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Cabral François Joseph

Anne-Sophie Robilliard

Fatou Cissé

Abdoulaye Diagne

UNIVERSITÉ DE
SHERBROOKE

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ASSESING STRATEGIES TO ACHIEVE MDGs GOALS: EVIDENCE FROM SENEGAL

Cabral François Joseph, Anne-Sophie Robilliard, Fatou Cissé and Abdoulaye Diagne

Abstract

Progress towards the MDGs is expected to slow as a consequence of the global economic downturn. This study applies an economy-wide framework to analyze the impact of the crisis on MDG achievement in six Latin American countries. It finds significant setbacks towards the goals and, in the case of the region's low-income countries, the cost of achieving these would rise between 1.6 and 3.4 per cent of GDP per year between 2010 and 2015 as compared with a no-crisis scenario. The additional public spending would contribute to economic growth though not sufficiently for full recovery to pre-crisis growth.

JEL Classification: C68, D3, I3, F35, O11
Keywords: computable general equilibrium models, distribution, welfare and poverty, foreign aid, macroeconomic analyses of economic development.

I. Introduction

In 2000, the Millennium Summit synthesized previously agreed global goals and targets in a document called the 'Millennium Declaration'. Formulated as eight goals and eighteen targets, the 'MDGs' were endorsed by the UN General Assembly in late 2001. Some countries in Africa like North Africa and Mauritius have made significant progresses in the way of realizing MDGs targets. However, in most of the rest of Africa, results obtained are quite low. In sub-Saharan Africa, the number of persons under extreme poverty (less than 1 $ per day) has increased shifting from 217 million in 1990 to 290 million in 2000 (CEA, 2005). Growth trend is more generally modest with regard to population growth and is quite irregular for most of the African countries. It is obvious that many countries were not on track to meet most MDGs, as shown by the United Nations' most recent MDG report (United Nations, 2008).

Senegalese economy like the one of the others economies in sub-saharan economies does not behave differently. The pattern of Senegalese economic and social development for the last forty years can be divided into two periods. During most of the first period - between 1970 and 1985 - like other countries of the West African Economic and Monetary Union (WAEMU), Senegal has experienced a growth in its GDP close to the average sub-Saharan African countries. But the pattern of growth has worsened progressively from 1979 onwards due to the sharp deterioration in its terms of trade. The depreciation of the dollar against the French franc at which its currency, the CFA franc, was linked by a fixed exchange rate has significantly reduced the competitiveness of Senegalese's exports. In addition, world prices of groundnut oil and phosphates, the two main exports, have steadily declined, widening deficits in the trade balance and foreign reserves narrowing. The increase in the global civil servants salaries reached a very high amount compared to the trend of the budget deficit. Its impact has create an adverse effect on the situation of the private sector, subject to high taxation as well as large public payments arrears and an alignment of its wages to the one of public sector which are high enough, stiffening the highly formal labor market. Although inflation was moderate, the monetary situation will soon worsen rapidly due to both capital flight and the monetization of deficits.

Like other WAEMU countries, the Government could circumvent the statutory limits advances to the Treasury by the Central Bank of the States of West Africa (BCEAO) using trade credit refinanced by this later. If this relaxation of fiscal discipline enabled the Government to better contain the social and political tensions, it induced the eviction of private credit market that sharply curbed their investment and production. Business competitiveness was hampered also by other distortions in the business environment. The vicious circle in which the Senegalese economy was installed was stopped by the nominal devaluation of the CFA franc in January 1994.

This monetary adjustment has marked at the same time the beginning of the second period. It began with the creation of the West African Economic and Monetary Union (WAEMU), which soon had a major impact on the state budget through the introduction of a common external tariff, the harmonization of value added tax (VAT) and the establishment of a solidarity pact that established standards of macroeconomic management to accelerate the economic convergence of members of the Union. The recovery of economic growth, return of capital and the maintenance of foreign aid to relatively high levels have significantly improved the conditions for macroeconomic management but have not sufficiently played a role to accelerate the development. The adoption in 2000 by the International Community of the Millennium Development Goals (MDGs) to which Senegal had agreed has lead to a radical shift in policy vis-à-vis the social sectors that have suffered greatly during the first period adjustment of the economy.

The reduction of internal and external imbalances must now be accompanied by policies that eradicate extreme poverty and hunger, promote universal access to basic education and primary care quality for the reduction of infant and maternal mortality, promote gender equality, the empowerment of women, and access to safe drinking water. The new policies are also expected to reduce the deleterious effects of internal and external shocks on the economy and particularly on vulnerable groups. All these new policies have been placed in the context of the poverty reduction strategy from the early 2000s.

Several public programs on education, health and water have been undertaken by the Senegalese government on the 2000 years to support the .MDG achievement. However, the MDGs picture is mixed. Encouraging signs of progress have been made on access to primary education, gender parity on primary education, child and mother health, and access to water both on urban and rural areas. At the same time, growth is slow, irregular and not pro poor (Cabral, 2010). The speed of progress is insufficient for achieving the goals such as halving poverty by 2015, achieving gender parity in post primary education, and improving sanitation coverage. The reduction of child mortality and maternal mortality are also insufficient. The expectation is that with unchanged trends of past achievement the country should not be able to attain these goals by 2015 (Senegal, Rapport suivi des OMD, 2006).

The purpose of this report is to analyze the strategies to achieve the MDGs that are macro economically feasible for the Senegalese economy. More specifically, we try to address three questions. First, what is the trajectory that the Senegalese economy will follow under current policies and will it be sufficient to achieve the MDGs in 2015? Second, what is the amount of additional public spending needed to achieve the MDGs in 2015? Third, what would be the best financing option for MDG achievement in 2015? This paper tries to address these questions for Senegal and explores some of the major macroeconomic challenges that the country is facing. Hence, to run the MDGs scenarios, we use MAMS (Maquette for MDG simulation), a model developed by the World Bank, which is spelled out in detailed in Lofgren and Diaz-Bonilla (2008).

After this introductory section, the second one describes the main reforms and macroeconomic policies adopted under the strategy of poverty reduction and the performance that the economy experienced. The third section analyses social policies implemented by the Government, the main patterns of poverty and inequality and the Senegalese performance on MDGs achievement. A brief description of MAMS – the model used to assess the issue of MDG and run appropriate simulations - is presented in the forth section where the MDGs determinants are analyzed. The fifth section analyzes for Senegal different financing scenarios to achieve MDGs. The final section draws policy implications from simulation results.

III. Trends of poverty, inequality and non-poverty MGDs (1990-2009)

While assessing the ability of Senegal to achieve MDGs by 2015, it is important analyze the past trend of those MDGs.

Poverty and inequality trends

Household consumption data shows that the share of population under poverty line has declined from 67.9% in 1994-1995 to 57.1% in 2001-2002. It represents a reduction of 10.8 percentage points. Similarly, at the household level, the headcount has declined from 61.4% to 48.5%. Over the period 2002-2005, many progresses are also made as one can observe a significant decrease in the poverty headcount. Indeed, the proportion of people living below the poverty line declined from 57.1% in 2002 to 50.8% in 2005. As for the proportion of households living below the poverty line, it has also declined, shifting from 48.5% in 2002 to 42.6% in 2005. The incidence of poverty has declined more in urban than rural areas. In 2002, the incidence of rural poverty was 57.5% and decreased to reach 55.6% in 2005. As nearly 6 out of

10 persons are poor people in rural areas, achieving the first MDG target is the reduction of poverty by half by 2015 (République du Sénégal, 2004; 2010b). This will imply a drastic decline in rural areas and hence substantial public investment flows towards the rural sector as suggested by Maputo declaration.

From 1994-1995 to 2002, the Gini coefficient that measures the degree of inequality has slightly diminished at the household level whereas it has slightly increased at the individual level (République du Sénégal, 2004; 2010b). This trend has not been significantly modified since the last household survey (ESPS) reveals that individuals in richest quintile have absorbed 40% of expenditures while those in the poorest quintile only 8.2% (République du Sénégal, 2007).

Trend of the non-poverty MDGs during the period 1990-2009
Is the country on-track to achieve the MDGs under current policies and why?
A number of sectoral studies arried out to analyze the trends of MDGs in Senegal and its probability to achieve each of them by 2015 are used to indicate if the country would be "on track" or "off track" to achieve the MDGs. Those assessments are brought together in Table 4. However, unlike the modeling framework that is used in the below, which takes into consideration non-linearities in the path to MDG achievement, this assessment of the likelihood of achieving the MDGs of this section basically uses path trends and projects them linearly.

Concerning MDG1, the goal is to cut by half by 2015 the share of the population living under the poverty line. Hence, from a national headcount of 68% observed in 1994/1995, poverty incidence should decrease to 34% or less by 2015 a record. However, insufficient growth and insufficient job creation in the past years seem to put this target out of reach under current trends.

With regard to non-poverty MDGs, one can observe that since 2000, Senegal is implementing an ambitious educational and training program for the whole decade (Plan Décennal pour l'Education et la Formation - PDEF). This has boosted the fiscal effort toward to the educational sector. Quality of educational services delivered has been enhanced not only through an increase in the service in the education sector but also through various investments outside of that sector. In the recent years the net completion rate has increased from 53.4% in 2005 to 59.6% in 2009 (Table 4). The value of the net completion rate was equal to only 24% in 1990. This reflects considerable improvements but will not be sufficient to achieve the MDG2 target which is set at 90% by 2015.

Table 4: Current and target values of the MDGs in Senegal 1990-2010

		1990	2005	2009 or 2010	Target	Ach. Prob*
MDG1 - Poverty headcount	(%)	68.0	50.8	n.a.	34.0	Low
MDG2 - Primary completion rate	(%)	24.0	53.4	59.6	90.0	Low
MDG4 – Under-5 mortality	(per 1,000)	131.4	121.0	85.0	43.8	High
MDG5 - Maternal Mortality	(per 100,000)	510.0	401.0	370.0	127.0	Low
MDG7a - Access to water	(%)	56.0	76.6	84.8	90.1	High
MDG7b - Access to sanitation	(%)	25.8	41.0	43.5	70.1	Low

Source: République du Sénégal, 2007 and 2010b.
Note: Achievement probabilities are taken from the 2007 MDG report and updated using the 2010 report and analysis of recent trends.

Progress achieved under several public health programs also have led to significant decreases of the under-five mortality rate in Senegal. The share of age 0 to 11 month vaccinated has doubled between 2000 and 2008. The coverage of the other ages has also increased significantly. For children benefiting from nutritional status surveillance, especially for weight/age, the share of child population covered has increased from 112 000 in 2005 to 418 000 in 2008. All these efforts have lead to an important decrease in under five mortality (table 4). And according to UCPSE (2010) under this sustained effort, MDG4 could be achieved by 2015.

In the field of maternal mortality, efforts to reinforce the supply and the quality of maternal services have been increased by the Government. Hence, the proportion of deliveries attended by skilled health personnel has increased from 49% in 1999 to 66.9% in 2009. The ratio of neonatal consultation has also significantly been enhanced. It has shifted from 94.7% in 2009 to 88% in 2008 (République du Sénégal, 2010b). To facilitate the access of this group to services of quality, free delivery and free C section has been set. Therefore, maternal mortality has decreased going from 510 deaths per 1000 births[1] in 1992 to 401 deaths per 1000 births[2] in 2005. However, despite some progress, MDG5 target for 2015 will not be met under business as usual.

With regard to water, important progress has been made under the implementation of the "Drinking Water and Sanitation Program Goals" (PEPAM). At a national level, the rate of access to drinking water has increased from 56% in 1990 to 76.6% in 2005 (table 4). However, if the goals are already achieved in urban area, the rate of access to drinking water in rural area has to be enhanced (République du Sénégal, 2010b). According to latest numbers on this target, the access to water was measured at 84.8% in 2010. Hence, under current trends one can expect that the water access target will be achieved in Senegal by 2015 if effort in the sector is sustained. Progress in the access to sanitation is still small compared to the one of water access mitigating the achievement of the "water and sanitation" MDG. From 25.8% in 1990, access to sanitation has reached 41% in 2005. This will unfortunately not be sufficient to achieve the 70% access to sanitation target by 2015.

IV. The MAMS framework

MAMS (MAquette for MDG Simulations) is a recursive-dynamic CGE model designed for medium- to long-run development strategy analysis. Unlike other CGE models, it covers the generation of MDG and education outcomes, including the roles of different government functions in these processes. On the demand side of the model, domestically produced commodities can either be exported or sold to the domestic market. Output is imperfectly transformable between exports and domestic sales, allowing producers to supply both markets if their prices differ. The relative price of commodities for exports and domestic sales determines the share for each destination. A similar mechanism determines the share of domestic demand that is met by imports. Changes in the exchange rate affect both exports and imports by changing their prices relative to the domestic supplier and demander prices of domestic output; the exchange rate adjusts to keep the current account in balance. Household demand is determined via a linear expenditure system; the demand for a given commodity depends positively on household income (net of direct taxes and savings) via a fixed marginal income share; negatively on its own price; and on minimum demand determined through subsistence needs.

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[1] Measured by the demographic and health survey (EDS-2).
[2] Measured by the demographic and health survey (EDS-4).

The government collects different types of revenue—direct income taxes, indirect sales taxes (the largest revenue source), and import duties—and spends it on the expenditure categories listed above. Both revenue sources and expenditure categories are calibrated to match Senegal's budget composition. The required capital stock to support current government activities—the capital stock needed for education, health, water and sanitation and "other" government activities—is endogenous, depending on current government activities. Capital investment in public infrastructure, in contrast, is exogenous, but current government spending to maintain and operate the public infrastructure is endogenized, depending on the level of the infrastructure capital stock.

In international commodity markets, we assume that Senegal is price-taker, facing infinitely elastic export demands and import supplies at exogenous prices. Domestic commodity markets, in contrast, clear through price changes. For example, if demand for a given commodity increases—this could result from increased government spending on an activity that needs this commodity as input—the relative price of the commodity will increase; on the demand side, this reduces household demand for the commodity, and on the supply side, production of the commodity becomes more profitable and increases. The latter leads to a rise in factor demand in this sector and to higher wage rates of factors that are intensively used in this sector. Higher wage rates, in turn, reduce factor demand and production in other sectors where the relative output price has declined. Prices adjust instantly in MAMS. Consequently, MAMS-simulation results should be seen as depicting not a short-term forecast but rather the medium-term outcome after all prices have adjusted. In this sense, MAMS is a medium-term growth model, not a short-term macroeconomic model. Consistent with this medium-term orientation, MAMS does not model monetary policy or inflation, because monetary policy has real effects only in the short term, but is neutral in the longer term, the MAMS modeling horizon. MAMS keeps the consumer price index (CPI) fixed and uses it as a numéraire; that is, all prices in MAMS are "real" prices, deflated by the CPI index.

Household do not maximize utility on an intertemporal basis. In labor markets, this implies that overall labor supply depends only on exogenous population growth and not on wages; and that savings (and by extension investment) is not a function of interest rates (and return on investment) but is defined as a largely fixed share of post-tax household income. For each of the three labor markets, unemployment is assumed (the unemployment rate is above its exogenous minimum), with the producers employing as much labor as they desire at a reservation wage that is negatively related to the unemployment rate. For non-labor factors (land and private capital), we assume a market-clearing wage or rent (the first of the two regimes).

Three ranges of MDGs targets are explicitly included in the MDG module: education, health (child and woman mortality) and water and sanitation.

The MDG module modeled in MAMS framework (Logfren, 2010; Logfren and al., 2010) determines the values for the indicators related to the different MDGs and educational behavior. In the educational field, it is assumed that as they are rationale, households will make a decision on their education, which in turn determines the supply of different labor educations in the market.

The education system is composed of C cycles. Within each cycle c, the model endogenizes the following aspects of the students or pupils behaviors:

- the share of the enrolled that graduate from their current grade (grd); repeat (rep) or dropout (drop);

- the share among the graduates from their current grade (grd) who graduate from their current cycle (grdcyc) or continue to a higher grade within this cycle (contcyc). In term of shares, gdr=grdcyc+contcyc;
- the share among cycle graduates who exit the school system (grdexit) or continue to next cycle (grdcont). The sum of these share is unity;
- the share of the cohort of the first year in primary school that enters in school (neting1).

For each cycle, a logistic function defines the shares for first year in-cohort entry (neting1), for graduates from the current grade (grd) and for graduates who decide to continue the next cycle (grdcont):

$$SHR_{b,c,t}^{edu} = ext_{b,c}^{edu} + \frac{\alpha_{b,c}^{edu}}{1 + EXP(\alpha_{b,c}^{edu} + \beta_{b,c}^{edu} * ZEDU_{b,c,t})}$$

The only endogenous variable in the logistic function ($ZEDU_{b,c,t}$) is defined in a constant elasticity formulation as a function of the quality of education ($(EDUQUAL_{c,t})^{\emptyset_{b,c,edu-qual}^{edu}}$), the wage incentives ($(\frac{W_{f-labi,t}}{W_{f-labj,t}})^{\emptyset_{b,c,w-prem}^{edu}}$) defined as relative wage gains from continuing schooling (i.e relative wage gains that student can achieve if they complete a cycle that is sufficiently high that they climb to the next higher level in the labor market), under five mortality rate ($MDGVAL_{mdg4,t}^{\emptyset_{b,c,mdg4}^{edu}}$), size of the infrastructure capital stock, ($(\sum_{i \in INS} QFINS_{i,f,t})^{\emptyset_{b,c,f}^{edu}}$), household consumption per capita ($QHPC_t^{\emptyset_{b,c,qhpc}^{edu}}$):

$$ZEDU_{b,c,t} = \alpha_{b,c}^{educe} * (EDUQUAL_{c,t})^{\emptyset_{b,c,edu-qual}^{edu}} * (\frac{W_{f-labs,t}}{W_{f-labn,t}})^{\emptyset_{b,c,w-prem}^{edu}} * (\frac{W_{f-labt,t}}{W_{f-labs,t}})^{\emptyset_{b,c,w-prem}^{edu}}$$

$$* MDGVAL_{mdg4,t}^{\emptyset_{b,c,mdg4}^{edu}} * \prod_{f \in CAPGOVINF} (\sum_{i \in INS} QFINS_{i,f,t})^{\emptyset_{b,c,f}^{edu}} * QHPC_t^{\emptyset_{b,c,qhpc}^{edu}}$$

The treatment underlying the MDG 4, 5, 7a and 7b is similar but less complex. For these, a logistic function directly defines the MDG indicators as a function of an intermediate variable that is defined in a related constant elasticity (CE) function. The arguments of this function are similar except for that the relevant service supply is expressed in per capita form and not per enrolled student. Achieving the MDGs targets will rely on different determinants which are described in the next section.

V. Sector analysis of MDG determinants

Most policy papers that analyze and evaluate progress on the achievement of MDGs in Senegal make reference to a number of determinants that are likely to affect MDGs and that are likely to be affected by public policies (République du Sénégal, 2007, 2010b). These determinants are similar to those found in most countries: public delivery of corresponding services on the supply side and income per capita on the demand side are obvious determinants but other factors such as available infrastructure are also important. Complementarity between MDGs is also expected. For instance, the health status of children is likely to affect educational outcomes, while mothers' education and access to safe water and sanitation should matter both for MDG4 (under-five mortality) and MDG5 (maternal mortality).

While most of the above studies mention a range of determinants, the major supply side determinant appears to be service delivery in the related areas. On the demand side, household economic wellbeing is expected to play a role although it is rarely mentioned explicitly. However, in the case of MDG4 (under-5 mortality), reports from Demographic and Health Surveys carried out in Senegal provide statistics by socio-demographic characteristics that suggest that various demand factors, including economic wellbeing and mothers education, are likely determinants of child mortality. For

instance, according to the last DHS survey (EDS-IV, Senegal 2005), the probability of dying before age 5 is 3 times higher for children born in the poorest quintile of the population versus those born in the richest quintile (see Table in Appendix B).

Table 5: Senegal - Determinants of non-poverty MDGs

	Service delivery	Household consumption per capita	Public infrastructure	Other MDGs	Wage incentives
MDG2 - Primary completion rate	x	x	x	4	x
MDG4 - Under-5 mortality	x	x	x	7a & 7b	
MDG5 - Maternal Mortality	x	x	x	7a & 7b	
MDG7a - Access to water	x	x	x		
MDG7b - Access to sanitation	x	x	x		

Since no elasticity values for MDG production functions are available for Senegal, their values have been borrowed from a systematic review of relevant studies collected by Lofgren (2010). As with other studies using a similar methodology, the main purpose here is to highlight the relative importance of various determinants of MDG outcomes and, within a consistent economy-wide framework, discuss the relative merits of various sources of financing and the implications of a targeted pursuit of MDGs on the rest of the economy. Thus, while the exact quantitative findings of this study may be subject to revision if better elasticity estimates become available, the qualitative conclusions should remain applicable.

The different elements reviewed above and the available literature led us to rank the different determinants of Table 5 for Senegal in terms of their relative contribution to the achievement of the various MDG. This is presented in Table 6 where the most important determinant is numbered 1 while the less important is numbered 4.

Table 6: Senegal - Determinants of non-poverty MDGs

	Service delivery	Household consumption per capita	Public infrastructure	Other MDGs	Wage incentives
MDG2 - Primary completion rate	1	2	3	4	5
MDG4 - Under-5 mortality	2	1	4	3	
MDG5 - Maternal Mortality	1	2	4	3	
MDG7a - Access to water	1	3	2		
MDG7b - Access to sanitation	1	3	2		

The actual elasticity values were then set within the range of available estimates (Lofgren, 2010). The actual values used in the calibration of MAMS are provided in Appendix D.

VI. Calibration of MAMS

The heart of the MAMS calibration is a social accounting matrix (SAM) that maps all flows between production activities, production factors, institutions (e.g., households, government), and commodities

(goods and services) in the model economy. In order to calibrate MAMS-Senegal, the 2005 SAM of 128 x 128 dimension was adapted. The 128 accounts of the SAM are classified into five major groups: factors, institutions, activities, products, investment.

The SAM includes several types of factors, namely labor capital and land. Labor is differentiated by three education levels: unskilled labor, moderate skilled labor (middle manager, technician), highly skilled labor (senior manager). These factors receive from the sectors a flow of revenues that they channel to different institutions. Four categories of institutions (households, firms, government and the rest of the world) are considered. There are 46 activities, covering agricultural sectors; processed goods and services and the public sectors. This later include: infrastructures, public administration, public education for the three levels (primary, secondary, tertiary), health, water and sanitation. In this category of accounts, each sector pays income to factors of production (value added) and buys domestic inputs for its production processing (intermediate consumption). The different types of commodities are classified in 53 groups, covering agricultural products (including cereals and cotton); processed goods (for example, cotton fiber for export and manufactured goods for domestic use); utilities (including education, health water and sanitation); petroleum (imported); and services (including construction). The investment- saving block combines the savings of households, firms, the fiscal balance and saving the rest of the world or the balance of current account. This account also gives us the amount of gross fixed capital formation (GFCF) and changes in stocks of different sectors of the economy.

In order to build a database suitable for the core MAMS model, we use different sources of data. Data sources from which the SAM has been built are :
• the input-output table of 2005 (ANSD, Senegal) ;
• supply-demand balance of 2005 (ANSD, Senegal) ;
• table of public financial transactions in 2005 (DPEE, Senegal) ;
• balance of payments 2005 (BCEAO) ;
• the household survey of 2005 (ANSD, Senegal) ;
• The Direction of General Administration of Equipment of the Ministry of Education ;
• The social accounting matrix of 1996 (mimeo).

The main sources of the micro data are:
- Senegalese 2002 households survey (ESPS);
- Education and training decade program (PDEF) and UN data for education;
- Demographic and health survey (EDS-4) for health sector;
Drinking water and sanitation program goals (PEPAM) for water and sanitation sector.

The data on public debt for both domestic and foreign markets in the base year has been collected from the Central bank. The foreign debt/PIB ratio is equal to 47% whereas the domestic debt/PIB ratio is equal to 3%. By referring to public budget, current government spending expressed as a percentage of the GDP is equal to 1.56%, 1.04% and 1.06% respectively for education, water and health. By looking to the investment side, education, water and health is a share of respectively 1.26%, 0.68% and 1.06% (see table 7).

Table 7: MDGs related expenditures (% of GDP) in the base year

	Primary education	Health	Water & Sanitation
Current	1,56	1,04	1,06

Capital	1,26	0,68	1,06
Total	2,82	1,72	2,12

Source: République du Sénégal (2010a)

The data on the number of students per educational cycle was collected from the Ministry of education. It is equal to 1,444,163 pupils in the primary education sector. In the secondary and tertiary levels, the number of student enrolled is respectively equal to 401.050 and 60.331. The data on number of individuals in different age cohorts also comes from the Ministry of education and for some extent from UN population projections.

As mentioned above, the MDG elasticities values used in MAMS Senegal were ranked according to an appreciation of their relative importance (table 6). Their actual values were then taken within the range of estimates provided in Lofgren's review (2010). A full calibration of the MDG module of the MAMS model also requires providing estimates of needed increases in each determinant to achieve the MDGs by 2015. Since this information is not readily available and since, conversely, values for different MDGs are available for the years 2009 or 2010, which correspond to the middle of the simulation period, these so called scenario parameters were calibrated so as to reproduce the observed MDG trends from 2005 to 2010 (or 2009 depending on data availability). This calibration is apparent in the graph presented in the next section (Graph 13) were a green line representing the intermediate MDG value has been added.

VII. MAMS scenario analysis for Senegal
Baseline scenario (BAU)

The Business-As-Usual scenario (BAU) corresponds to the normal execution of standard functional operations, particularly in contrast to a project or program which would introduce change. It further assumes no external events would shock the economy. It is the usual benchmark against which dynamic scenarios are compared since that allows contrasting the likely impact of shocks or policies which impact is expected to affect the economy in the long run.

Assumptions on some key variables
In the BAU scenario for Senegal, the GDP is supposed to grow at the observed average rate for the 2005-2010 period (3.1% per year) and at the rate suggested by both official and IMF predictions for the 2011-2015 period (4.0% per year). Annual growth rate of government services provision is set at 5%. By doing so, we ensure that the BAU scenario replicates the aggregate functioning of the economy and/or generates a smooth continuation of past trends for key economic variables. Unemployment rate is set at 20% for semi- and highly-qualified labor and at a low level (5%) for non-qualified labor. Labor force participation by labor type has been computed by combining national account data and statistical and fiscal declaration data. The total number of labor force is estimated at 3.5 millions.

Closure rules
In the baseline, government receipts are fixed in term of rate (for the various taxes) or in term of annual growth (for other receipts). Government spending rules differ between education sectors and other MDG sectors. For education, the rule is that educational quality growth (educational spending per student) is fixed. For public non-education MDG (health, water and sanitation), spending is a fixed share of absorption. This is also the rule for spending in infrastructure, public administration and transfers to the rest of the world. In contrast, transfers to non government institutions are a fixed share of GDP. Savings are

investment driven: saving rate adjusts so that investment grows at the same rate as absorption. Balance of payment clear through the adjustment of the real exchange rate. Concerning the labor-factor market, unemployment is endogenous: wage changes generate changes both in labor demand and supply. Some of these rules change for the MDG scenarios.

Does the BAU scenario reasonably replicate the aggregate functioning of the economy?
By construction, the BAU reproduces the (imputed) GDP growth path described above. As explained in the calibration section, the BAU is also calibrated so as to reproduce known MDG values in the 2009 or 2010. Under the actual and forecasted growth trend, the growth path is defined by an average rate of 3.1% as reflected by the trend observed in the period 2005-2010 and a prediction of 4%[3] for the period 2011-2015.
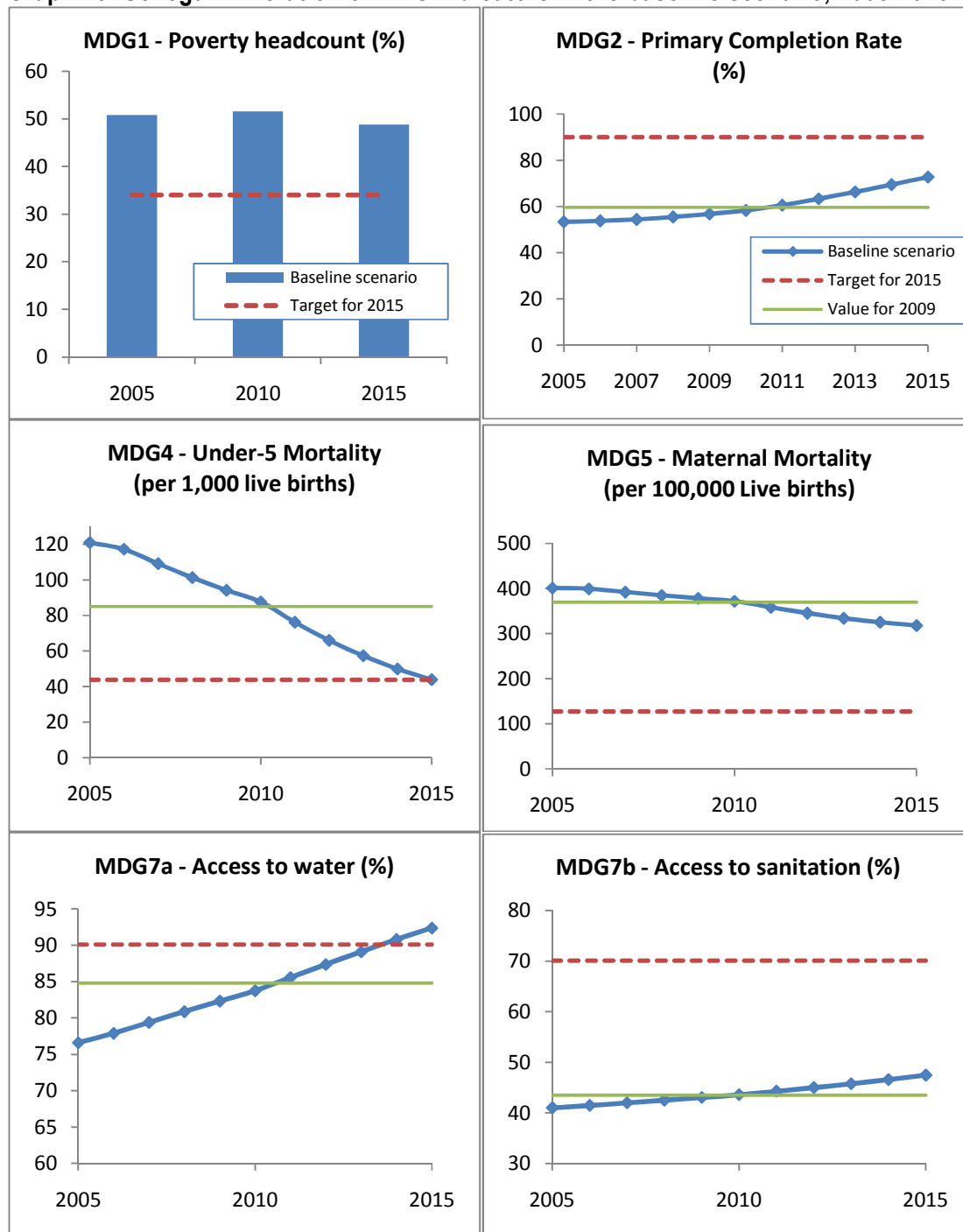
Are the MDGs achieved under the BAU scenario assumptions?
Graph 15 presents the trajectory of the different MDGs under the BAU scenario. Under the baseline scenario and the likely corresponding public expenditure, MDGs targets in 2015 will not be achieved in Senegal, except for under-five mortality (MDG4) and access to water (MDG7a). In 2005, the base year for MAMS, only MDG7a seems to be close to its target value compared to the other MDGs while for under five mortality, current and forthcoming programs suggest that progresses will be fast in next coming years. Distance to be covered from the base year for the MGD7 "water" is equal to 18% of the target value whereas it represents 71% of the target value for the MDG7 "sanitation" (Table 4).

According to simulation results, under the baseline scenario, Senegal would be allocating 3.71% of GDP of its public expenditures to primary education in 2015 (up from 2.82% in the base year), 1.54% to the health sector (down from 1.72 in 2005) and 1.94% of GDP to the Water & Sanitation Sector (down from 2.12) (see Table 7 for 2005 data). In total, MDG related expenditure would represent 7.18% of GDP in 2015 (up from 6.66% in the base year) which represent a small increase in terms of GDP share. In absolute terms, that would actually correspond to a 9.2% increase in service per student in the primary sector while service delivery per capita in the health and water and sanitation sectors would decrease by 16.1% and 14.5%, respectively.

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[3] Even if IMF predictions suggest 4.5% for next year, one has to notice that the issue of energy is not yet solved, suggesting that growth might be affected by this issue for the next 3 or 4 coming years. Hence, a prediction of 4% has been set for the period 2011-2015 to take into account the risk of adverse effects of, at least, energy shortcuts.

Graph 13: Senegal - Evolution of MDG indicators in the baseline scenario, 2005-2015

Source: République du Sénégal (2010b) and MAMS-SEN simulations.

Achievement of the MDGs targets is then determined by the progress made between 1990 and 2005, the additional sector costs needed to reach each specific MDG target and the elasticity of MDGs to those additional costs. More generally, modest achievements observed in the baseline scenario suggest that

substantial efforts will be needed to expand public provision of MDG related services so as to achieve targets.

MDG scenarios
MDG scenarios take the baseline or BAU scenario as a benchmark and scale up public spending to the extent required to achieve a set of imposed MDG targets. These scenarios can vary depending on what targets are being imposed and what source of financing is being used to cover for the new MDG spending. Possible sources of financing include foreign transfers, foreign borrowing, domestic borrowing and taxes, or a combination of them.

Analysis of MDG scenarios
Three main simulations are run. These are defined by the achievement of the overall package of MDGs (primary education, health, water and sanitation) under three alternative financing mechanisms (foreign loans, public transfers received from abroad, and additional tax revenue combined with public transfers received from abroad). These three scenarios are simulated under the BAU growth path described above, but, since growth is ultimately endogenous in these scenarios, new MDG spending may stimulate further growth, which is discussed in the below. Unlike the baseline scenario, though, MDG achievement is being imposed so the targets are reached by construction, except for the poverty target. However, achieving the set of non-poverty MDGs will imply costs and hence a fiscal effort and/or flow of aid or debt, all of which may have macroeconomic repercussions in the analytical framework.

Cost of achieving MDGs and alternative financing mechanism
To achieve the whole package of MDGs targets by 2015, the overall cost for Senegal, in terms of additional public spending, will depend to some extent on the financing mechanism used by the government. According to the simulation results, on average per annum during 2005-2015, Senegal's government would have to allocate 8.17% of GDP to primary education, 2.92% to health and 4.14% of GDP to water & sanitation in order to achieve MDGs 2, 4, 5, 7a and 7b by 2015, assuming the additional spending – relative to the baseline scenario – would be financed through foreign transfers (Table 8). Borrowing the needed budget from the rest of the world would not change the costs but, as mentioned below, it would have debt implications. On the other hand, costs would be higher if the Government is to choose a mixed financing mechanism combining an increase in direct taxes with foreign transfers. Increasing domestic taxes, while probably desirable from a foreign policy perspective as it will signal Senegal's strong commitment to the MDGs, would directly affect households' disposable income. Since income is an important demand side determinant of all non-poverty MDGs, the decreased private incomes would have to be compensated by more service delivery, thus increasing the additional total cost.

Table 8: Senegal: Public spending on MDG related services, base year and period annual average in 2005-2015 for simulated scenarios (% of GDP)

	Base year (2005)	Baseline scenario	MDG-achieving scenarios		
			foreign transfers	foreign borrowing	foreign transfers + direct taxes
Primary education	2.82	3.71	8.17	8.17	8.65
Current	1.56	2.04	4.60	4.60	4.86
Investment	1.26	1.67	3.56	3.56	3.79
Health Services	1.72	1.54	2.92	2.92	3.15

Current	1.04	1.01	1.67	1.67	1.78
Investment	0.68	0.52	1.25	1.25	1.37
Water & Sanitation	2.12	1.94	4.14	4.14	4.25
Current	1.06	1.03	1.97	1.97	2.03
Investment	1.06	0.91	2.16	2.16	2.23
Total	6.66	7.18	15.22	15.22	16.06

Source: MAMS-SEN simulations.

With respect to the baseline, the additional cost represents an additional 8.04% of GDP in the first two MDG scenarios, and an additional 8.87% of GDP in the combined financing scenario, based on a period annual average for 2005-2015 (Table 9). Reaching MDG2 appears to be the most expensive while the health sector comes last.

Table 9: Senegal: Additional average annual public spending on MDG-related services in the with respect to baseline, 2005-2015 (% of GDP)

	MDG-achieving scenarios		
	foreign transfers	foreign borrowing	foreign transfers + direct taxes
Primary education	4.46	4.46	4.94
Health Services	1.38	1.38	1.62
Water & Sanitation	2.20	2.20	2.32
Total	8.04	8.04	8.87

Source: MAMS-SEN simulations.

Translated into absolute numbers, these shares of GDP correspond to annual flows of 459.7 (for foreign financing) and 498.8 billion of F CFA, respectively (Table 10).

Table 10 : Senegal : Base year and average annual additional public spending on MDG-related services with respect to baseline and UNDP cost estimations (billions of FCFA)

	2005	MDG-achieving scenarios (2005-2015)			UNDP estimates (2005-2015)
		foreign transfers	foreign borrowing	foreign transfers + direct taxes	
Primary education	126.2	255.0	255.0	277.7	16.3
Health Services	77.0	79.0	79.0	90.8	21.4
Water & Sanitation	95.0	125.7	125.7	130.3	23.4
Total	298.2	459.7	459.7	498.8	61.1

Sources: MAMS-SEN simulations and UNDP (2007).

These numbers have to be contrasted with the base year global budget of MDG related sectors that amounts to 298.2 billion of FCFA in 2005. This means for instance that the primary education sector will have to absorb twice the value of its 2005 budget per annum on average over the 2005-2015 period. While sharp increases in the education budget have been registered since 2000, this could still be a challenge and it raises a crucial question with respect to the absorptive capacity of the social sectors in Senegal.

Although this question cannot be answered with the MAMS model, we believe it should receive some attention in future work.

Another issue raised by the results stems from the comparison of the cost estimates by sector with the estimates provided in the 2007 MDG report of the République du Sénégal that assesses the needs of each MDG sectors (see Appendix C for more detail[4]). These estimates are reported in the last column of Table 9 and appear to 10 to 15 times smaller than the ones generated by MAMS. In the case of education, other methodologies have been used to try and assess the cost of achieving the universal primary education goal. Mingat et al. (2003) is one example. In the case of Senegal, their estimates range from 20 to 40 billion of FCFA per annum depending on the scenario. While higher than the UNDP estimated for MDG2 (16.3 billion of FCFA per annum), these costs are 10 times lower than the MAMS estimates. This should also be a source of concern and scrutiny as to how the MDG reports costs where estimated[5]. As for the MAMS framework, the advantage is that, unlike a merely sectoral study, calculations more effectively and in an economy-wide setting capture the macroeconomic repercussions that MDG financing may have and these, in turn, may increase or even decrease the cost of financing the MDGs depending on the simulation. Furthermore, importantly, MAMS does not rely on linear trends that are based on past achievement in order to generate an MDG costing but it actually includes marginal returns of public interventions such that the closer the country is to reaching the 2015 target, the more difficult and costly it becomes to make further progress. More advantages of the MAMS approach are highlighted in Sanchez et. al (2010: chapters 1-2).

Trade-offs between alternative financing mechanisms
As a WAEMU member, Senegal is obliged to respect the convergence criteria that are related to the debt ratios, payments arrears, etc. It has been also highlighted in the previous sub-sections that growth has the highest potentiality to reduce poverty in Senegal. Hence, while dealing with the issue of the suitable financing mechanism, one has to take into account the growth rate pattern. Therefore, financing mechanisms should be assessed with regard to the respect of the convergence criteria and the choice will be made on the one that lead to the highest GDP growth rate.
Financing mechanism can have an impact on the total costs of delivering those services. The MDG financing gap can be filled either by foreign debt or by foreign grants. It can also be filled by raising taxes[6]. Each type of financing mechanism has macroeconomic and microeconomic implications.
The choice of direct tax financing combined with aid appears to have an explicit cost: less gain in terms of growth and poverty. When the choice is made for foreign borrowing financing, the country is shown to experience a high debt burden. While financing MDGs through foreign debt, Government MDGs services delivered could be constrained by the payment of interest. Hence, with regards to the criteria combining WAEMU convergence ratios and highest growth rate, the foreign transfers seem to be the more suitable and feasible financing mechanism for MDG achievement in Senegal as it produces more benefits compared to the other financing channels.

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[4] Note that costs in Appendix C are cumulated over the 2005-2015 period. They thus need to be divided by 11 years to translate into annual efforts.
[5] Unfortunately, the details of cost calculation are not presented in the main MDG report and sectoral studies were not available for consultation.
[6] Due to the small size of domestic borrowing which is close to 3% of the GDP in 2005, meaning that the domestic bond market is underdeveloped in Senegal, the pursuit of MDGs strategies through that financing mechanism was considered unrealistic and this is the reason why it was not simulated as permitted by the MAMS framework.

Poverty impact of MDGs strategies

Elasticity of poverty to growth has been computed from the last Senegalese household survey and, since growth is endogenous, it is used to compute poverty effects for each scenario[7]. Poverty headcount numbers are provided at the bottom of Table 11. Under BAU, poverty incidence falls from 50.8 in 2005 to 48.8 in 2015. Since no distribution effects are modeled in the current version of MAMS-SEN, this very modest decrease is attributable only to the low level of GDP growth per capita. Under MDG achieving scenarios, poverty reduction by 2015 is higher than in the BAU scenario, and poverty incidence reaches 41.3 in both foreign transfers and foreign borrowing scenarios by 2015. Not surprisingly, the result in terms of poverty reduction is less favorable when MDG achievement is financed in part through direct taxes. In any case, poverty reduction falls short of the 2015 target of 34%.

Document of economic and social policy growth path

Different results can be expected using a different projected growth path for the years 2010 to 2015 when one generates the baseline scenario, which, as said, takes the form of the benchmark for the MDG-achieving scenarios. Here we choose to simulate an accelerated scenario using estimates from the the Document of economic and social policy elaborated by UCSPE (Unité de Coordination et de Suivi de la Politique Economique). The UCSPE estimates that annual growth rate could reach 6% by 2015, supposed to be the final period in which provided energy constraints are lifted. In order to assess whether this more favorable growth path is likely to enhance the achievement of MDGs, the four scenarios (BAU and MDG achievements) are simulated under this accelerated growth path. Results in terms of MDG spending are presented in Table 13.

Table 13: Senegal: Average annual additional public spending on MDG-related services with respect to baseline, under an alternative growth scenario, 2005-2015 (% of GDP)

	2005	Baseline	MDG achievement		
			foreign transfer financing	foreign borrowing	foreign transfer + direct taxes
Primary education	2.82	0.00	4.39	4.39	4.86
Health Services	1.72	0.00	1.31	1.31	1.54
Water & Sanitation	2.12	0.00	2.14	2.14	2.25
Total	6.66	0.00	7.84	7.84	8.65

Source: MAMS-SEN simulations.

Results show that the accelerated growth scenario will not be sufficient to cut costs significantly. This is probably related to the fact that the projected growth path is not very ambitious given the energy problems that Senegal has to confront. And, it may also be due to little effectiveness of spending in speeding up MDG progress.

VIII. Conclusions and policy lessons

Like the bulk of less developing countries, Senegal has subscribed to MDSG goals. Within the framework of MAMS which is the first framework that explicitly takes into account the general equilibrium

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[7] The estimated value of this elasticity is -1.

consequences of pursuing the MDGs, simulations were performed and their results analyzed in the present study.

Achieving the MDGs is subject to various determinants; the most important of which have already been identified for various countries. They are related to service delivery, public expenditure, children's health and access to water and sanitation. It is then clear that achieving some MDGs will depend to the status of others. For instance, under-five mortality will determine primary completion rate while targets in terms of child and maternal mortally will be influenced by access to water and sanitation. Due to data limitations, though, identification of other determinants which are the very micro and sectoral level could not be determined.

Except for water, the target of which could be reached before 2015, and perhaps under-five mortality towards the end of the period, it appears that the MDGs would not be achieved by 2015 in Senegal based on a simulated baseline that maintains policy with no major changes in a business-as–usual setting. Hence, as social sectors have suffered a lot from the previous structural adjustment programs, fiscal efforts have then to be devoted to them. MDG services have to be extended to parts of the population that have not yet previously been covered by sectoral services while this population is growing. Consequently, to reach its MDGs targets in 2015, the overall additional cost of achieving all the non–poverty MDGs will be equal to 8.04% for Senegal under the actual and forecasted growth trend of 7.14% under the Document of economic and social policy growth scenario if the financing mechanism, which is considered to be foreign transfers, is chosen by policymakers with the support of its partners. One might care about the trade-off related with the choice of alternative financing channels as it appears that combining taxes and foreign transfers will lead to adverse effects on the competitiveness of Senegalese economy while external borrowing would lead to a high debt burden. The GDP impact is positive though not so large for the aid and foreign borrowing scenarios and positive but even more modest for the scenario combining foreign transfer and direct tax. Poverty incidence is also lowest in both foreign transfers and foreign borrowing scenarios than in the one where MDG achievement is financed in part through direct taxes. Hence, one of the best and more feasible options seems to be financing MDG achievement through foreign transfers as foreign borrowing would take the country to witness a significant increase of its debt burden. But one has to bear in mind that mobilizing such transfers from about is not entirely in the hands of the government.

MDGs achievement analyses in the case of Senegalese show that, even if it takes time, increasing social services like education and health, promotes not only MDG objectives but also growth in Senegal. It is obvious that success in increasing the number and proportion of people with primary education does not guarantee its quality. Therefore quality of education is clearly in need of improvement. Spending on infrastructure has also direct positive effects on MDGs objective as it facilitates the delivery of these services. Another venue for rapid progress toward the MDG targets in 2015 is improving the efficiency of service delivery. Education is a sector where policies for a better effectiveness of spending can produce positive and important changes. Increasing growth would ease the financing of the costs of MDGs. Public expenditures in areas other than those of MDGs must be oriented toward productive sectors with greater growth potential. Agriculture is one of such key sectors in the Senegalese context, particularly cereals and vegetables, for its strong links with other sectors and the positive impact on the trade balance of an increase of agricultural GDP. The negative impact on growth of rising taxes should be mitigated by selecting the least regressive taxes in Senegalese institutional context. At the same time, fiscal regimes that encourage new domestic investments must be promoted and the conditions under which they will occur must be identified.

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