Reforming grants to tackle child poverty: An integrated macro-micro approach

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Highlights

- We study the direct and the general equilibrium effects of scaling-up the South African Child Support Grant.
- We use a recursive bottom-up/top-down CGE-microsimulation approach with three different financing scenarios.
- The proposed reform brings small positive impacts at the macro level and a decrease in poverty.
- Direct and indirect factors contribute to the poverty change but unlikely to be significant, with the direct being prevalent.
- Important progressive heterogeneous are found, with the richest percentiles slightly deteriorating their welfare.

Abstract

Social grant schemes have become an important component of many developing countries' inclusive growth strategies with governments increasingly investing in large-scale cash transfer programs. South Africa's Child Support Grant (CSG) is one of the largest cash transfer systems in Africa. However, child poverty remains high in the country, leading to calls to expand the CSG. Government faces resource scarcity and therefore needs to create fiscal space to set up such a reform. This paper evaluates the economy-wide impact of the CSG on the economy using a recursive bottom-up/top-down CGE-micro simulation approach. This allows the estimation of the potential effects of a 20% increase in the grant on households' welfare, the economy, as well as on the fiscal constraint. This reform is evaluated under three fiscal scenarios to take into account the fiscal stress the country is currently experiencing. We find that the reform brings some positive impacts at the macro level, and a decrease in poverty for the whole population as well as for children. The direct effect brought by the CSG increase represents the largest contribution to poverty reduction, but the indirect (general equilibrium) effects globally reduce the positive poverty effects engendered by the CSG. Some interesting heterogeneous effects are also found, with the proposed reform being progressive and the richest percentiles showing a (small) deterioration due to the decrease in wage revenues. However, the overall poverty and inequality effects are small and unlikely to be robust. The paper's results can assist South Africa, and indeed other African countries, calling for increased coverage of grants as well as exploring universal coverage. Further, the use of the integrated macro-micro simulation methodology is a major contribution of this paper.

JEL classification: D58; E24; E6; H53; I3; J01; O55

Keywords: child support grant; computable general equilibrium; micro-simulation; poverty; South Africa

1 INTRODUCTION

Investing in large-scale cash transfer programs has become a crucial component of many developing countries' inclusive growth strategies (The Department for International Development (DfID), 2011). South Africa has one of the largest cash transfer systems in Africa. The Child Support Grant (CSG) has been an important instrument of that social protection and is both the largest of South Africa's social cash transfer programmes as well as one of its most successful social protection interventions. A number of studies have contributed to a growing evidence base, demonstrating the successes of the CSG in terms of reducing poverty and promoting human capital development (see below for a discussion of these studies). However, although these studies typically appreciate the importance of general equilibrium effects, they do not use the tools that can quantify them. This paper addresses that important gap. In particular, we investigate whether the indirect or general equilibrium effects resulting from the proposed scaling-up of the CSG scheme, other than the direct effects, affects poverty and inequality among South Africa children. Hence the necessity of using a micro/macro general equilibrium approach. As demonstrated in the following section, there are very few studies in the literature looking at the potential general equilibrium effects due to a social reform. In this paper, we found that the macroeconomic changes as induced by the proposed reforms are small and this results in marginal indirect poverty and inequality effects. Also, while the scaling-up of the CSG scheme clearly appears to be progressive, the overall poverty and inequality effects are small and unlikely to be robust.

The CSG was first introduced in 1998 and is the largest social protection scheme in the country by number of recipients (growing from 8.2 million children in 2007/8 to 10.7 million in 2011/12 and by 2016/17 had reached 12.1 million) with the amount allocated to the grant growing from 19.6 billion rands in 2007/8 to just over 34 billion rands in 2011/12 and 51.4 billion rands in 2016/17[i]. In addition, there have been various reforms and innovations within the provision of CSG since its beginning. The reforms include the expansions to the CSG's criteria for eligibility including an increase in the age limit from seven to eighteen years old, and adjustments to the income threshold to take inflation into account and improve equity (the amount per beneficiary rose from 200 rands on 2007/8 to 265 rands in 2011/12 and currently is pegged at 355 rands in 2016/17). Although great achievements were demonstrated in the lives of recipient children, about 2.35 million eligible children were still unable to access the CSG by 2011 (SASSA and UNICEF (2013)). Since 2011, there has been an improvement in reducing exclusion with the number of excluded children now at 1.8 million (Department of Social Development, SASSA and UNICEF, 2016). Government has been trying to reach the excluded children who are missing this lifetime opportunity and denied their constitutional right to social assistance. Also, the poverty rate among CSG beneficiaries is still critically high (81% versus 29% among non-beneficiaries (own calculations based on NIDS 2008). Therefore, there is potential for growth in the CSG. A major contribution of this paper is its focus on the general equilibrium effects of reforming the CSG, under different fiscal scenarios. To do that, a recursive bottom/up-top/down computable general equilibrium (CGE)-microsimulation approach is used to capture the overall impacts of the reform. Although the paper uses South African data, it is generalizable to many other countries wanting to understand the general equilibrium effects of social grants, and analyse the impacts given alternative fiscal scenarios. The use of this sequential methodology is in itself also a major contribution, which inspires from the pioneering work by Savard (2003). The use of a top-down CGE-microsimulation approach as in Herault (2006) on South Africa would have allowed only to capture the general equilibrium effects as generated by the increased government spending due to the reform. By introducing a (starting) bottom-up sequence (as we do here), we also capture the general equilibrium effects engendered by the variation in the labour force participation and household consumption due to the reform. The fully integrated CGE-microsimulation framework (as in Cockburn et al., 2007), although it has the advantage of ensuring a full consistency between the macro and microeconomic models, it would not have allowed to have an econometrically-estimated microsimulation model, which is the most suitable framework to capture the direct effects on labour supply. The rest of the paper is arranged as follows: Section 2 briefly looks at relevant literature, while section 3 details the micro macro methodology used. In section 4 we discuss the findings and conclude the paper in section 5.

2 Literature Review

Studies on the evaluation of social grants abound in South Africa (for example, Samson et al. 2004, Booysen, 2004, Eyal and Woolard, 2011, Ntuli and Wittenberg (2013). Most of the studies have used a micro modelling approach. Such an approach can identify the *partial equilibrium effects* of social grants on labour force participation and household consumption patterns. According to various studies (e.g., Case and Deaton, 1998, Keller, 2004, Klasen and Woolard 2008, Bertrand et al, 2003), the receipt of the *social age old pension* is an important source of support for those unemployed, especially the youths and young adults. These two groups tend to stay longer in their households due to pension payouts of their parents. As summarised in Van der berg and Siebrits (2010), this has two effects on the labour market. One is that some people stop or delay looking for work when they benefit from hosehold members receiving grants. The other is that when migrant absentees are included, then social grants income may allow individuals the freedom to search for employment away from home (see Samson et al, 2004). This second effect is stonger for women than it is for men. On the other hand, Posel et al. (2006) find that, while OAP eligibility has no overall labour supply effect, OAP has a significant and positive impact on female labour supply only. These findings, which constitute most of the available evidence on the impact of social grants on labour market indicators in South Africa, are not necessarily extendable to the case of the *Child Support Grant* for various reasons. First, in 2008 (the year of our data) the unit amount of the OAP was around 4.5 times higher than that of the CSG (the ratio is similar also in more recent years). Considering the high fixed costs that poor people (especially in rural areas) may need to absorb while looking for job, the relatively small amount of the CSG is expected to generate modest or insignificant changes in the labour market outcomes. Second, CSG and OAP-beneficiary households differ substantially in their socio-demographic structure. While the latter are relatively often constituted by three generations, CSG-beneficiary households are predominantly bi-generational households. Even though we have no evidence supporting it, we believe that such a diversity may engender different mechanisms driving the effect of the grants on labour market outcomes.

Also, more generally, as discussed in Eyal and Woolard (2011), the sign of the labour outcome with respect to a change in the grant depends on whether leisure is a normal or inferior good. As the authors state, assuming that leisure is a normal good (as generally done) "cannot be taken for granted in the South African context, and in particular not amongst [some groups of people], given their documented high levels of unemployment" (p. 8).

Williams (2007) found that, although receiving the CSG seemed not to affect women's search behaviour or actual employment, it influenced labour force participation positively. One possible reason that is advanced is "…receiving a CSG may give a mother some income stability and alleviate her enough from domestic duties and immediate subsistence needs that she is capable of holding a job. This would account for an increase in broad participation. However, if the means test income threshold is likely to be a binding constraint for her, this willingness to work may not translate immediately into active job search and employment – she may be passively network-searching for an employment opportunity that compensates her enough for the loss of her CSG." (Williams (2007: p 70)). Eyal and Woolard (2011) found that the CSG receipt increases the probability of mothers of entering the labour force and of being employed, while decreases that of being unemployed. However, in general, according to CASE (2008: 27), the labour supply effects are small given that the amount of the CSG is also small.

The partial equilibrium results of cash transfers on consumption impacts are generally positive with a number of studies finding that cash transfers significantly improved household consumption, dietary diversity and per capita calorific consumption (see DfID (2011); Adato and Bassett (2009); Hoddinott et al (2000); Booysen (2004); Attanasio and Mesnard (2006); Kebede (2006)).

As mentioned, however, these studies use a partial framework for the evaluation, thus are not able to account for spillover effects. Yet, there is a need to link the micro effects of such transfers to the macro economy. The need to link macroeconomic performance to income distribution has been partly driven by the rate at which cash transfer programs are being implemented in developing countries. Until two decades ago theoretical neoclassical economics never provided the innovation that would see a combined modelling approach that would resolve the limitations of a delinked empirical framework (Ahmed and Donoghue

(2007)). Generally, changes in cash transfers, such as the CSG, exert an impact at the household level through two main micro channels, at least in the short term; firstly, they influence how the household allocates labour between work and leisure and as such alter rates of labour force participation (Ferro et al (2010); Foguel and Barros (2010)). Secondly, they also alter the consumption pattern of households by improving the diversity and per capita consumption of the grant receiving household. At the same time, changes in the CSG, especially in a context where the size of the program is relatively large, can have impacts at the macro level which alter prices and quantities of goods and services. These changes in prices have an impact on household monetary poverty and inequality. The interplay of labour reallocations and consumption changes will affect production. Furthermore, the transfers have impacts on the fiscal balances. In order to capture these macro-micro dynamics, what is needed is a framework which not only explains the micro changes but also captures the macro adjustments from these changes (Ahmed and Donoghue (2007); Debowicz and Golan (2014)) and also be able to feedback to the micro framework.

As an illustration of the importance of incorporating such general equilibrium features, a study by Davies and Davey (2007) used a social accounting matrix approach to analyse the impact on the local economy of an emergency cash transfer programme in rural Malawi. This approach was used to capture the economy wide impacts of the cash transfer on the local economy. The cash transfer program was found to have extensive multiplier effects on employment and local economic activities. The ability of this type of economy-wide framework to pick up second round effects of transfers highlights the role that CGE models can play in assessing the full impact of changes in transfers. However, there are still only very few such studies evaluating social assistance programs such as the CSG using a top-down/bottom-up modelling framework (see Cury et al. (2016) and Debowicz and Golan (2014)). Cury et al. (2016) found that the two Brazilian social protection schemes *Programa Bolsa Familia* and *Beneficio de Prestaçao Continuada* have significant positive effects on poverty but the contracting general equilibrium effects due to the higher taxes needed to finance the two programs largely offset the positive effect. Debowicz and Golan (2014) find that poverty reduces due to the Mexican *Oportunidades* program. They also argue that this methodology produces larger effects than what a partial framework would produce. Their study captures how the conditionality of the grant affects children's school attendance. However, in their paper, there is no specific funding for the extension of the grant, leading to a decrease in government savings and in the long run a decrease in total investment. Our paper follows a similar bottom-up/top-down modelling approach of combining a micro and a macro model, and additionally offers a discussion on alternative fiscal alternative scenarios to take into account the financial stress situation in the country. To our knowledge, there is no such application for South Africa.

3 THE MACRO-MICRO MODELLING FRAMEWORK

Conceptually, the modelling process is a three steps process. **Step 1** consists of micro-simulation modelling (see section 3.1). The goal of this step is to estimate the aggregate change in employment and household expenditure due to CSG reforms (the details of the reform scenarios are provided below) as well as the total budget needed to implement the reform. Such variations are then transmitted to the CGE model as exogenous shocks, usually representing policy scenarios. This constitutes **Step 2** of the modelling process (see section 3.2). This model simulates changes in different variables (e.g. volumes of consumption and production, prices, employment) which are then inserted into the micro module in order to estimate the change in household incomes and the real welfare, which is then used to estimate the distributive and poverty effects following the reform in the CSG scheme (**Step 3**) (see section 3.3). All in all, such an approach serves to estimate the direct (transfer to the households) and indirect effects (equilibrium effects resulting from the reform).

3.1 The micro model and the linking variables to the CGE module (bottom-up)

As mentioned above for the micro model, we are first interested in the two main channels through which the changes in the CSG affect the economy (*bottom-up*), notably the labour force participation and household consumption. At this stage, the micro model is also used to estimate the cost of scaling up, as only with micro data can eligible and beneficiary children and households be identified. Concerning the *household expenditure*, at this stage we simply add the change in the CSG to the observed total expenditure (by making the implicit assumption that the marginal saving rate is equal to zero). We then estimate the average change in per capita household expenditure by income deciles.

With regards to the *labour force participation*, the change in the incentive to participate in the labour market due to a variation in the social transfer is estimated. Knowing whether labour force participation or employment are affected by CSG receipt is not obvious due to the endogeneity of the CSG variable. In South Africa, as in most other contexts, the grant is not randomly assigned but its receipt is likely to be correlated for example to income, education, place of residence and bureaucratic restrictions. It follows that, if some modelling precautions are not taken into account, the CSG coefficient risks being biased.

We use an instrumental variable probit model (with the standard errors corrected for geographic clusters' correlation), where the binary (dependant) variable is the labour force participation and the per household amount linked to the grant (continuous variable) is instrumented by the number of children below the age of 14 owning a birth certificate, which is one of the eligibility criteria (and, probably, the most stringent) for the CSG. According to our data, there is no significant difference of the distribution of the birth certificate across deciles. The empirical validity of this instrument is tested through the Wald test (for the exogeneity), the Sargan test (for the over-identifying restriction) and the Kleibergen-Paap test (for weak instrument). From all these tests, we can conclude that the instrument is valid. The estimations follow the procedure described in Wooldridge (2002, pg. 472-477) and are computed by maximum likelihood estimation[ii].

Formally, we estimated the following recursive model:

$$\begin{cases} \Pr(y_{1,i} = 1 | \mathbf{x}) = \beta y_{2,i} + \sum_{j,i} \alpha_{1,j} x_{1,j,i} + u_i \\ y_{2,i} = \eta_2 x_{2,i} + \sum_{j,i} \gamma_{1,j} x_{1,j,i} + v_i \end{cases} \qquad (1)$$

Where (u_i, v_i) has a zero mean and bivariate normal variance, and is independent of J regressors **x**. $y_{1,i}$ (labour force participation) and $y_{2,i}$ (total per household CSG amount) are our endogenous variables for individual *i* taking binary and continuous values respectively; x_1 are exogenous regressors (such as gender, age, years of education, log of per capita household income, marital status, geographic areas and provinces) and x_2 is the instrumental variable identifying the number of children below the age of 14 with birth certificates in the household and that enters only the equation for y_2 [iii].

All kinds of workers (for wage, self-employed and casual) and short-term unemployed are taken as participating in the labour force (following the definition reported in the Labour Force Survey reports in South Africa). The estimates are run on a sample of individuals not enrolled in school at the time of the survey and aged between 15 and 64 years old. Although we are aware that the CSG is more likely to affect mothers in the younger tail of the population, we used the entire working age population, as defined by Statistic South Africa and consistent with the definition of workers in the Social Accounting Matrix (SAM) used in the CGE model. This model is then used to predict the change in the proportion (or probability) in labour force participation following the extension of the CSG.

In order to capture important heterogeneous effects within the population and to reflect more closely the labour force classification included in the macro data, we estimated equation (1) separately by degree of skills, as identified by the level of education (i.e., unskilled – if with primary school or less; semi-skilled – if completed middle school; skilled – if completed secondary or higher).

3.2 The CGE model and the linking variables to the micro module (top-down)

In terms of modelling, we use the static Partnership for Economic Policy (PEP 1-1) standard model by Decaluwé et al (2013). Though the model is fully described in Decaluwé et al (2013), we provide the main characteristics of the model and present the changes introduced in order to better reflect the South African context.

In line with the SAM, the CGE model has 6 activities and 12 commodities. The production function technology is assumed to be of constant returns to scale and is presented in a two-level production process. At the first level, output is a Leontief input-output of value added and intermediate consumption. At the second level, a CES function is used to represent the substitution between composite labour and capital.

Labour is further disaggregated between highly skilled workers and non-highly skilled workers. The latter is composed of workers that completed primary school or less (considered as low-skilled) and workers that completed middle school (considered as semi-skilled workers). These labour categories are consistent with the micro-model.

Households are disaggregated by their income decile. The model distinguishes three sources of income, labour income (salaries and wages), capital income and transfers income from institutional sectors (households, firms, government and rest of the world). Households use their income for paying taxes, transfers to other institutions, consumption and saving. On the consumption side, household behaviour is modelled as a Linear Expenditure System and subject to its budget constraint.

Firms mainly derive their income from capital income plus transfers from other institutions. After paying income tax and transfers to other institutions, the remaining income constitutes firms' savings. Government income is composed of direct taxes paid by households and firms, indirect taxes on domestic sales, import tariffs, transfers from other institutions, and a share of capital income. Government savings is equal to government income less its consumption and transfers paid to other institutions.

To link South Africa and the rest of the world, we use the traditional small country assumption, meaning that South Africa does not have any influence on world prices. We also assume that South African producers cannot sell as much as they want on international markets. To sell more on these markets and to increase their market shares, producers have to be more competitive than other producers. Thus, export supply is constrained by export demand, which is assumed to have a finite elasticity, reflecting the competitiveness of local producers on the international market.

In order to take into account the South African context, we change a hypothesis from the PEP 1-1 model. South Africa is faced with the problem of high unemployment. Following Blanchflower and Oswald (1995), we assume that there is an equilibrium wage rate compatible with the unemployment rate. The authors show the existence of an empirical relation linking wage rates and unemployment rates, also called "wage curve". The relation shows a negative slope between unemployment rates and wage rates. Kingdon and Knight (2006) have econometrically estimated a wage curve for South Africa. They find the same result as

Blanchflower and Oswald and, specifically, that a 10% increase in the unemployment rate leads to a 1% decrease in wages. We used the Kingdon and Knight results in our parameterisation of the wage curves.

In terms of closure rules, we assume that the nominal exchange rate is the numeraire. Labour is mobile across sectors whereas capital is sector-specific. The rest of the world's savings is fixed meaning that we do not allow South Africa to borrow from the rest of the world. Then, world prices are fixed, following from the assumption earlier that South Africa is a small country. Government spending is fixed as well as government savings, and tax rates adjust according to the different scenarios (see below).

3.3 Linking the CGE results with the micro module (top-down)

Once the CGE model is run, the new prices and volumes after a change in the social transfer (as described above) are transmitted to the micro module (*top-down*) in order to estimate changes in monetary poverty and inequality. In particular, to generate the new (simulated) real welfare indicator, the variations in consumer prices, employment, wage rate as well as of revenues from self-employment agricultural and non-agricultural activities are integrated into the micro module. More specifically, we estimate the changes in the employment status and its associated revenue, in the incomes from agriculture and non-agriculture sectors, and a household specific consumer price index. Such factors identify the indirect effects generated by a change in the social grant. The variation in the CSG represents the direct effect of the reform. It is worth mentioning here the implications of step 1 described above on step 3. Due to simulations performed in step 1 at the micro level, there is (a) an increase in household expenditure (as a direct result of the increase in the CSG) and (b) an increase in the labour force participation. As for (a), step 3 includes the increase in household expenditure (component ΔG_h^s, as seen in equation (4) below). As for (b), step 3 is run on the original (observed) labour force for simplicity; (b) is in fact obtained by simply estimating probabilities and not labour force status. In any case, taking into account the increase in the labour force participation as generated by (b) would not have changed the results since CGE predicted changes in wage workers are quite small (see below in the results section) and also because, according to the CGE model, we do not have a wage curve for self-employed workers (so, the latter would not be affected by the procedure followed).

The change in the employment status is estimated through a multinomial logit model which is run separately by skills (as presented earlier – unskilled, semi-skilled and unskilled). For people aged between 15 and 64 years old who were not enrolled in school at the time of the survey, we first identify four possible statuses: wage worker, unemployed, self-employed (including those in the informal sector) and not participating in the labour market (i.e. not working or discouraged). After the model is estimated, we predict the individual probability associated with each of the four categories and that reflects the observed employment choice (to do that, we estimated the individual random terms drawn from the Gumbel distribution, as done in Bourguignon, Fournier and Gourgand, 2001). The relevant estimated changes produced by the CGE model – namely wage workers and unemployed by worker's skills – are then fed into the micro analysis. More specifically, the calibration of micro data with respect to the macro data is obtained by following a job-queuing procedure (as in Cockburn et al., 2018). An "x per cent" increase (decrease) in the rate of wage workers is transmitted to the micro data by changing the employment status among unemployed or people not participating in the labour market (wage workers) that showed the highest (lowest) probability of being wage workers, until the macro variation is reached. Here it is assumed that the self-employed are not affected by changes in the employment status. Also, the labour force observed from the data is used for this analysis. It is worth noting that the macro and micro data used in the simulations include informal activities. Our proposed policy reform is in fact likely to affect formal and informal workers differently. However, in our model there is no explicit separation between formal and informal workers. Informal labourers can be both in the wage workers and self-employed categories. One reason for not separating formal and informal workers is that the eligibility criteria do not discriminate on the basis of formal or informal activity but on a number of criteria, including income. Hence, we expect that if the household income is below the threshold, they too would be eligible, even though they are involved in informal activities. The other reason is that, consistently with the macro data and the context, we already segmented our labour market model by the labour force's skills (unskilled, semi-skilled and skilled), which are likely to match fairly well with informal/formal workers (i.e., informal are prevalently unskilled, while formal prevalently skilled).

Variations in the employment status are reflected in the changes in wage income. People losing their wage jobs, experience a reduction in wage incomes equal to their observed wage, while those finding a wage job have an increase in wage income equal to their predicted wage (calculated by estimating a Heckman selection model on some individual and household characteristics, and including a residual term estimated by drawing randomly from a normal distribution with the relevant – (i.e. unskilled, semi-skilled or skilled – observed variance). For simplicity, it is assumed that unemployed people do not benefit from South African unemployment subsidies if they become unemployed.

Income from self-employment activities ($\Delta\varphi_h$) in the agricultural and non-agricultural sector, for household *h* is defined as:

$$\Delta\varphi_h = \sum_{j=1}^{J} Q_j \Delta\left(p_j VA_j\right) \qquad (2)$$

where Q_j is the production value of agricultural or non-agricultural good *j* at the base year and $\Delta\left(p_j VA_j\right)$ is the change in the value of the value-added good *j*.

Total wages and incomes from self-employment activities are finally calibrated in a way such that the average changes in the micro data are the same as the variations predicted by the CGE.

Changes in total household revenue from work activities (ΔR_h^s) relative to the base year for each scenario *s* can thus be written as:

$$\Delta R_h^s = \sum_{i \in h} \Delta w^s \Delta E_i^s + \Delta\varphi_h^s \qquad (3)$$

where the change in revenues from the wage sector comes from the variation in the wage rate (Δw^s) as well as in individual employment status (ΔE_i^s), for all household members *i* aged between 15 and 64.

Similarly to Cockburn et al. (2018), the percentage variation in total household revenues from labour activities (with respect to the base year revenues) (r_h^s) is applied to total household expenditure to estimate the change in total revenues. By doing that, we implicitly assume that there is no variation in the marginal savings rate. Also, the resulting income change is compatible with the expenditure variable (unlikely to be the case had we added the absolute change in the household revenue as estimated in (3)). The value we obtain is then added to the initial expenditure variable, which represents the household welfare used for poverty and distributive analysis.

Finally, the household welfare under scenario *s* (EY_h^s) is simply the sum of the base household expenditure (Y_h^0), the change in the expenditure due to the variation in the revenues from work activities ($r_h^s Y_h^0$) and the change in the grant (ΔG_h^s), subsequently divided by a household specific price deflator. The price deflator (with base at the survey year) is derived from a Cobb-Douglas utility function; it then takes into account household *h*'s budget share of commodity *k* (w_k). Standard FGT poverty class indices, growth incidence curves and factor decomposition (Shapley-Shorrocks approach) are used in the poverty and distributive analyses. To sum up, our simulated equivalent income (or welfare) (EY_h^s) is:

$$EY_h^s = \left(Y_h^0 + r_h^s Y_h^0 + \Delta G_h^s\right) \Big/ \prod_{k=1}^{K} \left(\frac{p_k^s}{p_k^0}\right)^{w_{k,h}} \tag{4}$$

For poverty and distributive analyses, EY_h^s is finally divided by the household size. Also, R502 is the national monthly poverty line estimated at 2008 prices (the base year) (see Argent et al., 2009, based on a lower poverty line as reported in Hoogeveen and Özler, 2006).

3.4 Data, model calibration and simulation scenarios

The National Income Dynamic Study (NIDS) from 2008 (SALDRU, 2008) is used for the micro models and the poverty analysis, combined with the General Household Survey (GHS) 2007 (Statistics South Africa, 2008). The latter is only used to estimate the average distance from the welfare office in each district, which is not available from the NIDS (2007 is the last year for which the information on the availability of welfare centres was collected). We then merged it with the NIDS 2008 through the district identification code.

The CGE is calibrated on the Social Accounting Matrix (SAM) from Davies and Thurlow (2013) based on 2009 data. The original SAM had 49 activities and 68 commodities. For the purpose of this study, the SAM was aggregated in order to match the same number of commodities as in the micro-model. Therefore, the sectors/commodities are as follows: Meat, Fish, Fruit and vegetables, Dairy, Grain milling, Starches, Bakery, Other foods, Beverages and tobacco, Non-alimentary products, Education, other products[iv].

The SAM has two broad factors (labour and capital); four institutional sector accounts (households, enterprises, government and the rest of world); and two saving and investment accounts (change in inventories and gross fixed capital formation). Households are disaggregated by decile of income. Along with the SAM, some additional data such as elasticities are required. Income elasticities are borrowed from Chitiga, Fofana and Mabugu (2012) whereas trade elasticities are taken from Gibson (2003).

We evaluate the impacts of a 20% increase of the value of the CSG. It implicitly means that through the proposed reform the Government would just affect only those households which were already beneficiary of the programme, and that it would not make any effort in reaching out new beneficiaries. According to the NIDS, in 2008 51.6% of children under 15 were benefiting from the CSG, with children aged between 6 and 10 being the most covered (around 60%), followed by those below 6 (53%) and between 11 and 14 (just 41%). This simulation is carried out with three different macroeconomic closure rules. Under simulation 1 (Sim1), the policy is financed through an increase in household direct tax, while in simulation 2 (Sim2), the policy is financed through an increase in corporate taxes. Under simulation 3 (Sim3), the scaling-up of the CSG scheme is funded through a uniform indirect tax on commodities. These three alternative funding scenarios allow keeping government savings constant as it is not realistic to assume that South Africa can let its current deficit increase any further.

4 RESULTS AND DISCUSSION

Results from step 1 (microsimulation)

As discussed earlier, households first benefit from a 20% increase in the CSG. . This generates a change in the labour force (the econometric results are reported in the Appendix Table A1[v]), an increase in per capita household real consumption, and the corresponding increase in the transfer from the government to the households. These effects due to the CSG reform are applied simultaneously to the CGE model in order to capture the macroeconomic impacts of an increase of the CSG. The results concerning the three channels above are shown in Table 1.

Table 1: Results from the micro model used for the macro model

Labor force categories	Simulation1: change in labour force participation (%)
Unskilled	3.26
Semi-skilled	2.96
Skilled	0.76

Deciles of households	Simulation2: Change in per capita household expenditure (%)	Simulation3: Percentage change in the transfer from the government received by households (%)
Decile 1	11.00	10.76
Decile 2	6.79	7.40
Decile 3	4.93	7.52
Decile 4	3.33	7.90
Decile 5	2.10	7.89
Decile 6	1.28	8.45
Decile 7	0.56	7.00
Decile 8	0.21	5.53
Decile 9	0.04	1.49
Decile 10	0.00	0.35

Source: Results from the microsimulation model

Each simulation is expected to generate a different impact on the economy. Ceteris paribus, an increase in the labour force would have an impact on wages and unemployment. In the same way, an increase of the transfer that households receive from the Government increases their income and their real consumption, and therefore has a positive impact on activities producing commodities that households consume. Moreover, the agents are affected differently according to the type of financing mechanism.

On one hand, we have a change in the labour supply that is different according to the skills. From the micro-model, we get the percentage change in labour force participation, and it is interesting to note that the impacts are quite different according to the skills level. This reform would have a non-marginal and statistically significant impact on unskilled and semi-skilled workers (3.26 and 2.96% respectively), while only 0.76% of skilled non-working people would enter the labour market.

For the changes in households' expenditure, we insert the changes as estimated from the micro-model; as expected, the change decreases with deciles, with the poorest decile showing the largest change in household expenditure. Finally, concerning the change in the transfer from the Government to the households, we had first to reconcile data. Indeed, in the SAM, we do not have a specific cell for CSG. We have a value representing all the transfers paid by the government to the different households, including the CSG. By using the by programme share of total spending on social transfers by the Government (as estimated with the micro data), we were able to reconcile the data and to estimate the increase of the government's transfers to each household, corresponding to an increase by 20% of the CSG. Poorer households, again, benefit the most of the increase of the grant.

Results from step 2 (CGE – macroeconomic aggregates)

Macroeconomic impacts of the increase of the CSG are different given the financing mechanism applied, but generally small. Nonetheless, they merit some discussion. The overall impacts are positive for the South African economy, with an increase in real GDP under the three simulations. However, under Sim3, the positive impacts are lowered by the increase in the commodity taxes that affect all the agents in the economy.

Following the reform of the CSG, there is an increase of labour supply. This has an impact on wages paid by firms to the households, as well as a negative impact on prices. The increase in the labour supply for each type of workers is not fully compensated by job creation in the economy, leading to an increase of unemployment rates for each category of workers under the three simulations. Moreover, the main transmission channel comes from households' expenditure. Indeed, the reform of the CSG leads to an increase in households' income (Table 3) that will increase their expenditure for each commodity. Under Sim3, as the government increases the indirect tax on commodity, the positive impact on households' expenditure is lowered. Besides this effect, firms are as well impacted by the financing mechanism as the price of their intermediate consumption increases as well. Therefore, in Sim3, firms are expected to benefit on one side from the decrease in wage rates due to the increase in labour supply, but on the other side their intermediate consumptions are relatively more expensive. A comparable negative effect on the wage rates was found soon after the end of the Apartheid, when a massive increase of the labour supply had occurred (see, e.g., Poswell, 2002; Burger and Yu, 2007).

Table 2: Macroeconomic impacts (in %)

	Sim1	Sim2	Sim3
Total investment	0.10	0.04	0.09
Real GDP	0.28	0.29	0.26
Consumer price index	-0.14	-0.13	-0.12
Unemployment rate unskilled	6.13	6.13	6.24
Unemployment rate semi-skilled	10.64	10.64	10.84
Unemployment rate skilled	1.23	1.22	1.65
Wage rate unskilled	-0.73	-0.72	-0.72
Wage rate semi-skilled	-1.14	-1.14	-1.14
Wage rate skilled	-0.26	-0.25	-0.28

Source: Results from the CGE

Households' income is derived from wages, capital income and transfers they receive from the different institutions. Given the increase in the CSG, we expect households' income to increase. However, the increase is lowered by the decrease in wages (Table 2). We find that households' gross income and expenditure are increasing for all the categories under the three simulations (see Table 3). It is worthy to note that, as expected, richer households are not significantly benefitting from the CSG reform, especially under Sim1 where they are the main contributors (notably the last two upper-deciles). Under Sim2, they are penalised through the reduction of dividends they receive from firms (as firms are the ones financing the policy, dividends they transfer are reduced).

Table 3: Impacts on households' income and expenditure (in % change)

	expenditure per capita		
	Sim1	Sim2	Sim3
decile1	2.09	2.09	2.07
decile2	1.36	1.37	1.34
decile3	1.12	1.14	1.11
decile4	0.93	0.94	0.92
decile5	0.73	0.75	0.73
decile6	0.60	0.62	0.60
decile7	0.43	0.46	0.44
decile8	0.33	0.37	0.35
decile9	0.28	0.34	0.31
decile10	0.23	0.26	0.26

Source: Results from the CGE

This increase in households' expenditure has an impact on the production of these sectors. The impact is simulated to be bigger in sectors where final demand represents a large component, such as the food sector. From Table 4, we can see that production increases for all the sectors which, as a consequence, hire more workers. The overall effect on labour demand is increasing (respectively 0.94% for Sim1 and Sim2, 0.92% for Sim3). However, this positive impact[vi] is not big enough to absorb the total amount of new comers on the market due to the CSG reform, leading to an increase in the unemployment rates (see Table 2).

Table 4: Impact on production volumes (in %)

	Sim1	Sim2	Sim3
Food	0.60	0.61	0.59
Non-alimentary	0.46	0.46	0.45
Fish	0.18	0.18	0.17
Other commodities	0.49	0.48	0.48
Beverage and tobacco	0.56	0.58	0.52
Education	0.53	0.55	0.53

Source: Results from the CGE

The increase in production for all sectors combined with the increase in households' demand lead to an overall decrease in the consumer price index, especially in the first simulation. Moving to the effects on the Government, its income is simulated to increase due to the raise in direct taxes receipts, as well as on indirect taxes (as consumption increases) and production taxes. Its savings remains constant.

Firms' income increase in the three simulations (respectively 0.09%, 0.10% and 0.08%), while their savings raise slightly in the three simulations. In terms of trade, given that South African producers are relatively more competitive (with local prices' decrease), their exports increase for all types of commodities. As the current account balance is fixed, imports increase as well.

Results from step 3 (microsimulations)

This section discusses the poverty results. It is important to note that there are no official poverty lines in South Africa. As mentioned earlier in section 3.3, we used R 502 as monthly poverty line in 2008 prices (as done in Argent et al., 2009, with the same micro data as ours). However, Stats SA (2008, 2015) calculated three poverty lines, the *food poverty line*, the *lower-bound poverty line and the upper-bound poverty line.* For this reason, in addition to report poverty estimates for poverty line set at R 502, we also tested the robustness of our results over a large range of poverty lines, including all poverty thresholds estimated in South Africa (see note to Table 5 below).

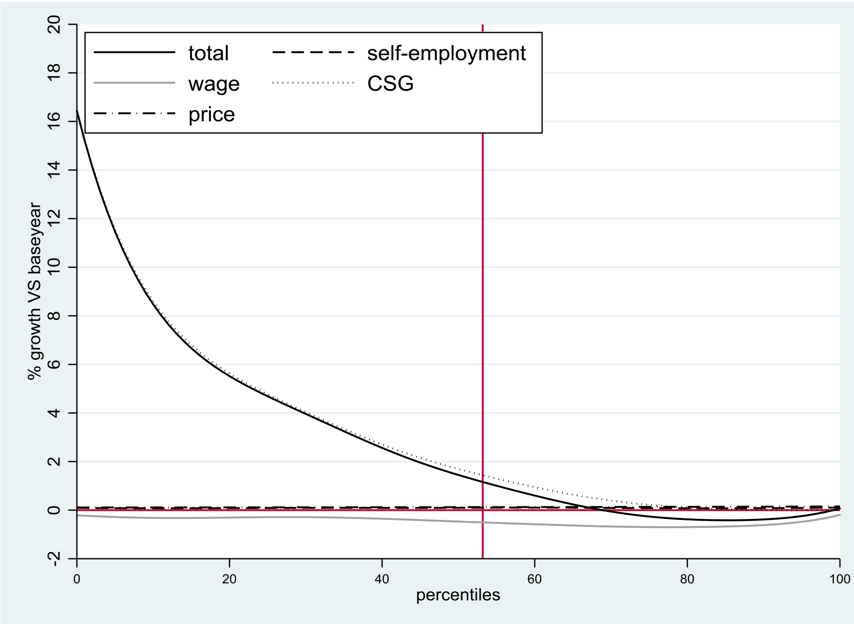
Table 5: Poverty Incidence, gap and severity and Gini index for base year, sim1, sim2 and sim3, children and whole population

	Headcount poverty	Poverty Gap	Poverty Severity	Gini	Headcount poverty	Poverty Gap	Poverty Severity	Gini
	All children				Whole population			
base year	64.41	32.87	19.97	67.67	53.18	26.11	15.57	68.70
sim1	63.93	31.20	18.26	66.75	52.89	25.05	14.48	68.24
sim2	63.93	31.20	18.26	66.75	52.89	25.05	14.48	68.24
sim3	63.93	31.21	18.27	66.75	52.89	25.06	14.49	68.24
	CSG beneficiary children				CSG beneficiary population			
base year	80.58	42.12	25.85	44.61	79.19	41.35	25.38	44.88
sim1	79.92	39.67	23.34	42.81	78.68	39.19	23.16	43.26
sim2	79.92	39.68	23.34	42.81	78.68	39.19	23.16	43.26
sim3	79.92	39.69	23.35	42.81	78.68	39.20	23.17	43.26
	Non-CSG beneficiary children				Non-CSG beneficiary population			
base year	29.20	12.71	7.16	62.55	27.76	11.22	5.99	62.19
sim1	29.12[a]	12.74	7.17[b]	62.60[c]	27.69[a]	11.24	6.00[c]	62.24
sim2	29.12[a]	12.74	7.17[b]	62.60[c]	27.69[a]	11.24	6.00[c]	62.24
sim3	29.12[a]	12.75	7.18[c]	62.60[c]	27.69[a]	11.25	6.00[c]	62.24

Source: authors' estimation based on NIDS 2008 and simulations
Note: the difference between poverty rates under simulations and the base year are always stat. sign. at 1%, with the exception of: [a] = not statistically significant; [b] = significant at 10% [c] = significant at 5%. Sim1-sim3 dominate base year distribution over a large range of poverty thresholds (between 300 and 700, with few exceptions starting from 600); results are available to the authors upon request. Statistical tests, as well as P0, P1, P2 and Gini are estimated with DASP (Araar and Duclos, 2007).

As shown in Table 5, P0 (Poverty Incidence), P1 (Poverty gap) and P2 (Poverty severity) decrease in comparison with the base year for the whole population and for children respectively. In accordance to the age eligibility of the CSG in 2008, our child population is defined as all individuals below 14 years old. It is worth mentioning that the statistical tests run for the distributive analysis shown in this section need to be taken with some caution as they refer to the sampling error in the micro data, and not to the modelling errors. Computing the latter in the context of a CGE-microsimulation model would be particularly cumbersome. The improvement is stronger for poverty severity. As the reform proposed in this study only affects a child-targeted social protection scheme, poverty and inequality among children are by far the most reduced; also, as the households with children are proportionally more situated among the poorest part of the distribution, the reform would help to substantially reduce the poverty severity rates (among children it would drop by up 8.5 percent). In the middle and bottom panels, Table 5 shows that the poverty reduction is more substantial for children (and overall individuals) living in CSG-beneficiary households; this is explained by the fact that the effect are mostly driven by the change in the CSG value. Figure 1 shows that the reform is clearly progressive, with the gains ranging from 16 percent for the poorest percentiles to around 1.5 percent for households around the official poverty line. This result confirms that the CSG is overall relatively well-targeted towards the poor. Also, it would result that the richest 30 percent would face some slight decrease in their welfare (by up -0.7 points) due to the reduction in the wage factor (by up to -1 point for those around the 70th and 90th percentiles), which is more important for these percentiles (results under the three financing mechanisms are substantially the same). The changes related to the self-employment revenues and the consumer prices would not differ throughout the distribution. As expected, the poverty impact brought by the CSG drives the overall reduction. This is consistent with the fact that incomes for households living in poverty come primarily from grants and labour incomes. In particular, for households around the poverty line, grants represent around 30% of total incomes while labour incomes account for around 45% (see Figure 1 in Finn, Leibbrandt and Woolard, 2009). In this model, the wage component is marginally affected as the minimum wage binds, and the labour market is mostly impacted through unemployment, without significantly affecting the employment rate. The remaining household income share is mostly represented by remittances and rental incomes, which are both unaffected in the short-run of these models. Other incomes and investments only account for a minimal part. Under the indirect tax scenario, poverty and inequality reduction are slightly smaller. Table 6 decomposes the change in the incidence of poverty by different income factors. While the direct (without considering the general equilibrium – see row "CSG") effect brought by the CSG reform drives the poverty change, the indirect general equilibrium effects have some impact too. For example, the CSG reform would generate some impacts on revenues from self-employment activities (agricultural and non-agricultural sectors) which account for up to around 6 percent of the total poverty change (irrespective of the financing mechanism). In addition, the reform would generally decrease consumer prices, then contributing to further decrease poverty (by up to 5%). On the opposite, the reform would reduce revenues from wages, which contribute to reduce the positive effect on poverty generated by the CSG increase (by up around 40% of the total headcount poverty change), by in practice cancelling the positive effects brought by the drop in consumer prices. This is especially true for the headcount poverty, because this indicator is sensitive to the movement of those around the poverty line, which, amongst the poor population, are also those more susceptible to changes in wages (as shown in Figure 1).

Figure 1: Growth incidence curves, whole population



Source: authors' estimation based on NIDS 2008 and simulations
Notes: The curves for "wage", "self-employment" and "CGS" are based on nominal (before consumer price changes) figures. The figure refers to sim1 – sim2 and sim3 would give similar results.

Table 6: Decomposition of the change in headcount and poverty gap by factors, children and whole population

	Children			Whole population		
delta in:	sim1	sim2	sim3	sim1	sim2	sim3
			Headcount poverty			
revenues self-employment	-0.027	-0.030	-0.026	-0.051	-0.053	-0.050
Wage	0.183	0.180	0.183	0.165	0.163	0.165
CSG	-0.608	-0.597	-0.610	-0.379	-0.372	-0.381
consumer prices	-0.025	-0.029	-0.024	-0.021	-0.024	-0.020
total change	-0.477	-0.477	-0.477	-0.287	-0.287	-0.287
			Poverty gap			
revenues self-employment	-0.026	-0.027	-0.025	-0.025	-0.026	-0.023
Wage	0.109	0.108	0.108	0.100	0.100	0.100
CSG	-1.712	-1.712	-1.712	-1.099	-1.099	-1.099
consumer prices	-0.037	-0.034	-0.029	-0.032	-0.030	-0.025
total change	-1.666	-1.665	-1.657	-1.056	-1.055	-1.048

Source: authors' estimation based on NIDS 2008 and simulations
Note: Shapley/Shorrocks decomposition (using adecomp Stata command)

5 CONCLUSION AND POLICY RECOMMENDATION:

In this paper an ex ante modelling framework was used to assess the macroeconomic and redistributive impacts of an increase of the CSG in South Africa. The bottom-up/top-down approach developed for this purpose is shown to be the appropriate tool as traditional microeconometric approaches do not take into account macroeconomic feedbacks that this type of reform can generate. In the same way, CGE macroeconomic modelling cannot evaluate the redistributive impacts of such policies. By combining these two methodologies in a recursive bottom-up/top-down fashion, we can capture the full impacts of this reform. This, on its own, is a major contribution of this paper. The purpose of our study was to evaluate the impacts of an increase of the CSG under three different fiscal scenarios in order to take into account the financial constraints of South Africa. Our results show that the reform has some positive impact on GDP and on the decrease in poverty. More specifically, at the macro level, we find that under the three different scenarios, households' real expenditure is increasing and this is particularly important for poorer households. However, although there is an increase in the supply of labour, we find that the increase in the labour supply for each type of worker is not compensated by job creation in the economy, leading to an increase of unemployment rates for each category of workers under the three simulations. However, the macroeconomic changes are small and this then results in marginal indirect effects on poverty and inequality. It is important to note though, that the main transmission channel comes from households' expenditure, thus, the reform of the CSG leads to an increase in households' income that will increase their consumption for each commodity. All in all, while the scaling-up of the CSG is progressive, the poverty and inequality effects are small and unlikely to be robust.

The results obtained under Sim 3 (reform financed with an increase in the commodity tax rate) are systematically below the results found under the two other funding mechanisms. At the micro-level, we find a decrease in poverty incidence, poverty gap and poverty severity for the whole population and for children respectively. The improvement is stronger for poverty severity, meaning that the reform would reach the poorer households. Therefore, the proposed reform would be quite progressive, with the gains ranging from 16 percent for the poorest percentiles to around 1.5 percent for households around the official poverty line. Also, the richest 30 percent would experience some small decrease in their welfare due to the drop in wage revenues, which is more important for these percentiles. Furthermore, while the increased amount of the CSG is the main contributor of total poverty decrease, we also find that the reform generates some indirect effects, although they seem generally small. In particular, the reduction in consumer prices as well as the increase in revenues from self-employment further reduce poverty, whereas the deterioration of wage revenues sensibly weakens the overall positive effects of the reform. All in all, the indirect effects are found to increase poverty but, as said, they are unlikely to be significant. Hence, in our specific context, the general equilibrium effects might be ignored at little cost.

This paper has shed some light on the issue of increasing social grant, and specifically child oriented grants in order to reduce poverty, through a sequential approach. The paper provides evidence on the effectiveness of scaling up CSG on impacting socio-economic development and shows its heterogeneous impacts throughout the distribution. Such evidence can inform future development and design of such policy and programs and support not only South Africa but other African countries' social protection commitments in the face of fiscal constraints.

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Appendix

Table A1: Results of the labour force participation model

	Unskilled	semi-skilled	Skilled
second stage main regressor			
Total CSG (in rands)	0.0009***	0.0014***	0.0031***
first stage instruments			
Number of children < 14 with birth certificate	136.10***	120.00***	59.75***
Wald test of exogeneity (chi2)	7.36***	23.15***	10.48***
Sargan test (F)	-0.0009	-0.0007	0.009
Kleibergen-Paap rk Wald F statistic	1080.09	1243.14	79.39
N	5002	7246	1489

Source: authors' estimation based on NIDS 2008.
Note: *p<0.10,**p<0.05,***p<0.01; other regressors include: gender, age, year of education, marital status, log of per capita household income, household size, geographic areas (tribal authority, urban formal, urban informal and rural) and provinces. In the Sargan test, the coefficient of the instrumental variable is never statistically significant. These estimates are used for the first set of simulations (first panel of Table 1).

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[i] Data included in the Budget Reviews of the National Treasury Republic of South Africa, available at www.treasury.gov.za, accessed Dec 2017.

[ii] *ivprobit* Stata command was used to run these estimations. The Wald test is generated automatically by Stata with ivprobit, while – for the Sargan test – we regressed the labor participation equation's residuals on the instruments and run a F-test. In our case, the instruments' coefficients are not statistically significant (i.e. do not explain the unobserved component of the main equation) then suggesting that they are valid instruments. The labor participation equation's residuals are estimated by following Gourieroux et al. (1987). As for weak instrument test, to the best of our knowledge there are not rules-of-thumb on the F statistics when the structural model is nonlinear; for this reason, we used the Stock-Yogo thresholds although we are aware that they have been developed for linear models.

[iii] We have also tried to use as additional instrument the average distance from the welfare office at the district level (merged from the General Household Survey 2007) but unfortunately the coefficient was not statistically significant.

[iv] Note that this last category contains all the durable goods that are not taken into account in the micro model.

[v] We always find a positive and statistically significant coefficient of the CSG and the probability of participating in the labour force. Also, the instrument (number of children below 14 with a birth certificate) is strongly significant and positive irrespective of the skills' level of the labour force, with its coefficient being larger for unskilled individuals.

[vi] Note that the model does not consider labour productivity effects and therefore the effects on the labour demand would be greater if they were taken into account.