged 65 years and above. As shown in Figure 6, the age group 0-5 consisted of 8.1 million children and those aged 65 and above years 1.1 million people in 2017.³

Figure 6. Population classification by simulation age groups for the year 2017



Source: Own computations using the 2017 population projections (UBOS, 2022).

Since we are using a recursive dynamic CGE model, we need projections of the changes in the population categorised by the two simulation age groups. We adopted the annual projected population of 42.9 million and a growth rate of 3.1 percent provided by the Uganda Bureau of Statistics (UBOS) for the year 2021 (UBOS, 2022). Based on this assumption, we project the population for the two simulation age groups. Table 1 predicts that between FY 2022/23 and FY 2027/28 the population of Ugandans aged 65 and above will increase from 1.30 million to

³ 2014 is the year for the most recent population census.

1.52 million and the population of children of five years and younger living in poor households would increase from 2.38 million to 2.78 million.

We use these projected populations to calibrate the total foreign aid required for the SCT. The SCT of 35,000 per elderly person aged 65 years and above amounts to UGX 546.9 billion in FY 2022/23 and UGX 638.1 billion in FY 2027/28. Lastly, the transfer of UGX 67,853 per child of five years and younger and living in poor households amounts to UGX 1,940.0 billion in FY 2022/23 and UGX 2,263.6 billion in FY 2027/28. The allocations of cash transfers to households are shown in Appendix 6.1 and the population projections for each of the scenarios are shown in Table 1.

Table 1. Projections of population and social transfers

	Scenario 1: 65+ years	Scenario 2: 0-5 years among poorest
Population distribution (million people)		
22/23	1.30	2.38
23/24	1.34	2.46
24/25	1.38	2.53
25/26	1.43	2.61
26/27	1.47	2.70
27/28	1.52	2.78
Monthly grant transfer per beneficiary (UGX)		
Grant/transfer	35,000	67,853
Annual total grant transfer (UGX billions)		
22/23	546.9	1,940.2
23/24	564.0	2,001.0
24/25	581.7	2,063.6
25/26	599.9	2,128.3
26/27	618.7	2,194.9
27/28	638.1	2,263.6

Source: UBOS, Census, 2014 and population projections

With regard to financing, scenarios 1 and 2 assume that 7.9 percent of the SCT is financed by reducing international overhead costs. In addition, all scenarios assume an administrative cost of 8.5 percent of the total SCT, which is managed by the government. The administrative cost ratio of total SCT is based on the findings of Beegle et al. (2018), a World Bank study that provides the rates for similar developing countries like Ethiopia (7.2 percent), Cameroon (9.2 percent), Ghana (12.0 percent), Malawi (10.0 percent), Tanzania (12.0 percent) and Sierra Leone (7.4 percent). Appendix 6.4 shows that, in FY 2023/24, scenario 1 would cost UGX 564 billion, of which UGX 45 billion would be financed by reducing international overhead costs, and UGX 48 billion would be the total administrative costs that the government would have to manage. In the same period, the second scenario would cost UGX 2,001 billion, of which UGX 158 billion would be financed by reducing the international overhead costs, and the administrative cost amounts to UGX 170 billion. The third scenario is similar to the first

scenario, with an assumption that all of the cost is met using new foreign financing while maintaining the status quo regarding the quotas for government and NPISH.

4. Results

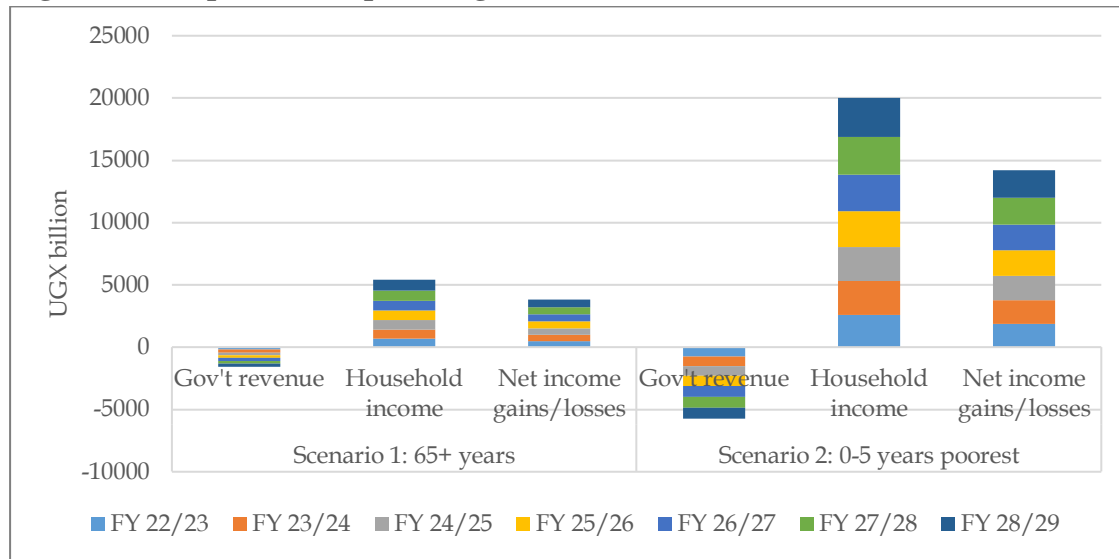
In this section, the results for the three scenarios considered in this paper are presented and discussed. The discussion is organised into two sub-sections differentiated by the source of financing. The first sub-section discusses the results for scenarios 1 and 2. These scenarios are simulated with an assumption that SCT is financed by a proportionate reduction of allocations to government and NPISH; the results are presented in sub-section 4.1. The subsequent sub-section 4.2 compares scenario 1 with scenario 3, which assumes that direct cash transfers to for households are financed by reducing allocations of aid funds for overseas overhead expenditure. These two scenarios (1 and 3) assume a universal allocation of the same amount of aid-based SCT to senior citizens (65+ years) in Uganda.

4.1. Results based on financing cash transfers by reducing aid allocations to government and NPISH

4.1.1 Impact on government and household incomes

The re-allocation of foreign aid (grants) from government and NPISH to direct cash transfers to households generates distributive effects on government and household incomes. The results in Figure 7 shows this across all scenarios and the simulation period (FY 2022/23 - FY2027/28). In FY 2022/23 government revenues would decline by UGX 207 billion and UGX 748 billion for scenarios 1 and 2 respectively. Conversely, in the same year, household revenues would increase more than twice and three times the respective losses in government revenues for scenarios 1 and 2 respectively. The structure of the impact remains the same for the rest of the simulation period (FY 2023/24 – FY 2027/28). On a net basis, the income gains by households exceed the income losses by governments by an annual average of UGX 542 billion and UGX 2,032 billion for scenarios 1 and 2 respectively. This shows that the redistribution of foreign aid directly to households generates positive effects on household welfare (incomes), a benefit that offsets the losses in government revenues. The results are shown in Figure 7.

Figure 7. Comparative impact on government and household incomes

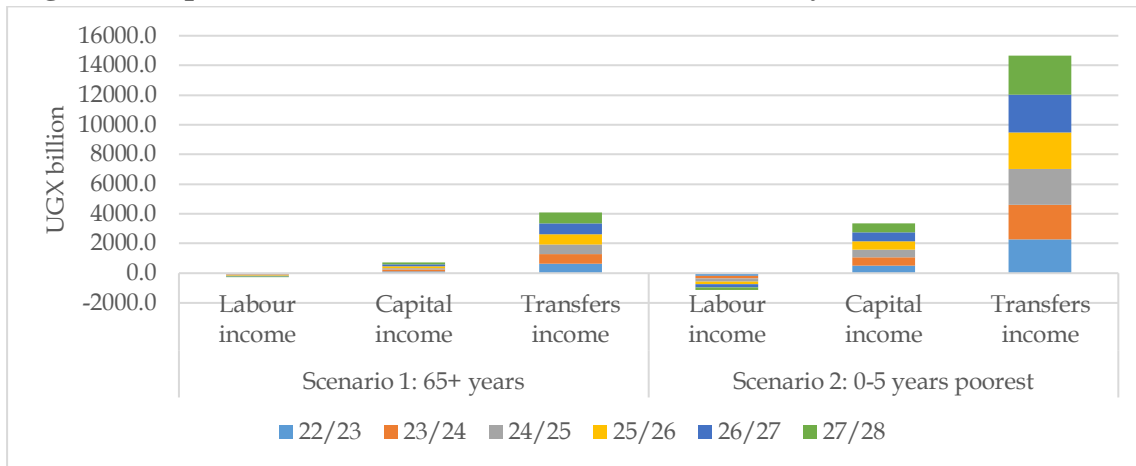


Source: Model results

4.1.2 Breakdown of the impacts on household incomes

To identify the drivers of the increases in household incomes, we break down the sources of income to households into labour income, capital income and transfers. The results show that social transfers lead to a reduction in labour incomes and increases in capital and transfer incomes. Figure 8 shows that, for the two scenarios, household transfer incomes account for more than 89.7 percent of the total increase in household incomes largely because of the direct social transfers of foreign aid to households. In FY 2022/23, labour incomes to households decline by UGX 43.8 billion and UGX 180.4 billion for scenarios 1 and 2 respectively. In the same scenarios, capital income increases by UGX 115.9 billion and UGX 519.2 billion for scenarios 1 and 2 respectively. Lastly, transfer incomes increase by 630.0 billion and UGX 2,266.3 billion for the two scenarios respectively. The same structure of the impacts is mirrored in the rest of the simulation period (FY 2023/24 – FY 2027/28). We conclude that the increases in household incomes are driven by transfers followed by capital incomes, which exceeds the reductions in labour incomes, as shown in Figure 8.

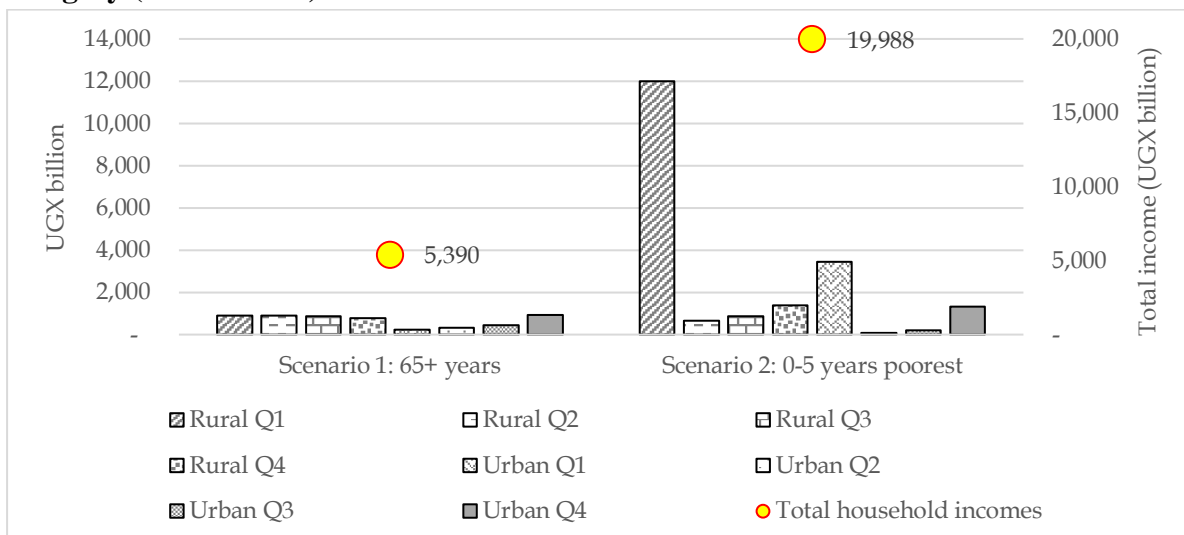
Figure 8. Impact of cash transfers on household incomes by source



Source: Model results

In addition, we find that rural households are the main beneficiaries of the direct aid-based cash transfers scheme. The results in Figure 9 show stronger positive effects of such transfers on the poorest households compared to their richer counterparts across all scenarios. In addition, it is the poorest who are the main beneficiaries in terms of increased incomes, and the policy measure has a reducing effect on poverty and inequality. These results are consistent with the findings of Bastagli et al. (2016), who found strong evidence that SCTs reduce poverty, income inequality and vulnerability. Evans et al. (2021) also found similar results, namely that SCTs are the most effective measures for eliminating the constraints related to poverty. Thus, for the case of Uganda, the results depicted in Figure 9 affirm that aid-based cash transfers are key to reducing poverty and inequality in Uganda.

Figure 9. Cumulative impact of cash transfers on household incomes by household category (UGX billion)



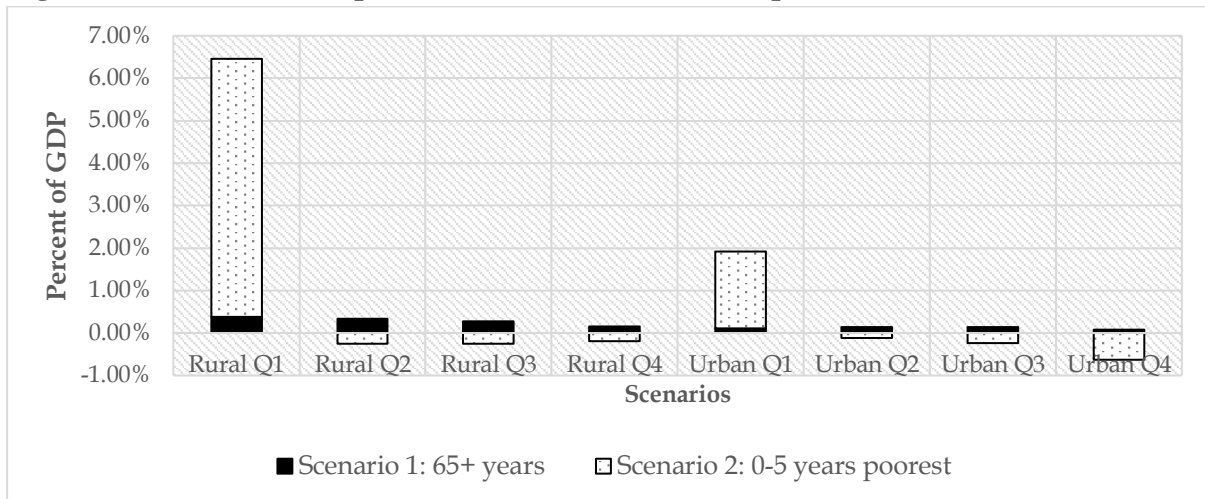
Source: Model results

4.1.3 Impact on real household consumption

Real household consumption encompasses the quantity of goods and services purchased for the final demands of households. The results in Figure 9 show that rural households are relatively the main beneficiaries compared to urban households across all simulations. In addition, among rural and urban households, the poorest households gain more than the richest households in terms of increases in real consumption. For instance, in scenario 1, where UGX 35,000 of the social grant is given to the elderly (65 + years), the consumption of the poorest quartile of rural households increased by 0.38 percent of GDP, whereas that for the richest rural households increased by 0.15 percent of GDP. In the same scenario, the consumption of the richest urban household increased by 0.12 percent of GDP and that of the poorest urban households by 0.09 percent of GDP. In the second scenario, where UGX 67,853 is given to children (0-5 years) among the poor households, the real consumption for the poorest rural households cumulatively increases by 6.08 percent of GDP and that for poorest urban households by 1.81 percent of GDP. The respective real consumption for the rest of the households decreases.

The rural poorest households are the main beneficiaries in all scenarios for two reasons. First, the cash transfer target children (0-5 years) living in poor households and also the elderly, the majority of whom also live in poor households. Secondly, the *Engel law* provides a theory that explains the increases in consumption of rural poor households (Byne and Capps, 1996, Cranfield et al., 1998). The *Engel law* states that the consumption basket of poor households is largely dominated by food commodities and that this changes towards service commodities as households' incomes increase. Thus, rural poor households also benefit from the strong second-round effects of the cash transfer. The increased consumption of agricultural commodities (food) stimulates an increase in agricultural output and labour demand. Since 95 percent of agricultural labour incomes are earned by rural-based workers (Tran et al., 2020), increases in agricultural output increase rural household incomes and real consumption. The results in Figure 10 are consistent with the findings of Levine et al. (2009) in Namibia and Egger et al. (2022) in Kenya, who revealed that cash transfers to households have increasing effects on household consumption.

Figure 10. Cumulative impact on real household consumption (FY 2022/23 – FY 2027/28)



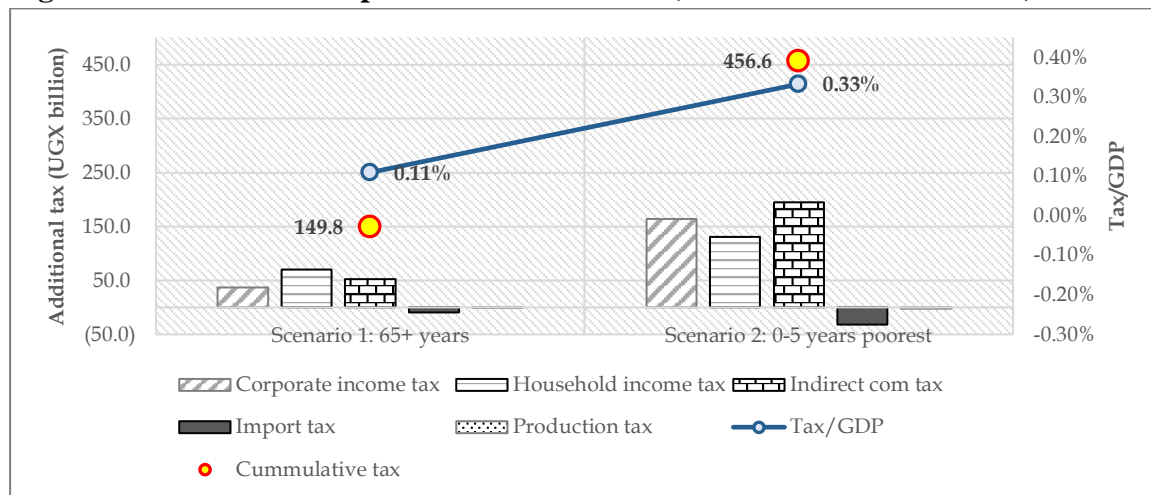
Source: Model results

4.1.4 Impact of social transfers on tax collections

The redirection of foreign aid grants from government and NPISH to direct transfers to households has an increasing impact on government tax collection. Between FY 2022/23 – FY 2027/28, tax gains due to the re-allocation of foreign aid transfers to senior citizens aged 65 years and above (scenario 1) generate an annual average tax take of about UGX 25.9 billion, which accumulates to UGX 149.8 billion for the simulation period, or about 0.11 percent of GDP. The leading tax head is household income tax (UGX 70 billion) followed by indirect taxes on commodities (UGX 52.2 billion) and corporate income tax (UGX 36.7 billion). The second scenario, which allocates aid-based cash transfers to poor households with children below five years of age, yields an annual average tax take of about UGX 76.1 billion, which accumulates to UGX 456.6 billion for the simulation period, or about 0.33 percent of GDP. The main leading tax heads are indirect taxes on commodities (UGX 195.2 billion) followed by corporate income tax (UGX 164.4 billion) and household income tax (UGX 41 billion) as shown in Figure 11.

It should be noted that, across all scenarios, import tariffs and production taxes fall largely because of the contraction of aggregate demand (GDP). The loss of import tariffs and production taxes is surpassed by the tax gains from income tax heads and indirect commodity taxes, hence the increased government position in tax collections. These results (Figure 11) are consistent with the findings of Branco (1994) that cash transfers increase both labour incomes and the government’s tax take.

Figure 11. Cumulative impact on tax collections (FY 2022/23 – FY 2027/28)

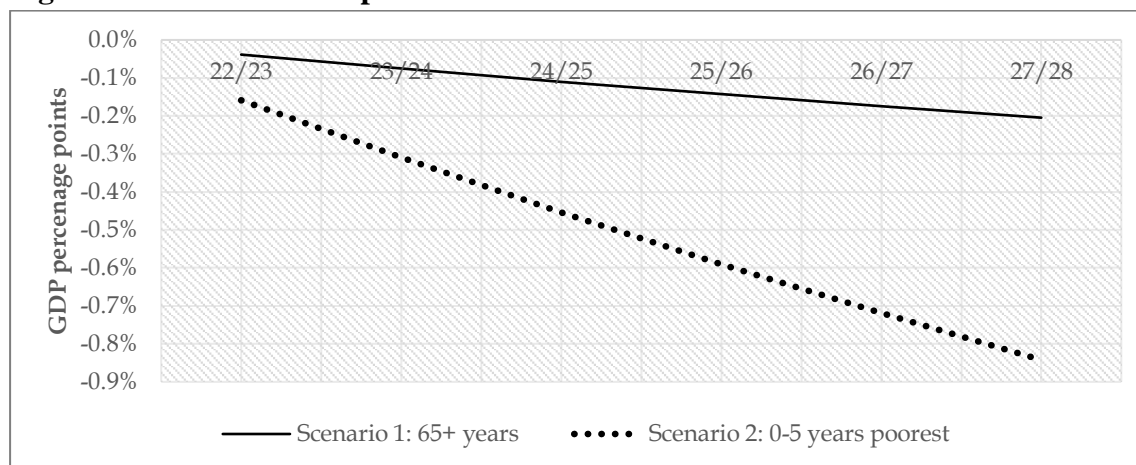


Source: Model results

4.1.5 Impact on economic growth

The results also show that social transfers to households financed by redirecting foreign aid from government and NPISH lead to reductions in economic growth. This is mainly because of the change in the allocation of the transfers from capital expenditure (by government and NPISH) to household consumption. It should be noted that increasing aid-based direct cash transfers to households without crowding out the traditional allocations to the government and private sector (NPISH) has an increasing effect on economic growth (see sub-section 4.2.2). Figure 11 shows that the loss in GDP is greater in the second scenario, where UGX 67,853 is allocated as social transfers to poor households with children aged five years and younger; this amounts to an annual reduction in GDP of 0.5 percent. This is followed by the 1st scenario, where a transfer of UGX 35,000 given to senior citizens (of 65+ years) reduces GDP by 0.1 percent annually. The results in Figure 12 are consistent with the findings of Yusuf (2018) in Indonesia, where SCT financed by increasing taxes was found to reduce economic growth.

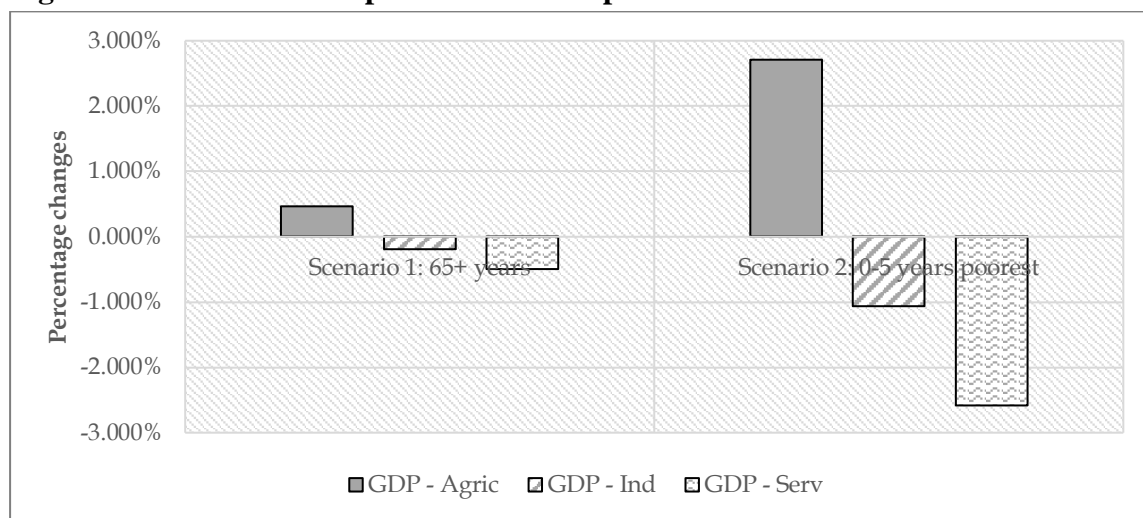
Figure 12. Cumulative impact of aid social cash transfers on real GDP



Source: Model results

In addition, Figure 13 shows that the reduction in GDP is largely driven by the service sector and the industry sector. This is because the re-distribution of aid from the government and NPSHI to households negatively affects public expenditure on infrastructure and services like education, health, and more. This forces the industry and service sectors' GDP to shrink. Conversely, agricultural GDP increases largely because the incidence of the social transfers is on poor households whose consumption basket largely consists of agricultural food commodities (about 40 percent) compared to the rich households, who spend about 15 percent on agricultural commodities. Thus, all scenarios lead to an increase in the demand for agricultural commodities, which causes an increase in output and growth (GDP) for the agriculture sector. This is consistent with the *Engel law* as explained in sub-section 4.1.3. The sectoral GDP results are shown in Figure 13.

Figure 13. Sectoral decomposition of the impact of social transfers on GDP



Source: Model results

4.1.6 Impact on household savings and investment

The results show that SCT financed by the re-allocation of foreign aid to government and NPSHI to households would have positive impacts on household savings and investments. However, at the macro level, the decline in aggregate investment is largely driven by the contraction of government investment alongside publicly driven private investment. The results in Figure 14 reveal the existence of distributive disparities across savings/investments by households. For scenario 1, where UGX 35,000 is given to senior citizens, the richest quartile of the households are the main beneficiaries in both rural and urban areas. The richest benefit more largely because the targeting of this scenario treats the elderly in poor and rich households the same. The richer households receive direct cash transfers and also have access to additional indirect incomes in the form of dividends and capital income, which is not the case for the poor households.

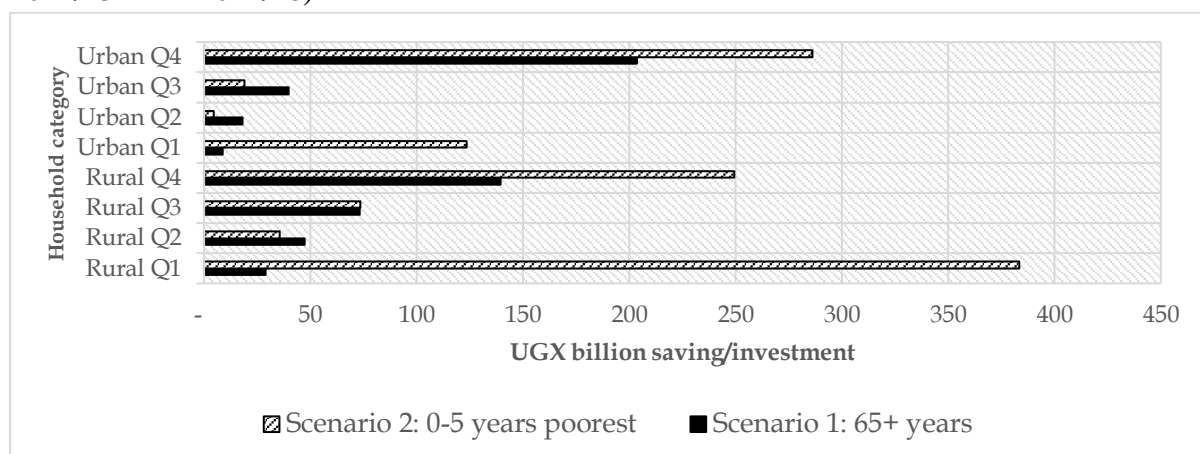
The second scenario posts unique results for rural and urban-based households. Among rural households, the poorest households are the main beneficiaries, whereas in urban areas the wealthiest are the main beneficiaries followed by the very poorest in terms of the gains from

savings and investments. This is because the targeting in this scenario focuses on directing the cash transfers to poor households with children five years old and younger. Since rural households largely depend on labour income, changes in their savings would be only driven by direct SCT and indirect effects on labour income from the expansion of the agricultural sector. Richer households in urban areas would benefit from increased dividends, capital incomes and labour incomes driven by increased consumer demand among poor urban households receiving the cash transfer. This explains the gains in savings for the poorest and richest households in urban areas.

In summary, the disparities in the results depicted in Figure 14 are explained by the fact that rural households are heavily dependent on agricultural labour income, whereas urban households are dependent on capital and dividend income. The 2016/17 SAM (Tran et al., 2020) shows that 95.3 percent of agricultural wages are received by rural labour and 26.2 percent of national rural wages is paid to the households that are in the poorest income quartile. Urban households are largely dependent on their investments in the industry and service sectors. Tran et al. (2020) also shows that the richest quartile of urban households derives 51 percent of their income from capital and 19 percent from dividends from firms and enterprises. Thus, we make two conclusions regarding household savings and investments. First, the poorest rural and urban households benefit more when direct aid cash transfers are directed to the poorest households with children five years old and younger. Second, universal SCTs to senior citizens aged 65 and above are relatively more beneficial to the savings and investments of richer households that to poor households in both rural and urban areas.

The results are consistent with the findings of Hagen-Zanker et al. (2018) and Gelders and Athias (2019), who found that social cash transfers increase household savings and investments. In addition, Evans et al. (2021) conducted a study assessing the educational impacts of cash transfers in Tanzania and found that they are effective in alleviating constraints from poverty through increasing incomes and savings.

Figure 14. Cumulative impact of cash transfers on household savings/investment (FY 2022/23 – FY 2027/28)



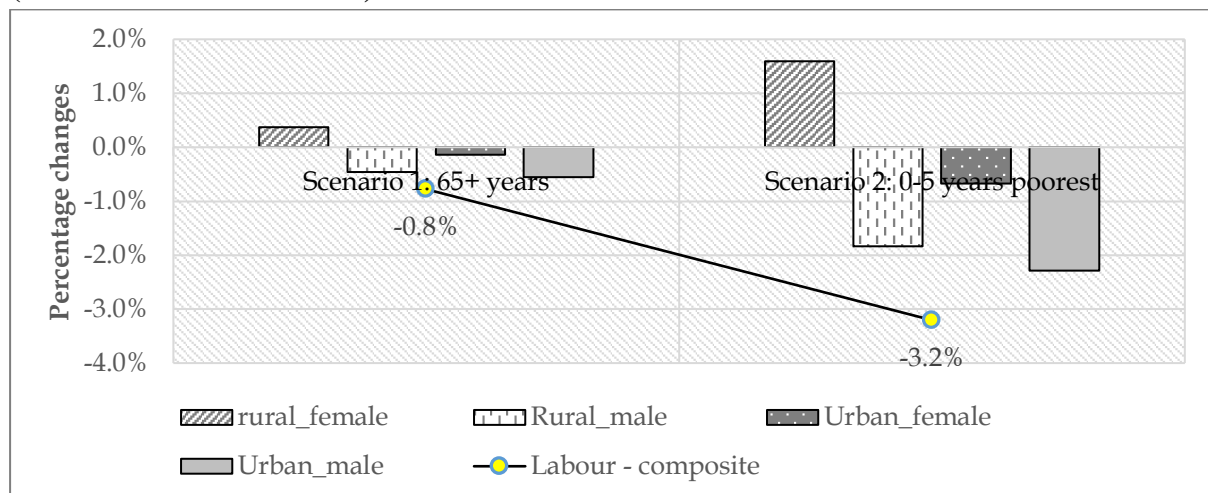
Source: Model results

4.1.7 Gendered impact on employment

The analysis reveals a gendered impact on employment as a result of the redistribution of foreign aid from the government and NPISH to direct transfers across households. On an aggregate level, employment falls in all scenarios by 0.8 percent and 3.2 percent for scenarios 1 and 2 respectively. The breakdown of the employment categories shows that employment for rural female workers increases, whereas employment for other labour categories (urban female and male labour in rural and urban areas) falls. This is driven by the composition of the population and the structure of the Ugandan economy as depicted in the 2016/17 Social Accounting Matrix (SAM).

The population census data (UBOS, 2022) show about 63 percent of children below five years of age live in rural households. In addition, the 2016/17 SAM shows that about 40 percent of the consumption basket for rural households consists of agricultural commodities (Tran et al., 2020). Thus, following *Engel's law*, the cash transfers to rural households increase the demand for agricultural commodities, thus increasing agricultural GDP, and that this accumulates to about 0.5 percentage points above the baseline between FY 2022/23 and FY 2027/28. Since a third of the labour income for rural female workers comes from the agriculture sector, the increase in agricultural GDP calls for more output and employment. This explains the increases in rural female labour employment across all the scenarios. However, the other labour categories (urban female and male labour in rural and urban areas) derive their incomes largely from the shrinking service and industrial sectors. This explains the reduction in employment of these labour categories in all scenarios, as shown in Figure 15.

Figure 15. Gendered cumulative impact of aid-based social cash transfers on employment (FY 2022/23 – FY 2027/28)



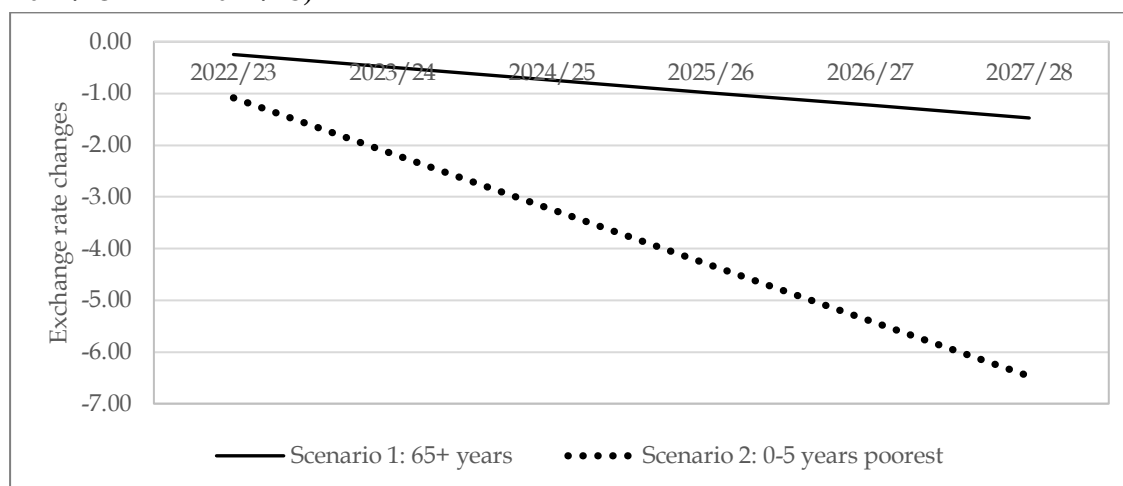
Source: Model results

4.1.8 Impact of social transfers on competitiveness

Firstly, social cash direct aid transfers to households involve the inflow of foreign currency into the domestic economy. Secondly, the incidence of this foreign aid generates distributive effects on the rest of the economy, including the tradable and non-tradable sectors. The results

show that social transfers to households financed with foreign aid cause appreciation pressures on the currency's real exchange rate across all scenarios. The differences in the impacts are dictated by the total amount of aid allocated in each scenario. This transformation is detrimental, especially to the tradable sectors. Exchange rate appreciation makes Uganda's exports expensive in external markets and its imports cheaper in the domestic market. This stimulates a wave of deterioration of the current account deficit (see Appendix 6.2). The cumulative impact of foreign aid on the real exchange rate is shown in Figure 16.

Figure 16. Cumulative impact of aid-based social transfers on real exchange rate (FY 2022/23 – FY 2027/28)



Source: Model results

4.2 Results of the alternative financing scenario

In this section, we discuss the results of the third scenario which is a replicate of scenario 1, but with a new assumption that direct aid cash transfers to households is financed by cutting down overseas aid overhead costs. The assessment compares scenarios 3 and 1, which finance the cash transfers by cutting the aid allocated to government and local actors like NPISH. We assume an allocation of UGX 35,000 per senior citizen (65+ years) for both scenarios.

The results in Box 1 show that financing direct cash transfers by switching the offshore aid overhead costs to local actors (households) would offer the greatest benefit to Uganda. Between FY 2022/23 and FY 2027/28, scenario 3 posits a positive cumulative impact on GDP of 1.5 percentage points compared to a -0.2 percentage points reduction for scenario 1 (Box 1: Figure a). This disparity arises from financing the cash transfers by cutting aid allocations to government and NPISH. This involves switching aid funds from investment expenditure (by the government) to consumptive expenditure by households, which hurts economic growth relative to the baseline. However, switching a portion of overseas overhead costs to financing the cash transfers to vulnerable households would provide additional benefits in the form of new resources, which increases aggregate demand, with no direct trade-off with the financing depicted in the baseline.

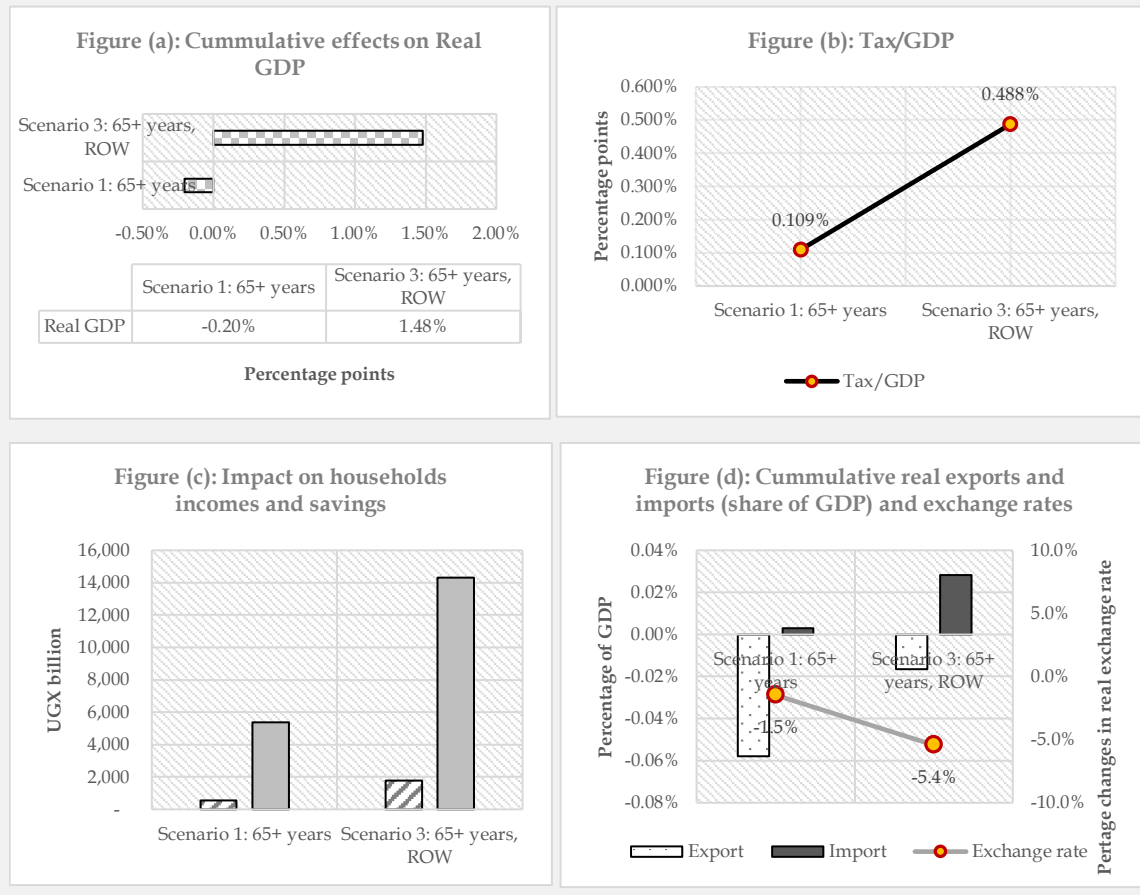
Financing cash transfers by reducing overseas aid costs would also cumulatively increase tax collections to GDP by 0.5 percentage points compared to 0.1 percentage points under scenario

1, which is financed by cuts of allocations to government and NPISH (Box 1: Figure b). Based on the impact of international competitiveness, the cumulative impact on exchange rate appreciation is stronger for scenario 3 (-5.4 percentage points) than scenario 1 (1.5 percentage points). This disparity is explained by the fact that financing cash transfers using cuts to the overseas aid architecture involves the inflow of foreign currency, which directly impacts on the appreciation of the exchange rate. The smaller appreciation in scenario 1 arises from increased consumption, which increases domestic prices, as well as agricultural output and exports.

Despite scenario 3 having higher appreciation rates (Box 1: Figure d), the loss in exports is less than that for scenario 1, though imports increase more quickly. Scenario 1 would hurt Uganda's international competitiveness more compared to scenario 3. This is because larger aid inflows under scenario 3 increase aggregate demand (GDP) and investment, and also reduce the loss in exports due to appreciation pressures on the exchange rate.

The results discussed above are consistent with the findings of Venton et al. (2022), who recommended the shifting of aid funds from the international aid architecture (overseas aid costs) to local individual actors. Venton et al. assessed the benefits as ranging from improvements to social and economic inclusion, equity, and sustainability. Thus, the results presented in Box 1 affirm the authors' call for donors to consider reconceptualising the role of the intermediary and shifting aid to local actors through direct cash transfers to the government.

Box 1: Comparison of cash transfer by source of financing (local/oversea spending cuts)



Source: Model results

5. Conclusion and implications

In this paper, we have discussed the impact of the re-prioritisation of foreign aid in Uganda, especially in order to improve household incomes, investment, economic growth and government tax revenues, as well as removing constraints on the poor through poverty alleviation. The findings of this study communicate the policy challenges that are currently faced by the government of Uganda in the effort to reduce poverty by introducing SCTs across the country. The economy-wide effects of shifting aid funds from the international aid architecture to local actors go beyond the sectors of incidence to the non-recipient households through the backward and forward linkages within the productive structure of the economy. The results imply that shifting funds from the international aid architecture to local actors like vulnerable households would yield many more economic benefits than the reallocation of aid from the government to a direct transfer scheme, as the latter would hurt economic growth. Thus, we recommend an increase in direct cash transfers to households through reallocations from the international intermediary structures to local actors.

The alternative option of reducing offshore aid-based overhead costs to finance SCT is the most effective in improving economic growth, household incomes, government tax revenues, employment and household savings and investments. This affirms that SCT is an effective economic policy with the potential to expedite the attainment of the first Sustainable Development Goal (SDG 1) and the NDP III objective of ending poverty in all its forms. Based on the empirical evidence demonstrated in this paper, we therefore recommend international donors to consider re-directing the aid funds from the overseas overhead costs to local actors by giving direct SCTs to vulnerable households.

Despite the positive benefits of the policy, there is a need to design an effective targeting strategy for vulnerable households to avoid the inclusion and exclusion errors identified by Levine et. al., (2009). The effective targeting strategy would avoid including children in richer households (no inclusion error) and also make sure that children in poor households are all included in the cash transfer scheme (no exclusion error). The efficiency and effectiveness of the targeting framework is key to achieving the outcomes of adopting the recommended scenarios suggested in this paper.

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7. APPENDICES

7.1 Appendix 1. Distribution of foreign aid to households in the form of social cash transfers

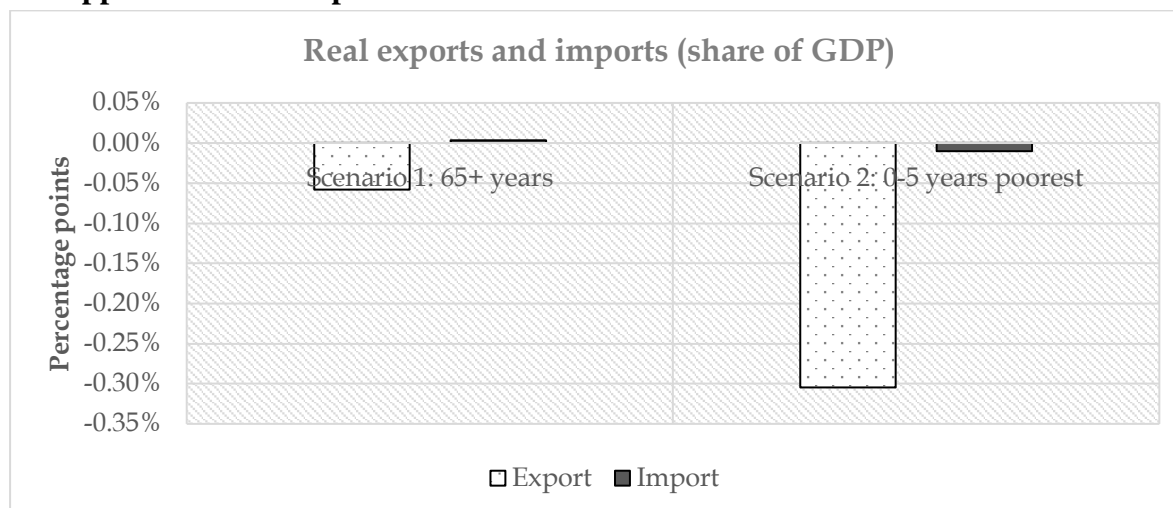
Table a. Social cash transfers to elderly 65 years of age and above (UGX bn)

	FY	FY	FY	FY	FY	FY
	22/23	23/24	24/25	25/26	26/27	27/28
Rural hh Q1	103.1	106.3	109.6	113.1	116.6	120.3
Rural hh Q2	94.3	97.2	100.3	103.4	106.7	110.0
Rural hh Q3	85.8	88.5	91.3	94.1	97.1	100.1
Rural hh Q4	60.6	62.5	64.4	66.4	68.5	70.7
Urban hh Q1	30.7	31.6	32.6	33.6	34.7	35.8
Urban hh Q2	39.8	41.1	42.4	43.7	45.1	46.5
Urban hh Q3	51.0	52.6	54.2	55.9	57.7	59.5
Urban hh Q4	81.6	84.2	86.8	89.5	92.4	95.2

Table b. Social cash transfers to children 5 years of age and below living in poor households (UGX bn)

	FY	FY	FY	FY	FY	FY
	22/23	23/24	24/25	25/26	26/27	27/28
Rural hh Q1	1,495.2	1,542.1	1,590.4	1,640.2	1,691.5	1,744.5
Rural hh Q2	0.0	0.0	0.0	0.0	0.0	0.0
Rural hh Q3	0.0	0.0	0.0	0.0	0.0	0.0
Rural hh Q4	0.0	0.0	0.0	0.0	0.0	0.0
Urban hh Q1	445.0	458.9	473.3	488.1	503.4	519.1
Urban hh Q2	0.0	0.0	0.0	0.0	0.0	0.0
Urban hh Q3	0.0	0.0	0.0	0.0	0.0	0.0
Urban hh Q4	0.0	0.0	0.0	0.0	0.0	0.0

7.2 Appendix 2. Real exports as a share of GDP

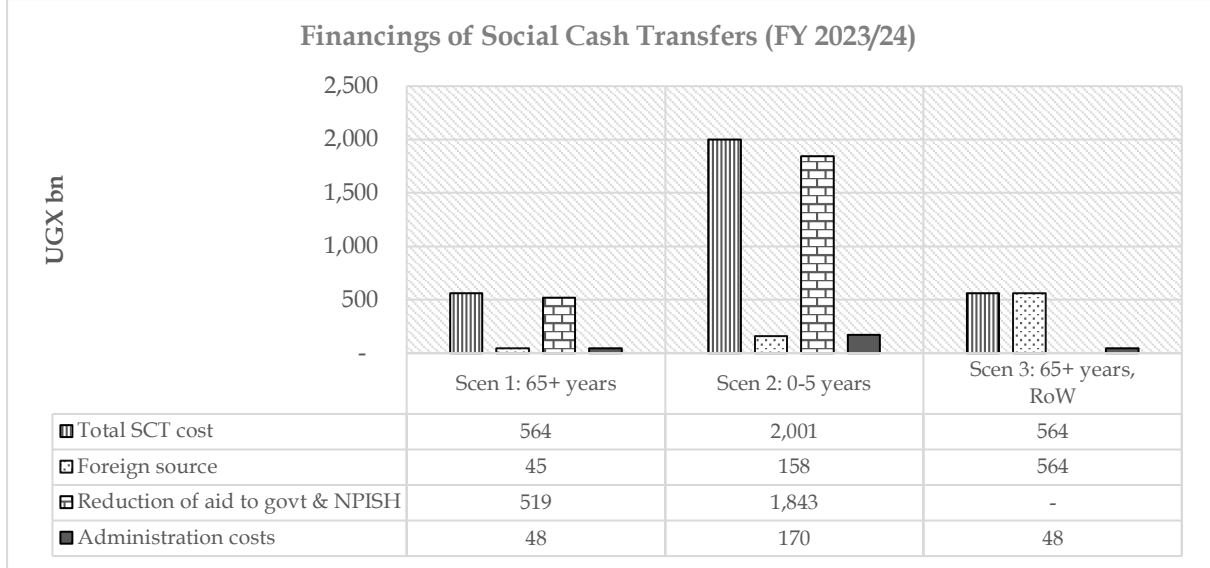


7.3 Appendix 3. Linking the SAM to the CGE model

	a-agr	a-nagr	c-agr	c-nagr	f-lab	f-cap	h-urb	h-rur
a-agr			Pca $\theta_{aa,c}$ a $QAaa$	Pcn $\theta_{aa,c}$ n $QAaa$				
a-nagr			Pca $\theta_{an,c}$ a $QAan$	Pcn $\theta_{an,c}$ n $QAan$				
c-agr							Pca $QHca$ $,hu$	Pca $QHca$ $,hr$
c-nagr							Pcn $QHcn,h$ u	Pcn $QHcn,h$ r
f-lab	$WFfl$ $QFfl,aa$	$WFfl$ $QFfl,an$						
f-cap	$WFfk$ $QFfk,a$ a	$WFfk$ $QFfk,a$ n						
h-urb					$shryhu,f$ $l YFfl$	$shryhu,f$ $k YFfk$		
h-rur					$shryhr,f$ $l YFfl$	$shryhr,f$ $k YFfk$		
total	$PAaa$ $QAaa$	$PAan$ $QAan$	Pca Qca	Pcn Qcn	$YFfl$	$YFfk$	Yhu	Yhr

					= $WFfl$ $QFSfl$	= $WFfk$ $QFSfk$		
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7.4 Appendix 4. Financing Social Cash Transfers (FY 2023/24)



7.5 Appendix 4. Equations for the Computable General Equilibrium (CGE) Model

Production bloc

$$(1) \quad XS_j = \text{Min} \left[\frac{CI_j}{io_j}, \frac{VA_j}{v_j} \right]$$

$$(2) \quad VA_j = A_j^{KL} \left[\alpha_i^{KL} LD_i^{-\rho_i^{KL}} + (1 - \alpha_i^{KL}) KD_i^{-\rho_i^{KL}} \right]^{-1/\rho_i^{KL}}$$

$$(3) \quad LD_i = A_i^{LL} \left[\alpha_i^{LL} QL_i^{-\rho_i^{LL}} + (1 - \alpha_i^{LL}) NQL_i^{-\rho_i^{LL}} \right]^{-1/\rho_i^{LL}}$$

$$(4) \quad CI_j = io_j XS_j$$

$$(5) \quad DI_{i,j} = aij_{i,j} CI_j$$

$$(6) \quad LD_i = \left(\frac{\alpha_i^{KL}}{1 - \alpha_i^{KL}} \right)^{\sigma_i^{KL}} \left(\frac{r_i}{w_i} \right)^{\sigma_i^{KL}} KD_i$$

$$(7) \quad NQL_i = \left(\frac{\alpha_i^{LL}}{1 - \alpha_i^{LL}} \right)^{\sigma_i^{LL}} \left(\frac{wq}{wnq} \right)^{\alpha_i^{LL}} QL_i$$

Income and demand bloc

$$(8) \quad YH_h = \lambda_h^{WQ} \cdot wq \sum_j QL_j + \lambda_h^{WQN} \cdot \sum_j NQL_j + \lambda_h^R \sum_{nag} r_{nag} KD_{nag} + \lambda_h^L \cdot \sum_{ag} r_{ag} KD_{ag} + P_{index} TG_h + P_{index} TH_{h,hj} + P_{index} TWH_h + DIV_h$$

$$(9) \quad YDH_h = YH_h - DTH_h$$

$$(10) \quad SH_h = v \cdot \psi_h \cdot YDH_h$$

$$(11) \quad YF = \lambda^{RF} \sum_i r_i KD_i + \lambda^{LF} \cdot rl \cdot LAND$$

$$(12) \quad SF = YF - \sum_h DIV_h - e \cdot DIV^{ROW} - DTF$$

- (13) $YG = \sum_i TI_i + \sum_i TIE_i + \sum_i DTH_h + DTF$
(14) $SG = YG - G - PINDEX \sum_h TG_h$
(15) $TI_i = tx_i(P_iXS_i - PE_iEX_i) + tx_i(1 + tm_i).e.PWM_iM_i$
(16) $TIM_i = tm_i.e.PWM_iM_i$
(17) $TIE_i = te_iPE_iEX_i$
(18) $DTH_h = tyh_hYH_h$
(19) $DTF = tyf.YF$

International trade bloc

- (20) $XS_i = B_i^E \left[\beta_i^E EX_i^{k_i^E} + (1 + \beta_i^E) D_i^{k_i^E} \right]^{\frac{1}{k_i^E}}$
(21) $EX_i = \left[\left(\frac{PE_i}{PL_i} \right) \left(\frac{1 - \beta_i^E}{\beta_i^E} \right) \right]^{\tau_i^E} D_i$
(22) $EXD_i = EXD_i^o \cdot \left(\frac{PWE_i}{PE_{FOB_i}} \right)^{elast_i}$
(23) $Q_i = A_i^M \left[\alpha_i^M M_i^{-\rho_i^M} + (1 - \alpha_i^M) D_i^{-\rho_i^M} \right]^{\frac{-1}{\rho_i^M}}$
(24) $M_i = \left[\left(\frac{PD_i}{PM_i} \right) \left(\frac{\alpha_i^M}{1 - \alpha_i^M} \right) \right]^{\sigma_i^M} D_i$
(25) $CAB = \sum_i PWM_iM_i + \lambda^{ROW} \sum_i r_i KD_i / e + DIV^{ROW} - \sum_i PE_{FOB_i} EX_i$

Price bloc

- (26) $PV_j = \frac{P_jXS_j - \sum_i PC_iDI_{i,j}}{VA_j}$
(27) $r_i = \frac{PV_iVA_i - w_iLD_i}{KD_i}$
(28) $w_i = \frac{wq.QL_i - wnq.NQL_i}{LD_i}$
(29) $PD_i = (1 + tx_i)PL_i$
(30) $PM_i = (1 + tx_i).(1 + tm_i).e.PWM_i$
(31) $PE_i = \frac{e.PE_{FOB_i}}{1 + te_i}$
(32) $PC_iQ_i = PD_iD_i + PM_iM_i$
(33) $P_iXS_i = PL_iD_i + PE_iEX_i$

Equilibrium conditions

- (34) $P_{inv} = \prod_i \left(\frac{PC_i}{\mu_i} \right)^{\mu_i}$
(35) $P_{index} = \sum_i \delta_i PV_i$
(36) $Q_i = DIT_i + \sum_h C_{i,h} + INV_i + Dstk_i$
(37) $EX_i = EXD_i$
(38) $LSQ = \sum_j QL_j$
(39) $LSNQ = \sum_j NQL_j$
(40) $IT + \sum_i PC_iDstk_i = \sum_h SH_h + SF + SG + e.CAB$

Dynamic equations

$$(41) KD_{i,t+1} = (1 - \delta)KD_{i,t} + Ind_{i,t}$$

$$(42) LSQ_{t+1} = (1 + ng).LSQ_t$$

$$(43) LSNQ_q = (1 + ng).NQL_t$$

$$(44) C_{i,h,t+1}^{min} = (1 + ng)C_{i,h,t}^{min}$$

$$(45) \frac{Ind_{i,t}}{KD_{i,t}} = A_i^{IK} \left(\frac{R_{i,t}}{U_{i,t}} \right)^2$$

$$(46) U_{i,t} = P_{inv_t}(ir + \delta_i)$$

$$(47) IT_t = P_{inv_t} \cdot \sum_i Ind_{i,t}$$

$$(48) SG_{t+1} = (1 + ng)SG_t$$

$$(49) CAB_{t+1} = (1 + ng)CAB_t$$

$$(50) TG_{t+1} = (1 + ng)TG_t$$

$$(51) CG_{t+1} = (1 + ng)CG_t$$

$$(52) Dstk_{t+1} = (1 + ng)Dstk_t$$

$$(53) DIV_{t+1} = (1 + ng)DIV_t$$

$$(54) DIV_ROW_{t+1} = (1 + ng)DIV_ROW_t$$

$$(55) TWH_{t+1} = (1 + ng)TWH_t$$

$$(56) TH_{h,h,j,t+1} = (1 + ng)TH_{h,h,j,t}$$

$$(57) EXD_{t+1}^o = (1 + ng)EXD_t^o$$

Description of variables and parameters

Endogenous variables

$C_{i,h}$	Household h 's consumption of good i (volume)
CF	Composite agricultural capital-labor factor (volume)
CI_j	Total intermediate consumption of activity j (volume)
CTH_h	Household h 's total consumption (value)
D_i	Demand for domestic good i (volume)
$DI_{i,j}$	Intermediate consumption of good i in activity j (volume)
DIT_i	Intermediate demand for good i (volume)
DTF	Receipts from direct taxation on firms' income
DTH_h	Receipts from direct taxation on household h 's income
EX_i	Exports in good i (volume)
G	Public expenditures
INV_i	Investment demand for good i (volume)
IT	Total investments
LD_j	Activity j demand for labor (volume)
M_i	Imports in good i (volume)
P_i	Producer price of good i
PC_i	Consumer price of composite good i
PD_i	Domestic price of good i (including taxes)
PE_i	Domestic price of exported good i
$Pindex$	GDP deflator

P_{inv}	Price index of investment
PL_i	Domestic price of good i (excluding taxes)
PM_i	Domestic price of imported good i
PV_i	Value added price for activity j
Q_i	Demand for composite good i (volume)
r_i	Rate of return to capital in activity i
rl	Rate of return to agricultural land
rc	Rate of return to composite factor
SF	Firms' savings
SG	Government's savings
SH_i	Household h 's savings
TI_i	Receipts from indirect tax on i
TIE_i	Receipts from tax on export i
TIM_i	Receipts from import duties i
VA_j	Value added for activity j (volume)
w	Wage rate
XS_i	Output of activity i (volume)
YDH_h	Household h 's disposable income
YF	Firms' income
YG	Government's income
YH_h	Household h 's income
LS	Total labor supply (volume)
KD_i	Demand for capital in activity i (volume)
CAB	Current account balance
$Ind_{i,t}$	Demand for capital in activity i (volume)
U_t	Capital user cost
$C_{i,h}^{min}$	Minimum consumption of good i by household h

Exogenous variables

PWE_i	World price of export i
PWM_i	World price of import I
e	Nominal Exchange rate (numéraire)

Parameters

Production functions

A_i	Scale coefficient (Cobb-Douglas production function)
$aij_{i,j}$	Input-output coefficient
α_j	Elasticity (Cobb-Douglas production function)
io_j	Technical coefficient (Leontief production function)
v_j	Technical coefficient (Leontief production function)

CES function between capital and labor

A_i^{KL}	Scale coefficient
α_i^{KL}	Share parameter
ρ_i^{KL}	Substitution parameter
σ_i^{KL}	Substitution elasticity

CES function between skilled and unskilled labor

A_i^{LL}	Scale coefficient
α_i^{LL}	Share parameter
ρ_i^{LL}	Substitution parameter
σ_i^{LL}	Substitution elasticity

CES function between imports and domestic production

A_i^M	Scale coefficient
α_i^M	Share parameter
ρ_i^M	Substitution parameter
σ_i^M	Substitution elasticity

CET function between domestic production and exports

B_i^E	Scale coefficient
β_i^E	Share parameter
κ_i^E	Transformation parameter
τ_i^E	Transformation elasticity

LES consumption function

$\gamma_{i,h}$	Marginal share of good i
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Tax rates

te_i	Tax on exports i
tm_i	Import duties on good i
tx_i	Tax rate on good i
ty_{h_h}	Direct tax rate on household h 's income
ty_f	Direct tax rate on firms' income

Other parameters

δ_j	Share of activity j in total value added
λ_h^L	Share of land income received by household h
λ^{LF}	Share of land income received by firms
λ^{LROW}	Share of land income received by foreigners
λ_h^R	Share of capital income received by household h
λ^{RF}	Share of capital income received by firms

λ^{ROW}	Share of capital income received by foreigners
λ_h^W	Share of labour income received by household h
ψ_h	Propensity to save
μ_i	Share of the value of good i in total investment
ng	Population growth rate
δ	Capital depreciation rate
γ_{1i}	Parameter in the investment demand function
γ_{2i}	Parameter in the investment demand function
i^r	Real interest rate

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ROSKILDE UNIVERSITY
UNIVERSITETSVEJ 1, POSTBOX 260
4000 ROSKILDE, DENMARK

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