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Economywide consequences of attaining Millenium Development Goals in South Africa

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Abstract

South Africa has committed to eliminate poverty and reduce inequality by 2030 in its National Development Plan. To realise this, it will be critical to make strides in attaining the Millennium Development Goals. This paper uses a computable general equilibrium model to show the complexities of trade-offs between attaining these goals and their financing. There are clear spillover benefits from attaining goals such as universal primary education, and combating HIV-AIDS that the model takes into account. The conclusions point to the need for weighing up merits of different policies against their cost.

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1. Introduction

South Africa has committed to eliminate poverty and reduce inequality in the National Development Plan (NDP). To realise this vision by 2030, it will be critical for South Africa to make strides in attaining the Millennium Development Goals (MDGs). With 2015 fast approaching which is the cut-off date for realisation of the goals, it is imperative to ask questions about feasibility of achieving MDGs in South Africa. This paper discusses this question with a focus on the financial requirements of attaining some of the critical MDGs. Specifically, the paper uses a computable general equilibrium (CGE) model to show the spillover effects of achieving health and education MDGs.

Progress in achieving the health-related MDGs has been especially slow in South Africa. Based on current trends, the country will not reach the MDGs for child mortality (Goal 4) and maternal mortality (Goal 5). This paper is one of the first studies of its kind in the region that takes a detailed look at the economic impact of different options for creating and using fiscal space to attain outstanding MDGs. The rest of the paper is arranged as follows, section two discusses the MDG targets and progress in attainment. Section three discusses the model used with a special focus on the MDG module. In section four the results are discussed and section five concludes.

2. Status of MDG achievement in South Africa

South Africa has made progress in reaching some MDGs. MDG1 (Eradicate extreme poverty and hunger) was achieved in 2011. Indeed, the proportion of people experiencing extreme poverty (those living on less than $1 a day) fell by over half, from 11.3 per cent in 1994 to 4.0 per cent in 2011 (Republic of South Africa, 2013, p.122).

MDG 2 requires that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling. According to Hollenbeck (2001), educational attainment of individuals may be important on equity grounds, because an individual's education may be the key to their economic situation. Education determines the distribution, not just the growth, of income. Studies conducted in developing countries indicate that maternal schooling is also a very strong and consistent predictor of reduced child mortality and morbidity (Pavalavalli and Ramesh, 2001). As education can play a major role in attaining equity and health-related goals, education goals are discussed in more depth later. The number of 15 to 24 year olds who are literate has been increasing steadily, from 83.3 per cent in 1994 to 90.7 per cent in 2011 for females and from 88.4 per cent in 1994 to 94.6 per cent in 2011 for males (Republic of South Africa, 2013, p.124). Although South Africa has almost achieved the MDG target on primary education outcome before 2015, issues of educational quality and functionality remain critical within the country.

MDG3 deals with gender equality. The secondary and tertiary Gender Parity Index (GPI) of 1.07:1 and 1.38:1 for 2011 respectively, shows that slightly more girls than boys attend secondary and tertiary schools, indicating that the goal is achieved. However, for primary school, the GPI is at 0.96:1 in 2011, meaning that South Africa is still on track. (Republic of South Africa, 2013, p.125).

MDG4 is related to child mortality. Progress in the reduction of child mortality is assessed against three main indicators: under-five mortality rate, the infant mortality rate and the proportion of one-year-old children immunised against measles. Infant mortality declined from 54 in 2001 to 53 in 2007 (StatsSA, 2008) and to 38 in 2010 (Republic of South Africa, 2013). Although progress is in the right direction it is still far from the set target of 18 per 100,000. The high numbers are mainly as a result of HIV/AIDS.

The target for under-five child mortality is set at 20 per 1,000 live births. Between 1993 and 1998, estimated under-five mortality rates were 59 per 1,000 live births. However, this figure has since risen, from 97 in 2001 to 104 per 1,000 live births in 2007 (The Presidency, 2010). South Africa's child mortality is mainly due to the HIV/AIDS pandemic, which is responsible for more than half (57 per cent) of child deaths (Hill *et al.*, 2007). South Africa is one of 12 countries in which the child mortality rate has increased instead of fallen since 1990 (Health Systems Trust, 2009). As a result, to meet MDG4, South Africa has to achieve an average yearly rate of reduction of 14 per cent by 2015, which is unlikely to be met (The Presidency, 2010). However, using other data, (Republic of South Africa, 2013), infant mortality fell from 48 to 38 between 2007 and 2010. Against the target of 18, it is still clear that reaching this goal will have to take concerted effort on the part of all stakeholders involved.

MDG5 deals with maternal health. The South African maternity mortality rate is increasing, more than doubling between 1998 and 2003, from 84.25 to 165.50 (The Presidency, 2008). In 1998, maternal mortality was 150 per 100,000, but increased to 369 in 2000 and 625 by 2007, with the target set at 38 for 2015 (Republic of South Africa, 2013). HIV infections are the key reason why South Africa is unlikely to achieve the MDG target (Health Systems Trust, 2009).

MDG6 deals with AIDS, tuberculosis and malaria. As already stated before, AIDS is quite critical is South Africa. An antenatal survey conducted between 2005 and 2006 shows that the prevalence of HIV and AIDS has declined for most provinces, except for the Free State. The survey also showed that the prevalence between the less than 20 years age group has declined, indicating that new infections have slowed. HIV prevalence among the population aged 15–24 years fell from 9.3 per cent to 8.7 per cent between 2002 and 2008, (Shisana *et al.* 2009). Shisana *et al.* 2014, shows that by 2012, HIV prevalence had increased by 1.2 million people living with HIV compared to 2008. The availability of Anti-Retroviral Treatment was one of the main reasons for longer survival rates (Shisana *et al.* 2014). To combat HIV/AIDS, the Department of Health introduced a Comprehensive Plan for HIV/AIDS 2007–2011. The plan includes the provision of voluntary counselling treatment (VCT), preventing mother-to-child transmission treatment, nutritional supplementation and antiretroviral treatment to patients infected with HIV and AIDS (UNDP, 2007).

Target 8 of Goal 6 is that South Africa will have halted the incidence of malaria by 2015 and have begun to reverse this and other major diseases. Between 2000 and 2010, the incidence of malaria fell from 64,622 to 8,066 cases and to 6,846 cases by 2012 (Republic of South Africa, 2013). Death rates associated with malaria also fell, from 459 in 2000 to 87 in 2010 to 72 in 2012 against a target of 229, (Republic of South Africa, 2013). This means this target has already been achieved.

MDG 7 deals with environmental sustainability. South Africa has become increasingly more committed to improving environmental sustainability. Conservation efforts currently focus on improving biodiversity, expanding protected areas in hot spots, establishing Transfrontier

Conservation Areas with neighbouring countries and establishing cross-sectoral programmes that focus on development and poverty alleviation. South Africa has also made substantial progress in reaching Target 10 of Goal 7, which relates to access to safe drinking water. Since 1994, South Africa has started to address the basic services backlog. Between 1996 and 2011, households with access to water increased from 76.6 per cent to 90.8 per cent, while those with access to improved sanitation facilities increased from 49.3 per cent in 1996 to 66.5 per cent in 2011 (The Presidency 2013), making this target likely to be achieved for South Africa.

Finally, MDG8 deals with global partnerships toward development. South Africa supports various initiatives within Africa, and the rest of the developing community, including for instance becoming a member of the World Trade Organisation (WTO) or championing the New Partnership for Africa's Development (NEPAD). Not all the MDGs will be included in our modelling. The focus will be on MDGs 2, 4, 5, 6, (representing education and health goals). The purpose of the study is not to impose any hierarchy on the MDGs, but to try to simulate an improvement in the general situation within the time constraints.

3. The Model Used

In order to evaluate if South Africa can achieve selected MDGs, a dynamic CGE model based on the CGE developed by Chitiga *et al.* (2009) is used. To this, a specific module for studying the MDGs is added, based on Lofgren and Diaz-Bonilla (2006) specifications. Following Lofgren and Diaz-Bonilla (2006), it is assumed that each year, a student can graduate (grd), repeat (rep) or drop out (drop).When a student graduates (grd), he/she can be graduated within the cycle (cont_cyc) or the last year of the cycle (grd_cyc). Finally, when a student finishes a cycle, he/she can go on to the next cycle (grd_cont) or decide to leave the education system and enter the labour market (grd_quit). The intake rate (g1entry), students' behaviour to graduate (grd), and to graduate and go on to the next cycle (grd_cont) are computed using a logistic function. The rationale behind using such a function is to show that if the original value is quite low, with a small investment, it is easy to improve the value. Conversely, if the original value is quite high, it will be quite difficult to improve it and reach the limit value.

For each cycle, student behaviours' are influenced by the quality of education, the wage rate differential and the student's health. It is indeed easy to understand that if the government decides to hire more teachers/professors, ceteris paribus, it will reduce the teacher per student ratio, and therefore increase the quality of education. In this case, this will have a positive influence on the student who will then be keen to go on studying. After each year, students who graduate from a cycle will enter the corresponding labour market. For instance, we assume that students that do not complete their primary level, or complete and enter the labour force, will be considered as unskilled workers on the labour market. Students completing the secondary education level will enter the labour market as semi-skilled workers. Those who do not graduate from the secondary education level will enter the labour market as unskilled workers. Finally, students who finish their tertiary education level will enter the labour market as skilled workers. Those who do not graduate the tertiary level will enter the labour market as semi-skilled workers. This way, the retroactions and interdependencies between the education sectors and the labour market can clearly be seen. To compute the value of the education MDG (MDG2), the intake rate and the graduation rate for the length of the primary school are multiplied. To take into account the other MDG

(MDG 4, 5 and 6), we also use a logistic function. In this case, the arguments of the function are health services and water services supplied by government and per capita consumption. The details and list of the full model equations and description are available from the authors upon request to the interested reader.

4. Data Description

The data is based on the Social Accounting Matrix (SAM) of 2005 developed by Quantec. The SAM contains 56 activities and 56 commodities (after adjustment for education), two broad factors (labour and capital), four institutional sector accounts (households, enterprises, government and the rest of the world), and two saving and investment accounts. In the original Quantec SAM, the education sector includes the three levels (primary, secondary and tertiary). For purposes of this study, we split the education sector between these three components. To proceed, we use the government spending shares from the Reserve Bank for 2005.

In addition to the SAM, there is need to assign values for the number of students and for their behaviour at the base year. Indeed, the number of students and the different shares for the base year are observed values. For the following years, the model will compute them as they will be influenced by the different policies. The numbers of students per cycle (primary, secondary and tertiary) are taken from the Department of Education (2009). According to the South African Department of Education's descriptions, primary education goes from Grade 1 to Grade 7, secondary education from Grade 8 to Grade 12, while tertiary (higher) education includes universities, technikons and further education technical (FET) colleges.

The intake rate is computed from the Department of Education (2009). For the primary level, the share of students that graduate (grd) and repeat (rep) are taken from the Department of Education (2009). Assuming that each year, a student can either graduate, repeat or drop out, the sum of these three shares is equal to one. Therefore, we can find the share of students that drop out by difference. Transition rate (grd_cont), which is defined as the share of students that end a cycle and get into the next cycle, from Grade 7 to Grade 8, is taken from the Department of Education figures and is quite high, at 96 per cent. As a student can either continue to the next level, or enter the labour market, the sum of these two shares adds up to one. We can thus compute by difference the share of students that enter the labour market after graduating from the primary level. For the secondary level, for graduation rates, the results of the matric (exam at the end of Grade 12) were taken. For Grade 12, the repetition rate is 0.9 per cent, and the difference constitutes the dropout rate.

To compute transition rates, the following assumption was made: the Department of Education provided the share of students that pass matric and are allowed to go onto university (17 per cent). However, to be highly skilled, students can also attend technikons and FET colleges. Therefore, this share is increased to 75 per cent because most of the students that complete secondary education continue into higher education; in the absence of another share, this is assumed to be the correct one.

For the tertiary level, as no data exists for higher education, the following assumptions were made: 50 per cent of the students graduate and very few of them repeat (5 per cent). Informal discussions with key informants indicated that the number of students repeating a whole programme (as opposed to a course) is very low at tertiary institutions, as students will just

rewrite subjects they fail. For transition rate, the share of students that graduate and enter the labour market is obviously equal to 100 per cent as students cannot go further. Table 1 summarises the different shares at the base year.

Table I: Shares of student's behaviours

		2005
g1entry	primary	0.515
grd	primary	0.930
grd	secondary	0.683
grd	tertiary	0.500
grdcont	primary	0.960
grdcont	secondary	0.750
grdcont	tertiary	0.000
grdquit	primary	0.040
grdquit	secondary	0.250
grdquit	tertiary	1.000
rep	primary	0.003
rep	secondary	0.009
rep	tertiary	0.050
dropout	primary	0.007
dropout	primary	0.041
dropout	secondary	0.308
dropout	tertiary	0.450

Source: Various publications and own assumptions

5. Results

Given that 2015 is around the corner, we know that it is not possible for South Africa to achieve all the MDGs. In section 2 above, we pointed out that some of the MDGs were already achieved. On the other hand, for some others, it seems infeasible to reach them (especially MDG4 and MDG5). As underlined in the discussion above, these two MDGs are strongly related to the HIV situation. In other words, targeting the MDG6 (HIV) will have indirect positive impacts on MDG4 and MDG5. We explained as well above that MDG2 (the education related MDG), is also crucial (because of the links it has with other MDGs) and almost achieved. Therefore, the first scenario will focus on how much it would take to reach MDG2 (universal education) at the end of 2015. The second scenario will focus on reaching MDG6 (HIV indicator), knowing that improving it will have positive impacts on other MDG indicators. For both scenarios, the assumption is made that government borrows from domestic agents, and no fiscal policy adjustment is available to finance the policy attainment of the selected MDGs[1].

5.1. Scenario 1: Reach MDG2 in 2015

This scenario consists of reaching MDG2 (universal education) and looking at the cost in terms of primary education public spending compared to a situation without the policy. As explained earlier, improving the skills level of the population will have positive spillovers for

[1] For extra policy simulations, the interested reader can refer to Mabugu *et al*. (2012)

the other MDGs, by creating more skilled people for the economy in the long run. Table 2 shows how much extra the government has to spend.

Table II: Impact on government spending (in per cent compared to BAU)

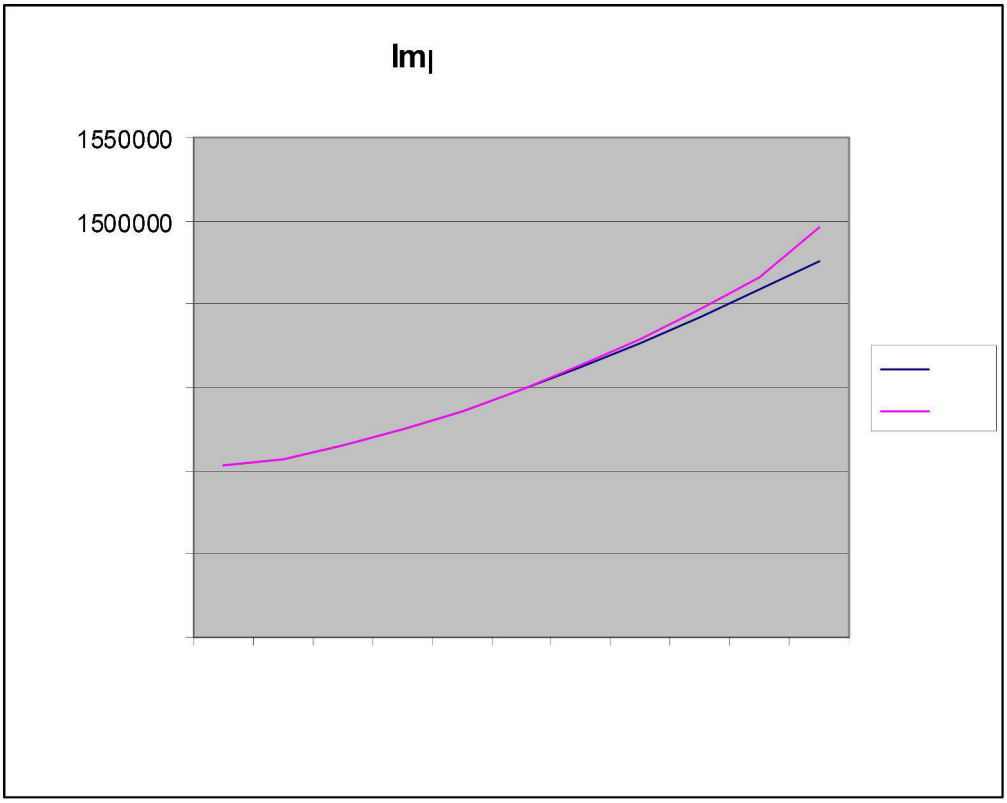
Years	Government consumption in 'primary'
2011	1.24
2012	3.38
2013	6.46
2014	10.84
2015	23.57

Source: Own computations based on the model

Increased public spending also has an impact on the whole economy. As government hires more people (to teach, to build new schools etc.), the effect on labour demand, and therefore on unemployment rates, is positive. A general equilibrium effect occurs, which means that government carries the other sectors of the economy through backward and forward linkages. The categories that really benefit from the policy are highly and semi-skilled labour, and the effect is negligible for low-skilled workers. The impacts on households' income and consumption are quite positive (1.14 percent).

For the government, given the increase in households' direct taxes and indirect taxes, its income is increasing. However, not surprisingly, government savings decrease due to the absence of fiscal reform to compensate for the policy. Indeed, it has been assumed that no fiscal policy is set up, and therefore, government is borrowing from domestic agents. Consequently, domestic investment is affected as firms are normally the main contributors to total investment. The fall in private investment shows a typical crowding-out effect. From Figure 1, it can be discerned that GDP increases slightly. The impacts on other MDGs are also positive, due to the increase in households' consumption.

Figure I: Impact on GDP (at basic prices)



Source: Own computations based on the model

5.2. Scenario 2: Reach MDG6 in 2015

This scenario simulates reaching MDG6 in 2015. According to the report on South Africa's MDGs, this objective is attainable (UNDP, 2007:75). In order to reach the target, government increases its consumption of health services. In other words, it builds extra hospitals, improves the transport system to enable people to reach their health centres, which allows more people access to free treatments and so on. As Table 3 shows, by 2015 government' consumption for health services would increase by 17.4 per cent.

Table III Impact on government's consumption on health services (in per cent compared to BAU)

Year	Government's consumption in health services
2011	3.27
2012	6.37
2013	10.09
2014	13.66
2015	17.40

Source: Own computations based on the model

Targeting MDG6 has positive knock-on effects for other MDGs, especially MDG4 and MDG5. The general improvement of health also affects the education indicator (MDG2), as children who are not sick can go to school and follow a normal school life. The implementation of the policy has positive effects on the entire economy. Indeed, government

needs to hire new doctors and nurses, as well as other people in order to build new care centre, and this has a positive impact on the level of employment. Unemployment decreases for each type of worker, especially for skilled and highly skilled workers. The impact on households is also positive, as their income increases by 0.63 per cent in 2015, and their dissaving decreases.

The level of direct taxes collected also increases, which leads to government's income increasing by 0.34 per cent in 2015. However, government's savings decrease by just over 14 per cent in 2015. In order to finance its policy, government borrows from the domestic market. This increase in public borrowing, mainly from the domestic firms, has an impact on total investment (IT). The same phenomenon occurs as in the previous scenario, with public investment (IT_PUB) having a crowding-out effect (Table 4).

Table IV: Impact on investment: (in per cent compared to BAU)

	IT	IT_PRI	IT_PUB
2015	-1.98	-2.38	0.07

Source: Own computations based on the model

6. Conclusion

This paper is one of the first applications in the region that looks at ways in which government might reach the Millennium Development Goals by increasing spending. For South Africa, reaching all the MDGs seems impossible, especially MDG4 and MDG5 (child and mother-related health goals), as the actual values are too far away from the target values. The results were quite promising for universal primary education (MDG2) and combating HIV-AIDS (MDG6), but in both simulations government has to borrow (from the domestic firms) to reach the MDG target. This is not sustainable in the long run, and increasing indirect taxes in order to reach the MDG target could harm households' spending, eventually reducing any benefits. This does not mean that little progress can be made to improve public health resources. Instead, the findings suggest that the post-2015 health agenda must be characterised by continuation of MDGs 4,5 and 6 with more effort at reducing child and maternal mortality and the fight against HIV and AIDS, TB and malaria should not stop in 2015 but intensify. In doing so, however, government should carefully weigh up the impact of increasing spending against the risk associated with increasing taxation rates, spending levels and deficit finance.

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