Realizing the Millennium Development Goals through socially inclusive macroeconomic policies

Country Study

Assessing Development Strategies to Achieve the MDGs in

The Republic of Senegal

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The overall objective of the project was to strengthen the capacity of policymakers to formulate and evaluate socially-inclusive macroeconomic policies aimed at facilitating the achievement of the MDGs through the adaptation of an integrated modelling framework to country-specific conditions. The methodological framework is based on the adaptation of the economy-wide model system, known as ***Ma****quette* for **M**DGs **S**imulation (MAMS) – a dynamic computable general equilibrium (CGE) model that includes a special module for the "production" of services associated with the Millennium Development Goals (MDGs). It also compromises methodologies at the micro level to identify determinants of MDG achievement, on the one hand, and to quantify effects on poverty and inequality, on the other.

The views and opinions expressed herein are those of the authors and do not necessarily reflect those of the United Nations or its member states.

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1. 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.

Senegalese economy like the one of the others economies in the region 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 labour 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.

2. Mains reforms, macroeconomic policy, economic performance and vulnerabilities

Economic reforms and policies

Reforms and economic policies implemented during the 1990-2008 period are an extension of a package of reforms initiated since 1985, which launched a process of real adjustment of the economy supplemented by a monetary adjustment in 1994. They also reflect the policy concerns related to economic growth and poverty reduction as targeted under the Millennium Development Goals.

If the stabilization program in the short term (1979-80) was implemented to cope with the deteriorating macro-economic aggregates, the aim of the economic and financial recovery Plan (1980-1984) was a

balanced public budget, foreign trade and labour markets and low inflation under control of aggregate demand. As to the adjustment program in the medium and long term (1985-91), it had to maintain the gains made in reduced demand. It was oriented towards export promotion and implementation of sectoral policies.

However, despite the adjustment program in the medium and long term (PAMLT), Senegal continued to face structural problems, due to the precarious public finances and the rigidity of imports and exports which characterizes the country's trade balance. Faced with macroeconomic imbalances in the year 1992, which were exacerbated in 1993, a series of internal measures to reduce public expenditure and improve revenue have been adopted by the government under the Emergency Plan (reduction of salaries in the public service, higher import tariffs and prices of petroleum products). Overall, it has not restored the financial capacity of the state. Moreover, the real exchange rate has appreciated substantially, seriously hampering the competitiveness of the economy. All these factors which characterized the situation in most countries of the WAEMU have contributed to the devaluation of the CFA franc by 50% in 1994.

With the devaluation of the CFA franc in 1994, the Government of Senegal embarked on the path of overall fit with the main objective of improving the competitiveness of the economy through economic growth. The new strategy was based on the implementation of a series of adjustment programs and economic reforms designed to restore the conditions for sustainable growth and ensure sustainable external and internal balance through the liberalization of the economy, a reduced size of the public sector, private sector development and inflation control. It was striving to preserve the immediate gains in competitiveness due to devaluation but also reduce its negative social effects. The Government has implemented since 1994 a program of macroeconomic adjustment and structural reforms, supported by the International Monetary Fund (IMF). Poverty Reduction Strategy Program (PRSP) adopted in December 2001 by the Government, has underpinned the economic policies of the five years that followed.

The implementation of the Accelerated Growth Strategy (AGS) that aims to make Senegal an emerging country by 2015 will enable Senegal to better capitalize on growth opportunities related to the growth of international trade.

The AGS incorporates the framework of the PRSP which is the result of a participatory approach in the design and implementation of economic policies that emphasize competitiveness. In its second phase, the PRSP is based on four strategic pillars: (i) wealth creation, (ii) promoting access to basic social needs, (iii) social protection, prevention and risk management and disasters, and (iv) governance and participatory development.

As for the Millennium Challenge Account (MCA), it is in line with policy objectives broken down by policy makers in the AGS and the PRSP. It relies on two main strategies: creating a favourable business environment and implementing infrastructures that would promote private investment. The main objective of this program is to set condition under which trade can be a key factor of growth, in line with the PRSP. The surge in prices on the world grain market in 2008 has served as a pretext to launch in 2008 of the Great Agricultural Offensive for Food and Abundance (GOANA). The latter is conceived as a strategy of agricultural intensification, but also to ensure coherence of policy options and programs set for the agricultural sector in recent years. The GOANA and the national program of food security (PNASA) which aim is to eradicate food poverty are programs that realize a close synthesis between the PRSP and the AGS.

Economic performance

Economic growth

Between 1985 and 1991, despite the adjustment program in the medium and long term (PAMLT), economic activity in real terms grew by 2.9% annually. This rate of growth is only slightly above the population growth (2.4%). The decline in grain production and the one of industry hardly hit by the dismantling of tariffs, the absence of a recovery in exports have exacerbated the budget deficit and current account imbalances.

With the currency adjustment that occurred in 1994, the situation has changed significantly and the domestic economic activity recorded a favourable trend in subsequent years. GDP growth is estimated at 2.9% in 1994, 4.8% in 1995 and stands at 5.5% in 2000.

In the period after 2000, the growth rate still recorded significant levels but remained relatively instable. While 2003 was marked by strong GDP growth, it is otherwise in the years 2002, 2006 and 2008 where it has been marked by contraction in activity under the influence of climate and energy shocks. Consequently, the growth rate of GDP has fallen during these periods below that of the population, making more difficult the efforts against poverty.

Table 1. Trend of some macroeconomic indicators, 2001-2008

	2001	2002	2003	2004	2005	2006	2007	2008
Constant GDP growth (%)	4.6	0.7	6.7	5.8	5.3	2.3	4.7	2.5
GDP Share (%)								
Primary sector	16.3	13.6	15.1	13.7	14.6	13.0	11.8	13.0
Agriculture	9.3	6.8	8.3	7.2	8.1	6.6	5.2	6.7
Secondary sector	21.7	22.3	21.4	21.7	20.5	20.1	20.3	21.1
Tertiary sector	43.8	44.9	44.7	45.8	45.4	46.6	47.4	46.3
Public administration	18.2	19.1	18.8	18.8	19.4	20.4	20.6	19.6
Investment, savings and consumption (% of GDP)								
Investment rate	18.4	17.2	22.3	21.6	24.5	24.8	26.4	27.6
Domestic saving rate	9.4	6.8	10.2	9.0	9.1	7.4	6.4	7.4
Public	3.1	6.0	5.8	6.4	6.4	3.7	4.9	4.0
Private	6.3	0.8	4.4	2.6	2.7	3.7	1.5	3.4
Gross national saving rate	13.4	11.2	15.9	15.2	16.7	15.6	17.2	17.6
Final consumption	90.6	93.2	89.8	91.0	90.9	92.6	93.6	92.6
Public finances								
Rate of fiscal pressure	16.1	16.9	17.1	17.4	18.5	18.8	19.3	18.3
External exchanges (% of GDP)								
Exports	28.7	28.5	26.6	27.1	27.0	25.6	23.2	28.4
Imports	37.8	39.0	38.7	39.8	42.4	43.1	43.2	48.5
Current Balance	-5.04	-6.03	-6.40	-6.39	-7.78	-9.21	-11.63	-14.18

Sources: République du Sénégal, 2010a.

The trend of domestic saving is in contrast with the one of investment. Domestic saving rate has diminished shifting from 9.4% to 7.4. Consequently, investment has mainly been financed by an increasing recourse to external savings.

Analysis of the sectoral composition of GDP shows that the tertiary sector has consistently provided nearly than half of GDP (50.79% during the period 1994-2000, against 63% in 1960-1979). The contribution of secondary sector, which was estimated at 12.5% between 1960 and 1979, reached 20.4% during the period 1994-2000. By contrast, the primary sector share declines from 23.3% to 19.3% during the same periods.

Driving factors of growth

From a sectoral supply side, the locomotives of growth are mainly secondary and tertiary sectors as highlighted by the growth rate of GDP (Table 2).

In terms of demand, final consumption is estimated at about 9/10ths of GDP in 2008, maintaining the gross domestic savings rate at a low level. Hence, consumption has contributed to drive growth. In the period 1990-2008, the rate of growth of gross fixed capital formation is much stronger with a growth rate of 4.9% and 6.8% respectively over the sub-periods 1990 - 2000 and 2001-2008. Therefore, one can notice the increasing role played by investment with regard to the growth pattern. This is mainly due to the fiscal effort devoted to public investment. The structure of the demand has been modified with the investment rate shifting from 18.4% en 2001 to 27.6% in 2008. So growth is more and more driven by investment. If foreign demand is growing faster than consumption during the final sub-period 1990-2000, it is otherwise in the years 2001-2008. During this period, net exports have contributed less to drive the economic growth.

Table 2. Trend of the GDP by major categories and affectation, 1990-2008

Sectoral GDP growth	1990-2000	2001-2008
Primary	1.8%	1.1%
Secondary	3.7%	4.7%
Tertiary	3.1%	5.7%
GDP growth (demand side)		
Intermediate consumption	3.2%	4.6%
Final consumption	2.3%	4.7%
Public	1.0%	4.3%
Private	2.5%	4.8%
Gross Fixed Capital Formation	4.9%	6.8%
Public	5.3%	9.8%
Private	5.5%	6.0%
Exports of goods and services	3.1%	2.7%

Source: Notes d'analyse des comptes nationaux du Sénégal, 1990-2008

Has growth been pro-poor?

The decomposition of poverty variation indicates that under sustained past trend, growth is the main cause of the decline in the incidence of poverty. Decomposition of the later, according to the Shapley approach, shows that for a decline in poverty incidence of about 32.22% in a mean period of twenty years, growth contributes to a reduction of nearly 34.95 points to poverty, while the redistribution component contrarily increases poverty by 3.25 points. Hence, poverty reduction is mainly due to growth than reduced inequality. However, in spite of the reduction of poverty being clearly noted, Senegal's growth profile cannot be tagged as fully pro-poor. Indeed, while growth reduces poverty, inequality it generates contributes to increasing

poverty. Hence, the review of the growth incidence curve (CIC) shows that the growth path obtained under a business as usual path (BAU) is not pro-poor in Senegal. So even if poverty is reduced, such reduction does not seem to benefit the poorest percentiles of the population (Cabral, 2010).

Vulnerabilities and economic constraints

Trends of the government budget and the current account of the BP

In the sub-period 1985-1991, public finances have significantly rebounded with a budget balance that shifts from of -5.7% in 1985/1986 to -1.1% in 1990/1991 but the salaries of the civil servants has continued to absorb a very high proportion of current receipts (41%). Another sign of improved fiscal management is a substantial reduction of internal payments arrears that has been divided by four shifting from 2% of GDP in 1985/1986 to 0.5% in 1991. The deficit was reduced to 3.6% of the GDP in 1991, which resulted in a net improvement in foreign assets between December 1985 and December 1991, equivalent to 2% of GDP. Government's net position has also improved (1% of GDP) limiting crowding effects of massive public borrowing from the banking system. If macroeconomic balances are almost restored in the early 1990s, these performances were obtained at the cost of a strong deflation in the economy and the competitiveness of the economy has not been restored, the real exchange rate having hence appreciated considerably. From 2000 to 2010, the budget balance behaved quite well. During this period, the ratio between the budget balance and the GDP went only two times beyond 3%. The main reason of the fiscal balance deficits observed during years 2006 and 2009 is the important level of public investment implemented to deliver more infrastructures. The external current account has relatively deteriorated during the 2005-2008 where the policymakers made the choice to implement large-scale public projects (airport, highway, etc.). Those public investments are mainly financed through public bonds on issued in the West African economic and monetary union (WAEMU) stock market exchange and multilateral and bilateral loans. However from 2008 to 2010, it has been enhanced.

Table 3. Ratio of budget deficit and current account balance with respect to the GDP, 2000-2010 (percent)

	Budget balance / GDP	Current account balance/ GDP
2000	1.1	-7.6
2001	-1.2	-5.0
2002	1.8	-6.0
2003	0.5	-6.4
2004	-0.2	-6.4
2005	-0.3	-7.8
2006	-4.4	-9.2
2007	-2.3	-11.6
2008	-2.2	-14.2
2009	-4.0	-7.6
2010	-2.6	-7.7

Source: DPEE

Financing government budget and the current account of BP constraints

Since 1992, serious slippage in fiscal policy has increased the budget deficit to 3% of GDP, which was funded by accumulated internal payment arrears that have reached more than 4% of GDP.

The parity change that occurred in January 1994 amends the extent of macroeconomic imbalances which the Government had to face. The external current account deficit remained high over 8% of GDP.

The highest performance was achieved in the management of the budget as the deficit on commitment basis (excluding grants) shifted from 15.2% of GDP in 1994 to 2.9% in 2000. This performance was maintained during the period 2001-2005 where it was even recorded a surplus of about 1.4% of GDP in 2005. After a downturn that occurred in 2006 and pushed the deficit to 3.7% of GDP, an adjustment effort has reduced it to 1.1% of GDP in 2008.

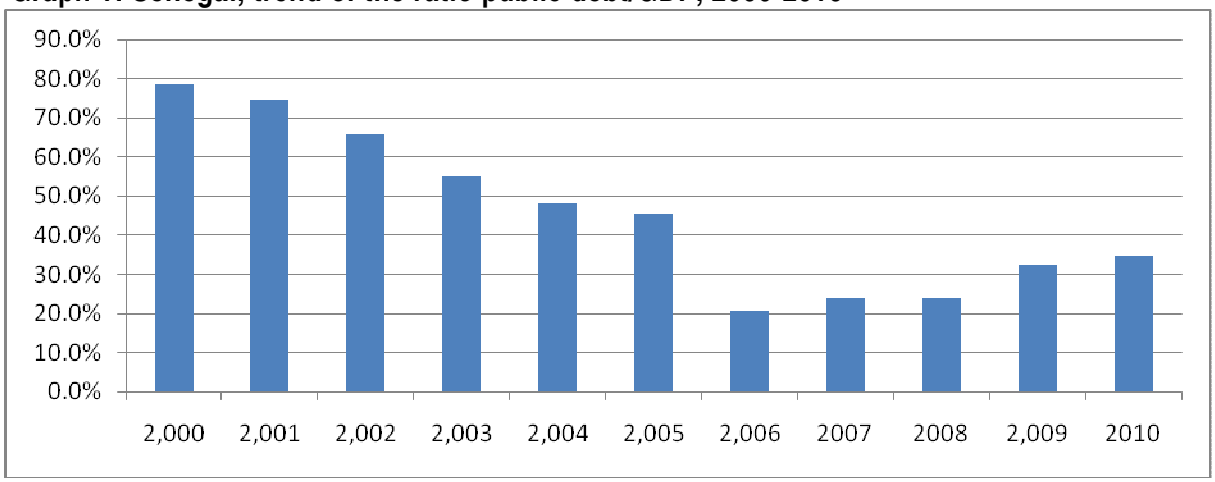
If the Government has undoubtedly accumulated extensive experience in managing his public finances enabling it to maintain the fiscal deficit to sustainable levels, it seems to have more difficulty in reducing the imbalances in the current account to acceptable levels.

Policies to be preferred by the Government are undoubtedly those that focus on boosting the supply side, especially in agriculture, both to face the external constraint and reduce poverty significantly. An agricultural growth of 6% over 15 years and the rest of the economy by 5% would lower the incidence of national poverty by 17% in 2020. Fiscal and current account balances would be reduced to levels that ensure macroeconomic balance (Diagne, Cabral, Cissé 2009).

GDP ratios for domestic, foreign, and total debts

Over the period 2000-2010, Senegal's public debt has varied from 78.6% in 2000 to 34.8% in 2010. Since 2005, funding through foreign loans and grants has diminished its relative importance vis-à-vis domestic sources. During this period, the Government has implemented large-scale public projects that have not previously received an agreement from donors. Hence, it has been funded by domestic savings and this has increased public debt that has been mainly financed through an accumulation of payments arrears.

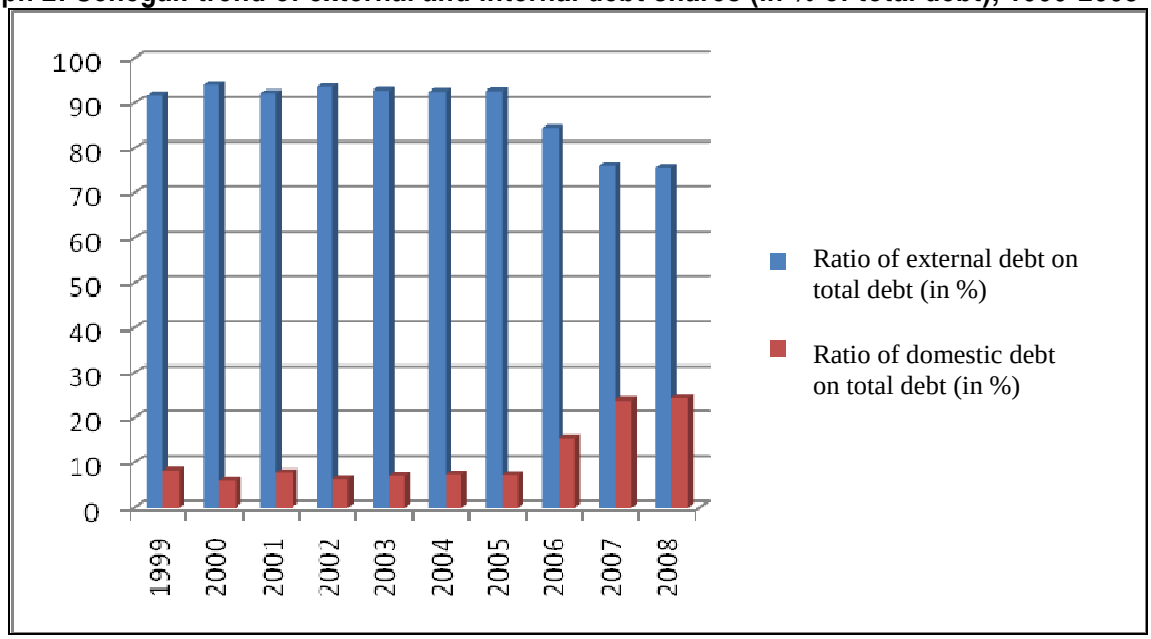
Graph 1: Senegal, trend of the ratio public debt/GDP, 2000-2010



Source: DPEE

The stock of domestic public debt as a percentage of GDP increase from year to year, reflecting the option of the Government to move towards the sub-regional financial market due to the increasing difficulties it faces in mobilizing external assistance .

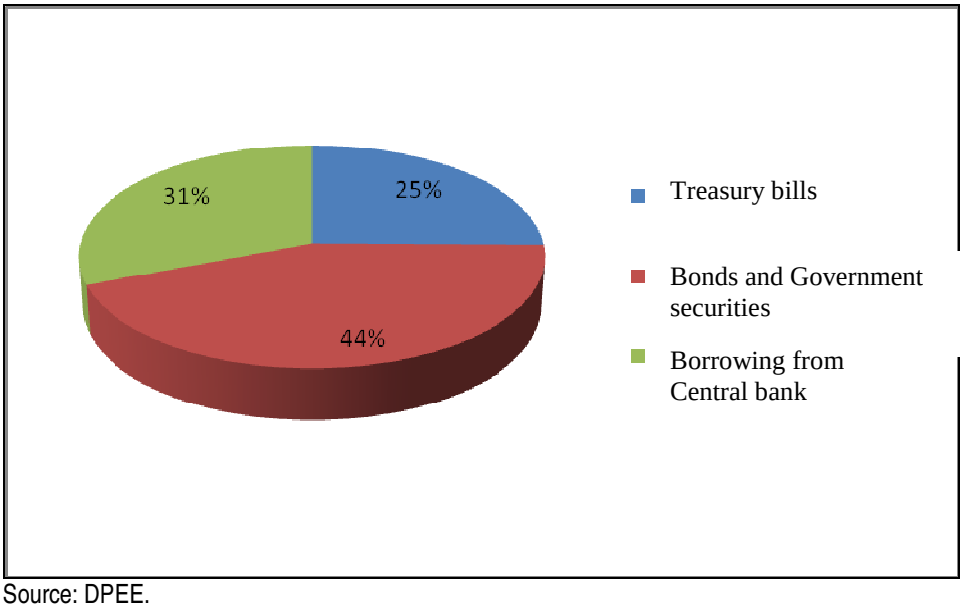
Graph 2: Senegal: trend of external and internal debt shares (in % of total debt), 1999-2008



Source : DPEE /MEF

An important trend that occurred during the years 2000s is phasing out use of direct advances from the Central Bank of Etas of West Africa (BCEAO). These have been replaced by the use of sub-regional financial market, as emissions of treasury bills and bonds (Graph 3). Those securities are issued in the West African economic and monetary union (WAEMU) stock market exchange.

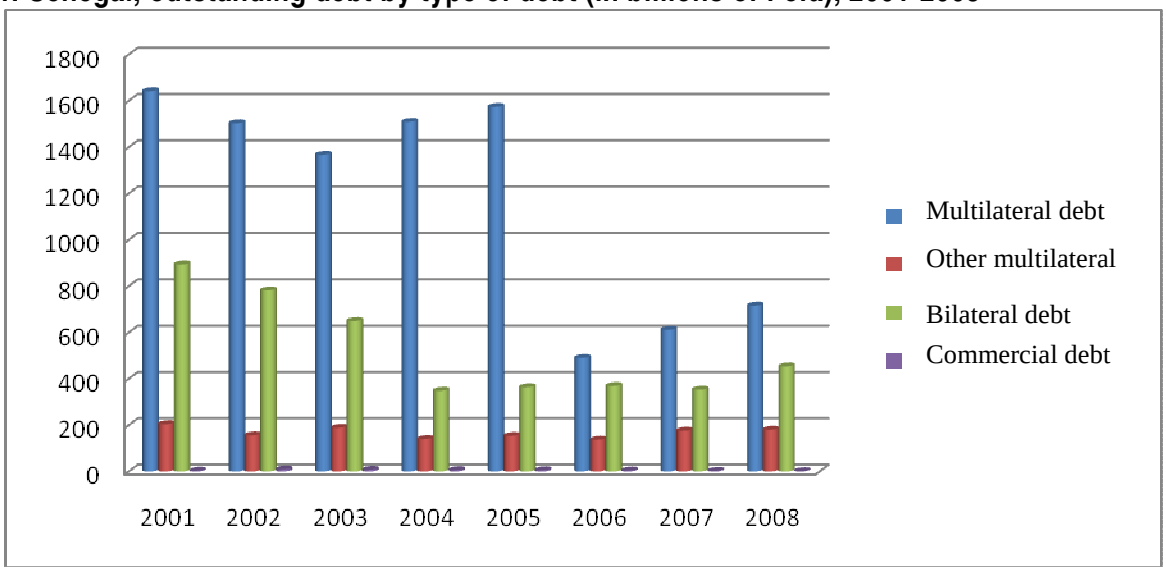
Graph 3: Public debt instruments and their utilization



Source: DPEE.

The external borrowing is the main source of state funding during the period 2001-2008. Commercial debt, composed of export credits, is very low with an average 0.3% of external debt (Graph 4).

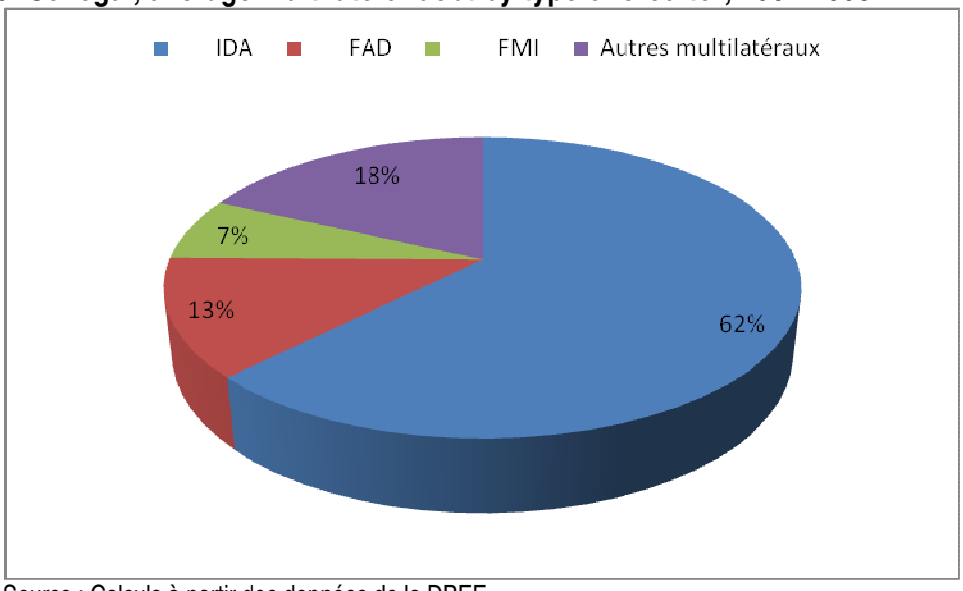
Graph 4: Senegal, outstanding debt by type of debt (in billions of f cfa), 2001-2008



Source : DPEE.

Multilateral debt has averaged a 1 176.9 billion of FCFAover the period 2001-2008, or 68.9% of external public debt. The share of debt owed to the World Bank (IDA) represents 64.6% of external debt or $ 757.9 billion on average over the same period (Graph 5).

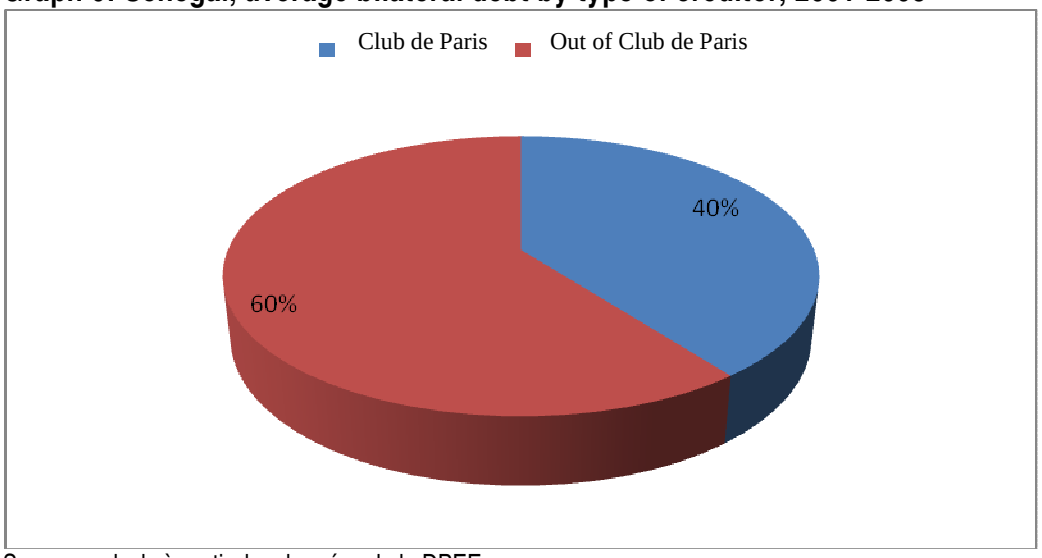
Graph 5: Senegal, average multilateral debt by type of creditor, 2001-2008



Source : Calculs à partir des données de la DPEE.

Bilateral debt amounted to 526.96 billion of fcfa on average between 2001 and 2008 or 30.8% of external debt. It is financed mainly by non-Paris Club group, in particular, Arab donors who hold 54.7% of total bilateral debt (Graph 6).

Graph 6: Senegal, average bilateral debt by type of creditor, 2001-2008



Source : calculs à partir des données de la DPEE.

The West African economic and monetary union (WAEMU) convergence criteria for which Senegal has subscribe set that the public debt ratio to GDP cannot exceed 70%. As this ratio is equal to 34.8% in 2010 in Senegal, the country can then raise external funds to finance his MDGs targets.

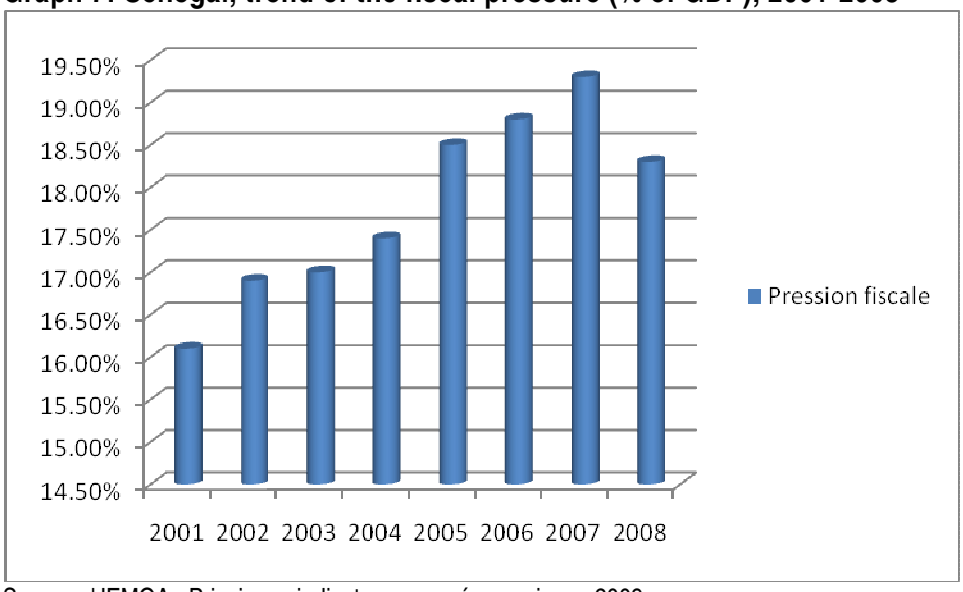
Tax structure and scope for raising taxes

In the absence of monetary policy, fiscal space is reduced to the Senegalese taxes and borrowing. But since loans are deferred tax, taxes emerge as the main element of economic policy.

The tax burden has risen sharply since 2005, not because of higher tax rates, but rather that of the tax base and modernizing of tax services (Graph 7).

The level of fiscal pressure has never reached 20% of GDP and remains low, as shown in the Graph 7. Achieving a target of 25% would allow more adequate funding of current expenditures as well as capital and accelerating progress towards the MDG targets. In order to get there, Government will likely focus on broadening the tax base, including that of indirect tax by playing a greater role for property taxes, further adapt to socio economic taxpayers and improve transparency in order to deter fraud and abuse risks in the exemptions.

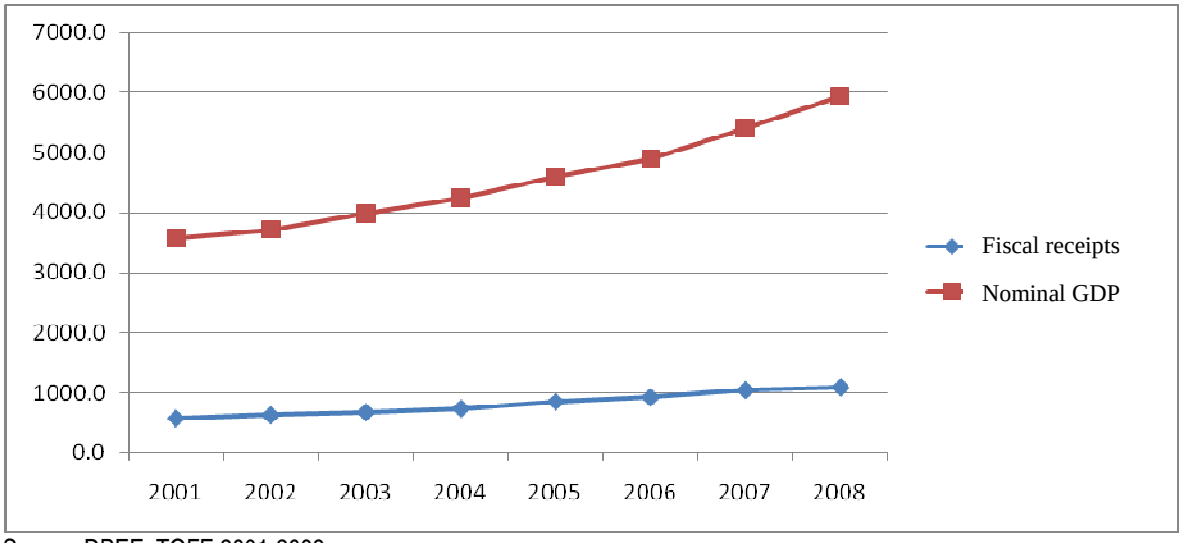
Graph 7: Senegal, trend of the fiscal pressure (% of GDP), 2001-2008



Source : UEMOA, Principaux indicateur macroéconomiques 2009

Nominal GDP has almost doubled, resulting in higher tax revenue (Graph 8). However, from 2006, taxes rate of growth was significantly slower than their base. The increase in tax revenue is affected differently by that of value-added industries. The primary sector is almost excluded from the tax, as its contribution is small, while the secondary sector acts as the main contributor, with an elasticity of 3.0 followed by the tertiary sector. Over the period 2001-2006, the elasticity of total tax revenue to GDP ratio is 1.5, indicating rather a relatively strong relationship between economic growth and increasing public resources.

Graph 8: Senegal, trend of fiscal receipts compared to nominal GDP (in billions of CFA francs), 2001-2008



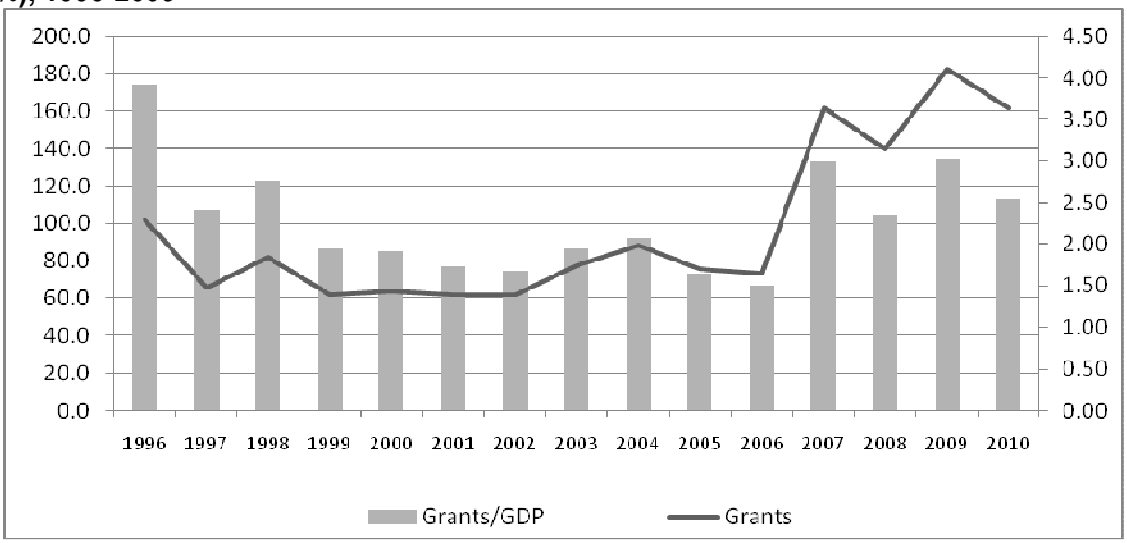
Source: DPEE, TOFE 2001-2009,

Foreign aid

Development assistance enjoyed by the Government comes in the form of budget support and project financing and development programs.

Budget support receipts are essentially gifts. As shown in Graph 9, this type of aid has increased sharply between 2006 and 2008. In relative terms, it represents a little over 10% of tax revenue from 2002. Another trend that emerges from its evolution is its high volatility. If it has stagnated between 1999 and 2001, it strongly fluctuated around an upward trend in subsequent years.

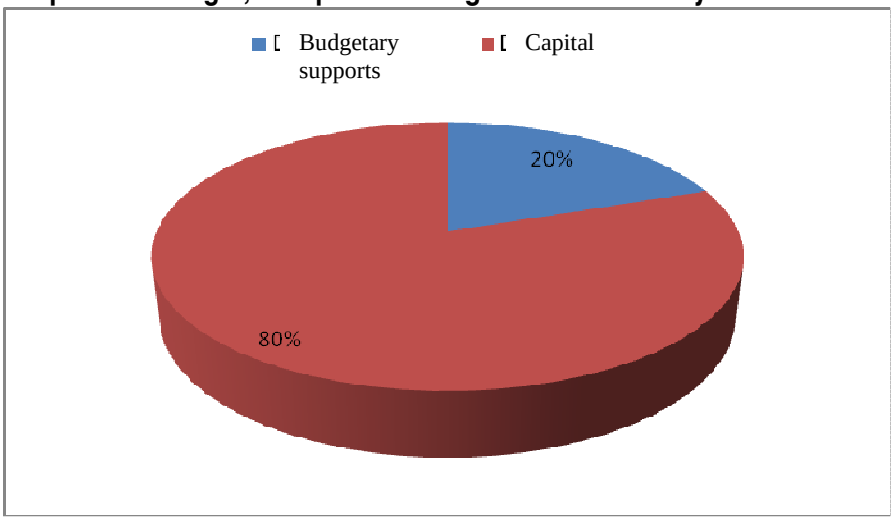
Graph 9: Senegal, trend of grants[1] (in billions of FCA francs) and share of grants to GDP[2] (in %), 1996-2008



Source: DPEE/ TOFE 2001-2009.

Besides budgetary support, the Government receives capital grants. The relative importance of it and its sources can be analyzed using the programs and projects identified in the Triennial Public Investment Program (Graph 10). During the sub-period 1996-2008, capital represents 80% of aids received by Senegal and budgetary supports, 20%.

Graph 10: Senegal, composition of grants received by the Government, 1996-2008



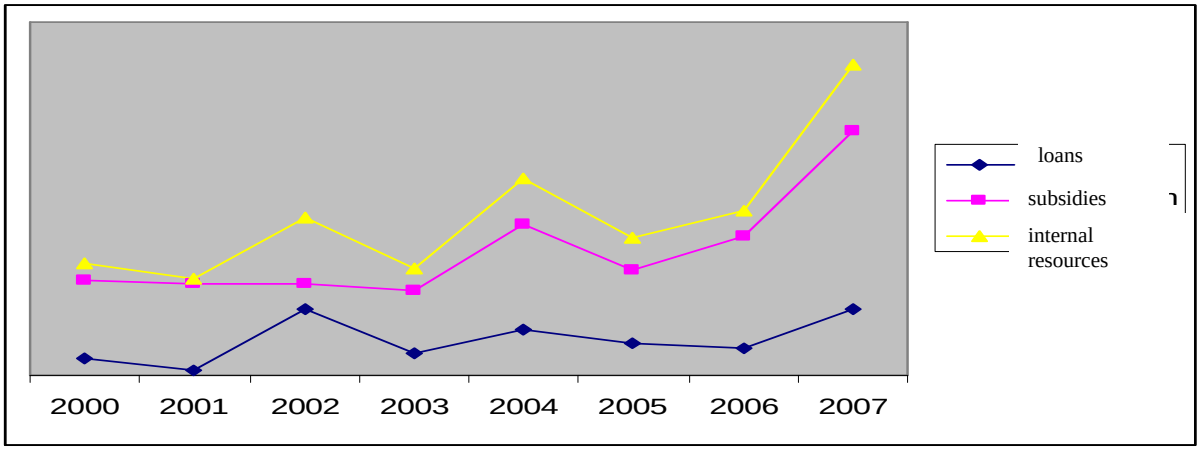
Source: DPEE.

[1] ordinate on the left
[2] ordinate on the right

The European Development Fund (EDF) with 2.57% of total funding comes after USAID (3.82%), the African Development Fund (3.32%) and the French Development Fund (2.18 %). If we aggregate the EDF contribution with that of European countries, the European participation in the sample reaches only 9.24% of total resources. However it is mostly grants for nearly 78.1% over the period.

European Union is not an exception to the rule. His contribution is highly fluctuating throughout the period, although the trend is slightly increasing. Before 2004, loans dominated the European funding. Then they have receded in favour of subsidies that remain as fluctuating. Since 2005, EU funding is on a growing trend.

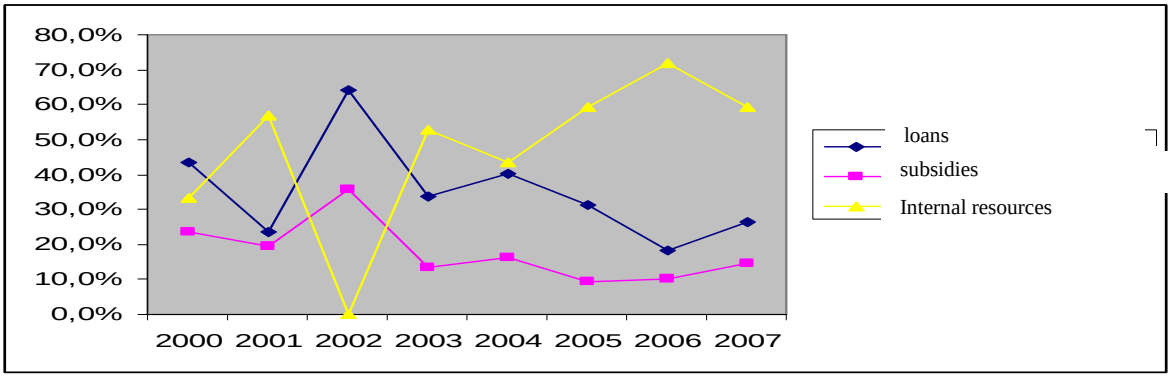
Graph 12: Senegal, trend of European funding by nature, 2000-2007



Source: Diagne, 2007.

In total, the Government is heavily dependent on foreign aid to finance its expenditures in both current and capital sides. Implementation of its programs and investment projects is severely hampered by the volatility of their funding.

Graph 11: Senegal, public resources by nature, 2000-2007



Source: A. Diagne, 2007

Terms of trade shocks

Internal shocks, as well as external shocks, strongly affect the terms of trade of Senegal. Internally, shocks on agricultural production are more severe and more frequent. But due to the low weight of agriculture on the GDP, these shocks tend to have a low fiscal effect. Furthermore, an important part of the GDP comes

from the informal sector which also has a weak contribution to fiscal revenues. Hence, even if the economy has experimented those shocks, fiscal revenue has increased (Graph 8). External shocks come from various sides. Senegal is importing 2/3 of his rice consumption whereas the whole consumption of wheat comes from abroad. Hence, the sharp increase that occurred for international prices in 2008 has affected Senegalese consumers hardly. The Government has tried to restraint its adverse affects by cutting foreign duties and by increasing subsidies toward the rural producers. Seeds and fertilities have been subsidized. The producer price has also been subsidized.

Table in appendix A summarizes the various shocks and their impact on the Senegalese economy. It shows that the most important shocks in the supply side are poor rainfall. In the demand side, the most important ones are declining world prices of certain export products (phosphate, peanut oil), a contraction on global demand and a depreciating U.S. dollar against the Euro which lead again to real exchange appreciation.

How has the world economic crisis affected the economy?
Several channels have helped to facilitate the transmission of shock to the Senegalese economy. However, the major channels through which the financial crisis has affected Senegalese economy are export demand and migrant remittances. Through those two channels, it has leaded to a contraction of the economic activity. It has induced a reduction in the household income and hence consumption. It has conducted to more tied budget and the need for budget adjustment and trade-off between public expenditures on capital and consumption (Cabral, 2010).

3. Social policy, inequality, poverty and MGD achievement (1990-2009)

Social policy during the period 1990-2009

Social policy in Senegal can be classified into two components:

- fight against vulnerability and the national strategy for social protection that takes into account social security, equity and gender equality, development of a social security system including support for vulnerable social groups (pensioners, disabled, etc.);
- support to the private sector including the creation of health insurance services.
- The following discussion outlines the objectives and main lines of this policy and the situation in the social sector.

Fight against vulnerability
Social protection and risk management are key instruments for accelerating growth and an effective fight against poverty. Senegal has developed a national strategy for social protection (NSSP), whose objective is to increase from 20% to 50% the rate of the population benefiting from this strategy.
More specifically, it aims at:

- ensuring access to basic social services for vulnerable groups;
- increasing access to the tools of hazard management and social protection systems, including health insurance schemes;
- improving the targeting, monitoring and evaluation of actions directed toward vulnerable groups;
- - achieving insurance systems for agricultural risks;

- providing income for people in need and vulnerable groups, while enabling them to join the formal systems of social protection;
- strengthening the mechanisms of direct transfer of resources for vulnerable groups;
- - improving the responsiveness to shocks and risks to vulnerable groups.

Description, coverage and method of financing social security schemes
Only 11.4% of the population benefited from the social policy in Senegal in 2007. It is for this reason that the NSSP has set as target a coverage rate of health insurance of 28% by 2010 and 50% by 2015.

Coverage and the financing of social security schemes are based on Convention No. 102 (1952) of the International labor organization (ILO). There are nine categories of social security benefits:

- Medical care for curative and preventive needs;
- Sickness, in case of a break in work resulting from an illness;
- Unemployment benefits;
- Old-age benefits;
- Benefits for accidents at work and occupational diseases;
- Family benefits;
- Maternity benefits;
- Disability benefits;
- Survivor benefits.

Insurance schemes differ whether people are in the private or public sector. In the private sector, the formal and compulsory system consists of a set of structures: the social security Fund (CSS), the insurance Institute pension Senegal (IPRES), institutions of sickness insurance (IPM) and the employers. In the public sector, there are two social insurance schemes: the National Pension Fund (FNR) and a component of the state budget through the Ministry of Finance.

The welfare policies are grouped into five categories:

- sesame map;
- free deliveries and caesarean sections;
- free treatment of certain serious diseases;
- grant to costly diseases care;
- support for indigent.

The Sesame plan
Sesame plan was introduced by the President of the Republic in April 2006 to "grant the free medication to seniors." This act "reflects the ideal of solidarity between generations" according to its designer. The elderly account for 7% of the population of Senegal which means 750 000 individuals. The number of older people supported by IPRES and FNR is approximately 30% of the workforce of 750,000 people while the remaining 70% do not receive any coverage.
A grant of 700 million CFA francs was raised from the internal public resources to fund this system of solidarity called "Sesame". As for IPRES, it allocates a budget of 300 million francs CFA to pre-hospitalization of its retirees through an agreement with hospitals.
Free deliveries and caesarean
Free childbirth is a social policy that occupies a significant place in the list of social benefits granted to the most vulnerable population. It is justified by the high rate of maternal and neonatal mortality which is about

401 deaths per 100 000 live births. This has led policy makers to formulate policies to reduce this mortality, according to Senegal's commitments under the Millennium Development Goals (MDGs).

Free treatment of AIDS
Senegal is one of Africa's countries where the AIDS prevalence rate is lowest. This rate is 0.7% nationwide, but 1.3% among pregnant women and finally 19.8% among sex workers. Achieving the MDGs, particularly that of the health target is to reduce the spread of AIDS and to reverse the trend by 2015. Specifically it is:
• to maintain HIV prevalence below 3%;
• ensure for 712 720 voluntary counseling and testing (VCT) and prevention of mother-child transmission (PMTCT) among 523 000 pregnant women;
• ensure access to Anti Retro Viral (ARVs) to 11,000 persons living with HIV (HIV-Pv) AIDS

Free treatment of Tuberculosis
Still in the pursuit of the health target, an initiative called "Stop Tuberculosis " was launched. Its objectives are:
• to track every year at least 70% of cases of smear positive tuberculosis and cure 85% of them;
• reduce, by 2015, prevalence and mortality of tuberculosis by 50%;
• eliminate tuberculosis by 2050.
To ensure the achievement of these goals, policymakers have made free access to the treatment of this disease.

Grant to costly diseases care
Social policies are also extended to other serious diseases like cancer, kidney failure, diabetes, sickle cell anemia, heart disease, etc. The government of Senegal has put in place a policy of subsidies to facilitate access to treatment of these diseases that are very expensive for patients. In 2006, state support in terms of subsidy an amount of 310 million FCFA.

Care of indigent
The medical services of hospitals, health posts and centers are totally or partially involved in care benefit expenditures of this group of population.
The Direction of Social Welfare of the Ministry of Solidarity, the Social Security Administration and the IPRES also support financially sick people without access to treatment.

Trend and structure of public spending

Total expenditure and net lending rose from 497.9 billion FCFA in 1996 to 1,578.2 billion CFA francs in 2007 which corresponds to an average growth rate of 10.3%. This strong positive growth is due to increased capital expenditures that have registered an average increase of 13.8% between 1996 and 2008 shifting from 183 billion CFA francs in 1996 to 594.7 billion FCFA in 2008. However, the relative share of capital expenditure in the budget varies between one third and one quarter of the budget. In 2000-2004, it increased steadily from 31% to 43%. As for current expenses, they absorb an average of nearly 60% during the period 1996-2008. This is mainly due to wages. In contrast, the rate of increase was more restrained during the period 1996-2008. Current expenditures grew by 10.45% on annual average shifting from 312.6 billion CFA francs in 1996 to 978.7 billion FCFA in 2008. This sharp increase is largely due to subsidies channeled by the state toward energy sector and toward households to cope with rising prices of primary commodities

The share allocated to education spending in the budget varies between a minimum of 20% during the period 2000-2001 and a maximum of 29% in 2004. As for the budgetary effort devoted to the health sector, it hardly reaches the target of 10% of the budget set by the Government under the MDGs pursuit. Indeed, in the period 1996-2008, the relative importance of health in the budget rises to 9.7%.

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 MDGs during the period 1990-2009

Is the country on-track to achieve the MDGs under current policies and why?
Since the onset of the MDG agenda, a number of sectoral studies have been carried out to analyze the trends of MDGs in Senegal and the probability of achieving each of them by 2015. The reports have been brought together in 2007 (République du Sénégal, 2007) and again in 2010 (République du Sénégal, 2010b). In the 2007 report, achievement probabilities for each MDG are provided. More recently, this assessment was updated using MDG indicators from 2009 and 2010. These numbers and assessment are brought together in Table 4 and are used to indicate if the country would be “on track” or “off track” to achieve the MDGs. Unlike the modelling 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. For instance, the Senegalese office for rural electrification will cover 1233 schools (République du Sénégal, 2010b) and infrastructure of transport through new roads has also considerably reduced the time needed for pupils to reach their schools. As a result, the net completion rate has increased significantly. 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. Indeed, several programs have been implemented in the health sector. The share of age 0 to 11 month vaccinated has doubled between 2000 and 2008. From 40% in 2000, this ratio is estimated to 80%. 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 which has dropped from 131.4 in 1990 to 121.0 per 1,000 births in 2005 according the demographic and health survey (EDS-4) and progress has accelerated in the recent years since the under-five mortality rate was estimated at 85.0 per 1,000 births in 2009 (ENPS-2009). 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[3] in 1992 to 401 deaths per 1000 births[4] in 2005. However, despite some progress, MDG5 target for 2015 will not be met under business as usual.

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

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. Large disparities exist between areas, 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). With the implementation of a new range of sub-programs of PEPAM, one can also be confident that the target in term of access to water will be achieved also in rural areas. 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 reflects significant progress but will not be sufficient to achieve the 70% access to sanitation target by 2015 under business as usual. Only the reinforcement of the implementation of PEPAM and additional fundraising for this program could make possible a significant acceleration in the access to sanitation.

Connection between public policy and the MDGs

In addition to monitoring the MDGs, Senegal, like most of developing countries, has developed and implemented policy instruments and strategies to achieve the MDGs. The development of these strategies confirms the determination of these developing countries to achieve the MDGs and allows them to obtain funding from the North for the implementation of these strategies.

Senegal has fully integrated the MDGs into its national agenda which aims explicitly to reach a number of targets through medium term strategic plans related to:

- the strengthening of the implementation of the second generation PRSP (2006-2010),
- the redefinition of sectoral strategies,
- cost estimates for achieving the MDGs and
- the consolidation of the national statistical system for integrated monitoring of PRSP and MDG indicators.

The PRSP II and the AGS which are fully validated in 2006 are entirely built under the pursuit of the MDGs targets. Thus, with the support of the Millennium Project team, Senegal has developed sectoral investment program by 2015. Education, health, infrastructure, growth and development, water and sanitation sectors have been taken into account by the PRSP II.

Exploring some policies that should be put in place to achieve the MDGs

Through the various strategies it has developed, Senegal has expressed its will to achieve the MDGs by 2015. Three critical areas require a deep effort over the next years so that most of these objectives can be achieved: education, health and agriculture. This later sector has the greatest potential for poverty reduction. The backlog accumulated in these three areas requires a reallocation of public spending in their favour but specific policies should be developed to remove obstacles on the road to the MDGs. In particular, the achievement of MDGs is subject to: (i) risks related to exogenous shocks that may affect the macroeconomic objectives and the absorptive capacity of resources action plan, (ii) natural risks, such as drought, rainfall remains the primary factor in agricultural production, (iii) the risks of locust aggression is a major threat to the economy, (iv) risks related to international price volatility, including that of oil prices, (vi) political and institutional risks can directly hamper the execution of capital expenditure planned over the period of implementation of PRSP II 2006-2010.

4. Brief description of MAMS

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.

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 modelling 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 labour markets, this implies that overall labour 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 labour markets, unemployment is assumed (the unemployment rate is above its exogenous minimum), with the producers employing as

much labour as they desire at a reservation wage that is negatively related to the unemployment rate. For non-labour 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 modelled in MAMS framework (Logfren, 2010; Logfren and al., 2010) determines the values for the indicators related to the different MDGs and educational behaviour. 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 labour 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 behaviours:

- 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):

$$SHR^{edu}_{b,c,t} = ext^{edu}_{b,c} + \frac{\alpha^{edu}_{b,c}}{1 + EXP\left(\alpha^{edu}_{b,c} + \beta^{edu}_{b,c} * ZEDU_{b,c,t}\right)}$$

The only endogeneous variable in the logistic function ($ZEDU_{b,c,t}$) is defined in a constant elasticity formulation as a function of the quality of education ($[\![(EDUQUAL]\!]_{c,t}\right)^{\emptyset^{edu}_{b,c,edu-qual}}$), the wage incentives ($\left(\frac{W_{f-lnhi,t}}{W_{f-labj,t}}\right)^{\emptyset^{edu}_{b,c,w-prem}}$) 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 ($[\![MDGVAL]\!]_{\downarrow}(mdg4,t)^{\uparrow}(\emptyset_{\downarrow}(b,c,mdg4)^{\uparrow}edu)$) , size of the infrastructure capital stock, ($\left(\sum_{i\in INS} QFINS_{i,f,t}\right)^{\emptyset^{edu}_{b,c,f}}$), household consumption per capita ($QHPC_t^{\emptyset^{edu}_{b,c,qhpc}}$):

$\emptyset_{b,c,w-prem}$

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.

5. 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.

6. 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 labour capital and land. Labour is differentiated by three education levels: unskilled labour, moderate skilled labour (middle manager, technician) and highly skilled labour (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 fibber 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.

7. 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 labour and at a low level (5%) for non-qualified labour. Labour force participation by labour type has been computed by combining national account data and statistical and fiscal declaration data. The total number of labour 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 labour-factor market, unemployment is endogenous: wage changes generate changes both in labour 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 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%[5] for the period 2011-2015.

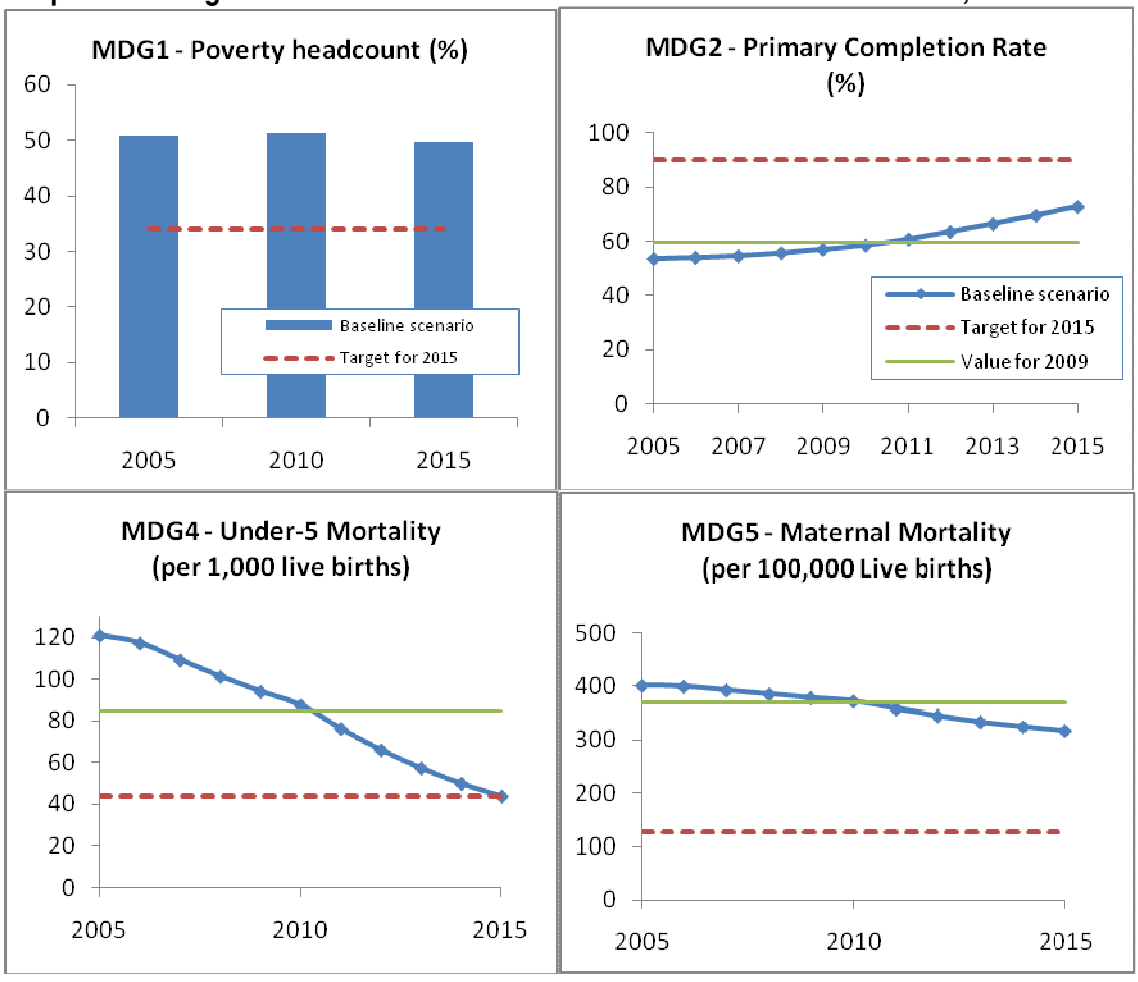
Are the MDGs achieved under the BAU scenario assumptions?

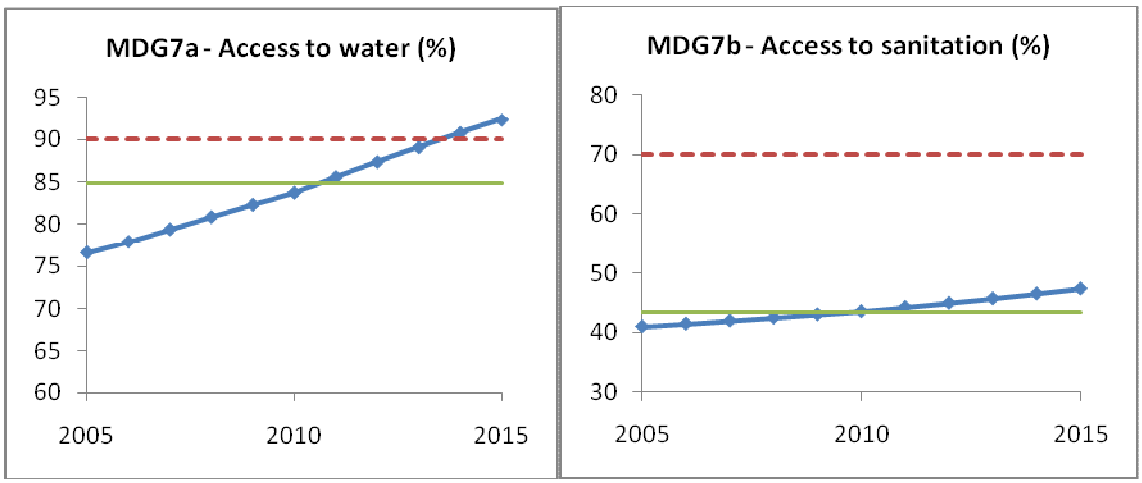
[5] Even if IMF predictions suggest 4.5% for next year, one has to notice that the issue of energy is not yet solved, suggesting that growth might be affected by this issue for the next 3 or 4 coming years. Hence, a prediction of 4% has been set for the period 2011-2015 to take into account the risk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

Graph 13 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".

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.

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)

			MDG-achieving scenarios		
	Base year (2005)	Baseline scenario	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)

		MDG-achieving scenarios (2005-2015)			UNDP estimates (2005-2015)
	2005	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[6]). These estimates are reported in the last column of Table 10 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[7]. 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).

[6] 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.

[7] Unfortunately, the details of cost calculation are not presented in the main MDG report and sectoral studies were not available for consultation.

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 will 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[8]. Each type of financing mechanism has macroeconomic and microeconomic implications.

If the MDGs are financed through foreign debt, Government MDGs services delivered could be constrained by the payment of interest. It is also obvious that rising stock of external debt one more time is not a good strategy for a country that has benefited from the Heavily Indebted Poor Countries initiative (PPTE). Furthermore, this can lead to adverse effects on growth in the long term. Financing the MDGs through foreign aid will produce the same effects but the Government will not be constrained in term of interest payments. For all MDG strategies, rising public spending on MDG-related services increases real GDP. The GDP impact is positive though not very large for the aid and foreign borrowing scenarios (Table 11). Public spending on MDG-related services increases the domestic components of the demand (public and private consumption, public and private investment). The negative impact of MDGs scenarios on exports result from an exchange rate appreciation caused by an inflow of foreign exchange. This later explains why the imports also increase. Adopting a direct tax financing mechanism combined with aid, on the other hand, has a positive but lowest effect on the GDP (Table 11).

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. 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.

[8] 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.

Table 11. Senegal: Projected macro variables in the four model scenarios (in %)

	2005	Baseline scenario	MDG-achieving scenarios		
			foreign transfers	foreign borrowing	foreign transfers + direct taxes
	bln FCFA	*Average 2005-2015 growth rate (%)*			
Real GDP at market prices	4 478	3.4	3.9	3.9	3.7
Private consumption	3 242	2.8	4.4	4.4	3.7
Government consumption	817	3.1	6.0	6.0	6.1
Private investment	676	3.0	5.6	5.6	4.8
Public investment	483	2.8	7.5	7.5	7.7
Exports	849	5.0	-1.2	-1.2	-0.7
Imports	1 590	2.5	5.9	5.9	5.2
Real GDP per capita (thou FCFA)	397	1.0	1.4	1.4	1.2
Real Exchange Rate	1.00	0.7	-2.5	-2.5	-2.1
		2015 level			
Trade-to-GDP (%)	54.5	54.6	54.7	54.7	53.3
Investment-to-GDP (%)	25.9	24.6	28.1	28.1	28.2
Private	15.1	14.5	15.0	15.0	14.4
Public	10.8	10.1	13.1	13.1	13.8
External debt-to-GDP	46.9	83.0	65.4	146.8	68.0
External debt service-to-exports (%)	5.3	7.2	15.6	33.5	14.4
		2005-2015 average level			
Foreign aid per capita (USD)	59.2	59.1	159.5	166.7	142.5
Grants	17.5	17.5	105.8	17.5	91.0
Loans	41.7	41.7	53.8	149.2	51.5
		2015			
Poverty headcount	50.8	49.7	45.6	45.6	47.4

Source: MAMS-SEN simulations.

Effects of MDGs on labour market

The entry age in primary school is 7 years in Senegal whereas the length of this cycle is 6 years. In a transitional path, whereas improving primary education enlarges the size of primary enrolment, the demand of skilled workers for that need and the need of the other MDGs targets increases in the same time. Private sector has then to compete with public sector in the skilled labour market whereas infrastructure and the real services per student cost (education quality) of bringing a cohort of pupils who graduate from primary cycle to secondary cycle has to be almost doubled with respect to the base year as assumed under the MDGs scenarios. Several links exist between the dynamic of labour market and MDGs strategies. On one hand, by pushing to the achievement of net completion rate in education and encouraging students to remain in school, the MDGs strategies decrease the relative supply of unqualified workers comparing to the baseline. On the other hand, to deliver MDGs services, the public sector has to use intensively more skilled workers in the field of health and education. Given the constraints of skilled labour market supply, this can

penalize the production of the private sector. Hence, in the short term and medium, when children and unskilled labour choose to go to school, supply of skilled labour is constrained but in the long term, high educated labour force would contribute to boost growth in the future, reason why the growth effects of the MDG strategy are very modest during the simulation period (see table 11). In the Table 12, the differences in annual wage growth are highlighted for the different categories of workers. Except for the scenarios where growth is more affected and leads to less labour demand (mdg2 under tax financing and mdg7), increasing demand of skilled labour leads to high wage rate for this type of labour even if supply of this category of workers rises due to elevated educational services delivery. The main reason of why this labour demand category is boosted is that MDGs related sectors are very skilled labour intensive, especially in health and education sectors. Tertiary skills are also more demanded due to MDGs needs as its wage rate increases significantly with respect to the baseline.

This evolution of wages and more largely income has an impact on poverty reduction.

Table 12. Base-year average wage (000 FCFA for labor and index for capital) and annual average growth of wages in the simulated scenarios (percentage points)

				MDG-achieving scenario		
		2005	Baseline	foreign transfers	foreign borrowing	foreign transfers + direct taxes
Wages						
Unskilled wage	(000 FCFA)	360	2.8	2.9	2.9	2.9
Middle secondary skilled wage	(000 FCFA)	1 063	-0.8	-0.7	-0.7	-0.7
High secondary skilled wage	(000 FCFA)	2 207	-1.1	-1.0	-1.0	-1.0
Capital rent	(index)	100	4.0	4.0	4.0	4.0

Source: MAMS-SEN simulations.

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[9]. Poverty headcount numbers are provided at the bottom of Table 11. Under BAU, poverty incidence falls from 50.8 in 2005 to 49.7 in 2015. Since no distribution effects are modelled 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 45.6 in both foreign transfers and foreign borrowing scenarios by 2015. Not surprisingly, the result in terms of poverty reduction is less favourable 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 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

[9] The estimated value of this elasticity is -0.5.

to be the final period in which provided energy constraints are lifted. In order to assess whether this more favourable 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)

			MDG achievement		
	2005	Baseline	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.

8. Conclusions and policy lessons

Like the bulk of less developing countries, Senegal has subscripted to MDGs. Within the framework of MAMS which is the first framework that explicitly takes into account the general equilibrium 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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10. Appendix

Appendix A: Summary of various shocks and their impacts known Senegalese economy 1969-2009

Years	Nature of the shock	Impact of the shock
1969-73	– Series of droughts	– Deteriorating terms of trade.
1974-77	– 1974 is the year of the first oil shock and also soaring world prices for major exports (crude oil, peanut over 274% phosphate and more than 132%)	– The imported inflation led to a 32% increase in domestic prices in 1975. – In 1974, the terms of trade improved by 33%. – An increase of 82% of export earnings.
1978-1980	– Poor rainfall	– Deteriorating terms of trade. – Drop in groundnut production. – Drop in real GDP of 6.7%.
1979/1981	– Rain noise – Poorly distributed rainfall – Belated and insufficient rainfall – Successive droughts	– Alteration of seed capital – Peanut crops, export earnings and food production disastrous harvests of peanuts, export earnings and food production disastrous
1982-83	– Collapse of international prices of groundnut crude oil – Extreme drought – Strengthening of world demand for phosphates	– Large deficit in the groundnut sector which has a major drain on public finances – Deficit of 300,000 tons partly covered by emergency food aid – Increase of 48% of the production of phosphate of lime. – Inflation rate of two digits.
1984-1988	– Weather conditions favourable – favorable trend of terms of trade despite the fall in the price of crude oil Peanut $ 1026 to $ 600 in 1986. – 1984: A contraction of world demand for phosphates and lower world price for phosphate	– Satisfying economic growth – Improvement of the current account balance of payments – Strong private capital outflow – Drop 6% of the production of phosphates of lime – Doubling the volume of exports of peanuts has been mitigated by the drop in – Deficit of the groundnut sector
1988-89	– Late arrival and early termination of the rainy season – Locust Invasion – Political climate disruption – Incidents border with Mauritania – elections of 1988 and postelectoral disputes with violence and impact on social climate – Increase in the price of crude peanut oil 14%.	– Decreasing volume of production despite the general expansion of cultivated areas. – Decline in tax revenue (revenue shortfall of 9.9%) – Persistence of private capital outflow – Higher groundnut crude oil exports by 66%
1990-1993	– Gulf war – Recession in most developed countries	– Implementation of the emergency plan to restore public finances
1994	– CFA devaluation	– Improving the competitive position of the economy (REER depreciation of 35%)
1995-1997	– Adverse weather – Appreciation of the dollar in 1997	
1998	– Adverse whether	
2000	– Rising international crude oil prices _ Appreciation of U.S. dollar	– Deteriorating current account balance of payments

2001	– Favorable rainfall – Slowdown of the global economy following the events of September 11 – Bending of international oil prices – Decommissioning of Sonagraines	– Sharp increase in peanut production – Improving the current account deficit – Deterioration of living conditions of producers in particular because of unpaid bills
2002	– Adverse whether	– Collapse of agricultural production – degradation of living conditions of farmers
2003	– Declining world prices of some export products, – Depreciation of U.S. dollar	– Recovery of agricultural production
2004	– Soaring price of oil, – Weakness in the dollar against the euro – Locust Invasion	– Low impact on agricultural production because of the rapid reaction of the authorities combined with the support of external partners – Production of phosphoric acid with a disability
2006	– Soaring price of oil, – Poor agricultural campaign	– The primary sector recorded a negative growth rate (5.5%). – A lowgrowth rate of real GDP (2.4%)
2008	– World food crisis. – Strong appreciation in oil prices	– Inflation
2009	– Global financial crisis	– Declining exports. – Drop in Senegalese immigrants transfers

Sources : Diagne, Daffé (2002), Fall et Ndiaye (2005), ANSD, Notes d'analyse des comptes nationaux du Sénégal, divers numéros.

Appendix B: Differential mortality rates by socio-demographic characteristics

Tableau 11.2 Taux de mortalité des enfants selon certaines caractéristiques socio-démographiques

Quotient (‰) de mortalité néonatale, post-néonatale, infantile, juvénile et infanto-juvénile pour la période de 10 ans ayant précédé l'enquête, selon certaines caractéristiques socio-démographiques de la mère, EDS-IV Sénégal 2005

Caractéristique sociodémographique	Mortalité néonatale (NN)	Mortalité postnéonatale[1] (PNN)	Mortalité infantile ($_1q_0$)	Mortalité juvénile ($_4q_1$)	Mortalité infanto-juvénile ($_5q_0$)
Milieu de résidence					
Urbain	32	21	52	41	91
Rural	46	36	82	85	160
Région					
Dakar	30	15	44	37	79
Diourbel	53	36	89	98	178
Fatick	56	23	79	82	154
Kaolack	44	35	79	84	156
Kolda	53	48	100	116	205
Louga	28	25	53	45	96
Matam	38	30	68	45	110
Saint-Louis	27	26	52	42	93
Tambacounda	56	44	100	111	200
Thiès	33	27	60	44	101
Ziguinchor	32	38	69	64	129
Niveau d'instruction					
Aucun	45	34	79	78	152
Primaire	32	20	52	44	94
Secondaire ou plus	17	13	30	30	60
Quintile de bien-être économique					
Le plus pauvre	50	39	89	103	183
Second	47	38	85	87	164
Moyen	41	31	73	69	136
Quatrième	31	22	53	41	92
Le plus riche	27	14	41	25	64

[1] Calculé par différence entre les taux de mortalité infantile et néonatale.

Source: DHS Report 2006.

Appendix C : MDG achievement needs assessment by sector (cumulated costs over 2005-2015 in Bn of FCFA)

	Objective	Needs	Source
MDG1	Food security	333.0	
	Nutrition	267.4	Rapport GTS Nutrition OMD 2005
	Private sector promotion	113.0	Rapport GTS Création de richesses OMD 2005
MDG2	Primary education	179.6	Rapport GTS Education OMD 2005
	Literacy	77.5	Rapport GTS Education OMD 2005
	Additionnal costs	18.6	Rapport GTS Education OMD 2005
MDG3	Gender equality		
MDG4	Under 5 mortality	175.9	Rapport GTS OMD Santé 2004
MDG5	Maternal mortality	59.1	Rapport GTS OMD Santé 2005
MDG6	HIV/AIDS	120.1	Rapport GTS OMD Santé 2005
	Malaria	39.3	Rapport GTS OMD Santé 2005
	Tuberculosis	21.4	Rapport GTS OMD Santé 2005
MDG7	Access to water	154.3	Rapport GTS OMD Environnement 2005
	Access to sanitation	103.5	Rapport GTS OMD Environnement 2005
	Housing	63.3	Rapport GTS OMD Environnement 2006

Source: République du Sénégal 2007.

Appendix D: Senegal – Elasticity of MDGs with respect to their determinants

	Service delivery	Household consumption per capita	Public infrastructure	Other MDGs	Wage incentives
MDG2 - Primary completion rate					
Entry	0.900	0.400	0.200	-0.100	0.005
Promotion	0.900	0.200	0.100	-0.100	0.005
MDG4 - Under-5 mortality	-0.300	-0.600	-0.100	-0.300	
MDG5 - Maternal Mortality	-0.900	-0.600	-0.100	-0.600	
MDG7a - Access to water	0.900	0.100	0.500		
MDG7b - Access to sanitation	0.665	0.100	0.500		