

How Important Is the Efficiency of Government Investment?

The Case of the Republic of Congo

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Abstract

The Republic of Congo, an oil rich country in Central Africa, has made substantial progress in the past decade in stabilizing the economy and achieving high growth rates. However, despite reaching middle-income country status in 2006, the economy is not diversified, poverty remains pervasive, and social indicators are well below the average for countries with a similar income level. This paper analyzes aspects of an ambitious investment program on which the government has embarked to improve the provision of basic services and promote private sector development. The success of this program, however, is questionable given the low absorptive capacity

of the country and in particular the poor efficiency of public investment management. The analysis is based on simulations with an economy-wide model for analysis of development strategies and government policies, MAMS (Maquette for MDG Simulations). The results of the simulations show that slightly delaying large investment projects, while simultaneously improving the efficiency of the investment program, would lead to significantly higher growth rates and lower poverty levels. The analysis therefore confirms the importance of efficient public investment management for the optimal use of the country's resources.

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1. Introduction

The Republic of Congo is an oil rich country in Central Africa that has recovered from years of conflict in the 1990s, reached middle-income status in 2006 and even achieved the highest GDP growth rate in Africa in 2010 and was among the 10 fastest growing economies worldwide. However, this impressive performance has been accompanied by less diversification and increased dependence on oil. The country continues to suffer from dilapidated infrastructure and insufficient public service delivery, while unemployment remains high and social indicators well below the potential of the country given its GDP per capita.

The government has therefore initiated a large investment program to improve public service delivery and facilitate private sector led growth in non-oil sectors. While the use of the resource wealth of the country to the benefit of the population is essential for its further development, the limited absorptive capacity of the Republic of Congo needs to be considered. The poor efficiency of public investment management is particularly problematic. In 2011, Congo ranked second to last in the Public Investment Management Index with particular challenges in the areas of project appraisal and evaluation.

This paper therefore assesses the impact of increased public investment given the timing and efficiency of the investment program. We consider different scenarios that analyze the outcome of front-loading versus back-loading investment while simultaneously improving the efficiency of the government investment program. Furthermore, the allocation of additional resources available through efficiency gains and its effect on the main economic variables is discussed. The analysis is done by means of MAMS, a computable general equilibrium model that has been adjusted to the characteristics of the Congolese economy.

2. Country background

2.1 Macroeconomic and social developments

Congo has made good progress in the last decade. Solid economic performance, backed by high commodity prices and increased oil production as well as sustained economic reforms, have brought the country to the lower middle-income country status and facilitated reaching the completion point under the HIPC initiative. Real GDP growth averaged 5.0 percent in the last decade (see Table 1), inflation was low with only 3.2 percent and the overall fiscal balance remained positive.¹

However, the structure of the economy changed fundamentally, from a fairly diversified and industrialized economy at independence in the 1960s, benefitting from its role as transport hub in the region, to one that is dominated by the oil sector, which in 2010 accounted for 68 percent of GDP, 85 percent of exports and 79 percent of government revenues. Currently, the authorities aim at reversing these developments. Frequent crisis episodes, including intense conflicts experienced in the 1990s (1993 and 1997-99) have tempered Congo's post-independence decades of growth, led to the destruction of infrastructure and resulted in difficulty in providing basic services by the government.

¹ For a more detailed analysis of growth in Congo, see Nielsen and Kikoni (2011).

The first full PRSP adopted in 2008 and the President's long-term vision ("*chemin d'avenir*" or "path to the future") envisages the transition to a modernized, industrialized and diversified economy. A number of reforms aimed at achieving this goal have already been completed or are under way. Some positive developments can be recorded, including an acceleration of growth in the non-oil sector, especially in construction and in private services. Nevertheless, the economy remains highly sensitive to the volatility of oil prices and production.²

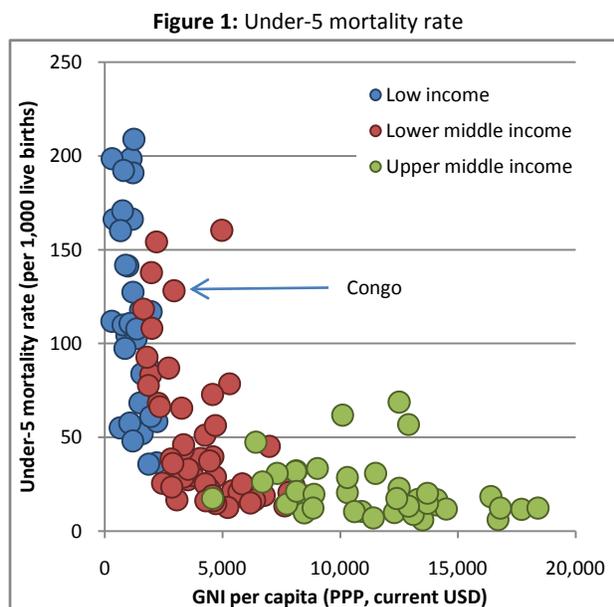
Table 1: Key Economic Indicators, 2006-2010

<i>(percent of GDP, unless otherwise indicated)</i>	2006	2007	2008	2009	2010	average 2000-2010
Real sector						
Real GDP growth (%)	6.2	-1.6	5.6	7.5	8.8	5.0
Oil (%)	6.8	-17.2	6.1	16.2	13.8	1.9
Non-oil (%)	6.0	6.6	5.4	3.9	6.5	7.3
Primary sector	6.4	-11.8	5.9	10.5	11.8	2.4
Secondary sector	8.0	9.5	6.6	5.4	6.4	10.8
Construction and public works	7.4	10.3	7.6	8.7	8.9	12.8
Tertiary sector	5.7	6.6	5.0	5.4	5.8	7.0
Transport and telecommunication	6.3	8.3	6.8	6.1	7.1	9.9
Commerce	5.9	7.1	6.0	7.5	7.5	9.3
Real GDP per capita (USD 2000)	1,197	1,156	1,199	1,265	1,348	1,157
Consumer price inflation (%)	4.7	2.6	6.0	4.3	5.0	3.2
Nominal GDP (CFAF billion)	4,043	4,023	5,311	4,530	5,947	3,454
External sector						
Exports of goods and non-factor services	85.7	76.7	73.3	70.8	84.5	79.7
Imports of goods and non-factor services	49.4	53.5	46.7	50.9	50.7	50.0
Current account balance	2.1	-7.9	1.2	-8.8	5.1	-0.1
Fiscal sector						
Total revenue and grants	44.4	39.5	46.6	29.2	37.5	34.7
Oil revenue	37.9	32.1	40.1	20.7	29.6	26.8
Non-oil revenue	6.4	7.0	6.1	8.2	7.8	7.6
Total expenditure and net lending	27.9	30.0	23.4	24.6	21.5	26.0
Current expenditure	18.4	19.6	14.9	13.9	11.4	17.4
Capital expenditure	9.4	10.4	8.6	10.7	10.1	8.6
Non-oil primary balance (% of non-oil GDP)	-54.2	-59.0	-49.1	-39.1	-34.4	-40.1
Overall fiscal balance (commitment basis, incl. grants)	16.5	9.4	23.1	4.6	16.0	8.7

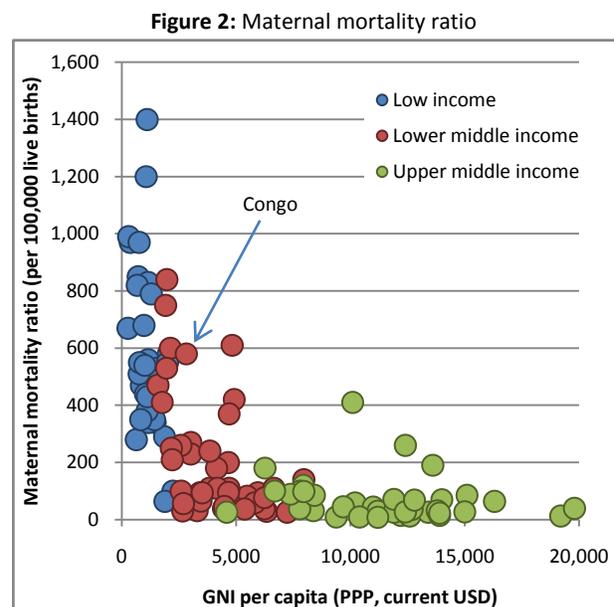
Source: WB staff calculation based on data from the IMF and the Congolese authorities. n/a = not available.

Social indicators remain low and are not in line with those of other lower middle-income countries. According to cross-country regressions, Congo's social indicators should be substantially higher given its high GNI per capita. This is illustrated by Figure 1 and Figure 2, showing the under-5 and maternal mortality rate in relation to the GNI per capita. It is obvious that Congo's performance is similar to that of low-income countries rather than middle-income countries.

² See World Bank (2010c) for a detailed discussion of the risks associated with oil price volatility in the Republic of Congo.



Source: WDI



Source: WDI

According to the latest household survey from 2005 (ECOM, Republic of Congo 2006), about half of the population lives below the poverty line and meeting most MDGs is a challenge. Health indicators are particularly low and infant and under-5 mortality have even increased in recent years (Table 2). In the education sector, school enrolment rates have increased significantly during the last decade in all school segments, following the introduction of free schooling in 2007/08, but qualitative indicators remain low. In addition, educational progress is highly unequal, with which much better outcomes in urban areas and for high-income households.

Table 2: Key social indicators, 1990 - 2009

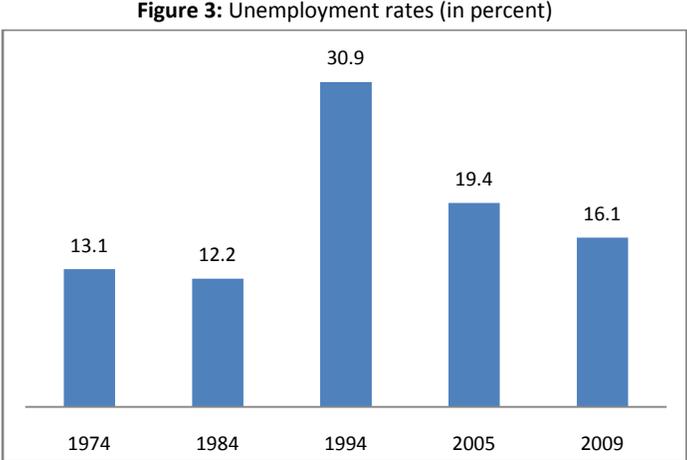
Indicator	1990	2000	2006	2007	2008	2009	Lower middle income countries ^a	Sub-Saharan Africa ^a
Education								
Gross primary school enrolment rate (%)	123	85	116	115	114	120	107	100
Net primary school enrolment rate (%)	81 ^b	-	59	-	-	-	87	75
Primary school completion rate (% of relevant age group)	59	55 ^c	77	77	73	74	90	64
Health								
Life expectancy at birth (years)	59	54	53	53	54	54	68	53
Infant mortality rate (per 1,000 live births)	67	74	78	79	80	81	43	81
Under-5 mortality rate (per 1,000 live births)	104	116	124	125	127	128	57	130
Memorandum item								
Population (millions)	2.4	3.0	3.5	3.6	3.6	3.7	-	-

Source: World Development Indicators. Note: a = data from 2008 or 2009, b = data from 1991, c = data from 2001.

Unemployment has been a long-standing problem in Congo with particularly high unemployment rates during the years of the conflict (Figure 3). The situation improved after the end of the conflict, although unemployment levels remained higher than in the 1970s and 1980s, especially in urban areas. Unemployment rates in 2005 and 2009 were estimated at 19.4 percent and 16.1 percent (for urban areas), respectively. Based on the 2005 household survey, the urban unemployment rate reached 32.6

percent in Brazzaville and 31.5 percent in Pointe-Noire, compared to an unemployment rate of only 5.8 percent in rural areas and 9.0 percent in semi-urban areas.

Unemployment affects especially the youth. Countrywide, according to the 2005 household survey, the unemployment rate was highest for the 15-19 age group (above 40 percent) and declined gradually thereafter with unemployment rates of 36.7 percent for the 20 to 24 year old and 27.7 percent for the 25 to 29 old. In urban areas, according to an employment and informal sector survey carried out in 2009, 25 percent of the population under 30 years is unemployed if the ILO definition is employed whereas this rate increases to more than 40 percent if a broader definition is used (EESIC, Republic of Congo 2010a and 2010b).



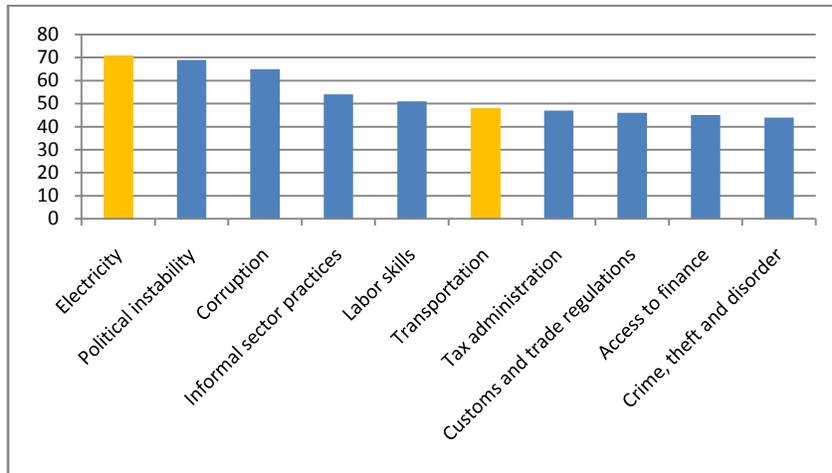
Source: RGPH 1974, 1984, 1994, ECOM 2005, EESIC 2009 (urban areas)

2.2 Infrastructure – bottleneck and potential growth source

Access to and cost of infrastructure represent major constraints to private sector investment. In fact, according to the Enterprise Indicator survey carried out in 2009, more than 70 percent of private firms consider the lack of electricity as the main obstacle for private sector development in Congo (World Bank 2009, Figure 4). Power cuts have reduced firm turnover by 19 percent and 82 percent of firms have to rely on a generator. The quality of the fixed line telecommunication network is poor, and the international/regional connectivity is underdeveloped. The overall dilapidated infrastructure leads to exceptionally high input costs in all areas.

Poor transport infrastructure and transport services remain a bottleneck to investment and trade. As reported in the 2012 Doing Business report (World Bank 2011), it takes 62 days to import goods and 50 days to export goods. The railway between Pointe-Noire and Brazzaville is very inefficient with high freight tariffs, and the road between the two cities is still under construction. The rail network is among the worst in Africa in terms of service quality and safety, and tariffs are among the highest. Rail traffic fell by two-thirds during the conflict and has never returned to pre-conflict levels. Tariffs, at USD 0.16 per ton/km, are up to three times as high as in southern Africa. This is due to insufficient rehabilitation and maintenance of tracks, outdated and insufficient rolling stock, weak internal supervision, management deficits and human resource limitations. Surface transportation costs are more than double the southern African average (Briceño-Garmendia and Foster 2009).

Figure 4: Major obstacles in the Republic of Congo (percent of companies surveyed)



Source: World Bank Enterprise Surveys website custom query and World Bank (2009)

Growth remains constrained by the underdeveloped physical infrastructure. A cross-country statistical analysis conducted by the World Bank (World Bank 2010b) shows that the contribution of the infrastructure sector to Congo’s per capita growth over the past decade, at 0.5 percentage points, was considerably lower than in other countries in the region: 0.87 for Nigeria, 0.91 percentage points for DRC, 0.89 percentage points for CAR, and 0.99 for the SSA average. The growth in Congo stemming from infrastructure was due mainly to increased access to mobile telephony while the poor quality and inadequacy of power supply acted as a brake on the economy.

Given this, infrastructure improvements can contribute substantially to growth. Infrastructure has the potential to contribute more than 3 percentage points a year to per capita GDP growth in the future, if access to and quality of infrastructure services were improved to the level seen in Mauritius, the leading African country in infrastructure quantity and quality (World Bank 2010b). This compares with an average of 2.3 percentage points for the whole Africa continent. Upgrading Congo’s infrastructure, in particular in the power sector, is a prerequisite for economic development and the provision of social services.

2.3 Government investment and efficiency in the Republic of Congo

As a response to the challenges faced by the country, the Congolese government has embarked on an ambitious investment program to improve access to and delivery of basic services. The authorities have, hence, scaled up investment spending substantially to improve the dilapidated infrastructure, particularly in the power and transport sectors. The investment budget is estimated to reach CFAF 981 billion (approximately USD 2.1 billion) or 14.0 percent of GDP in 2011, representing an increase of almost 67 percent compared to the investment budget of CFAF 589 billion (approximately USD 1.2 billion) or 10.1 percent of GDP in 2010 (Table 3). In comparison, private investment, especially in the non-oil sector has remained limited, averaging less than 5 percent of GDP in the last 10 years.

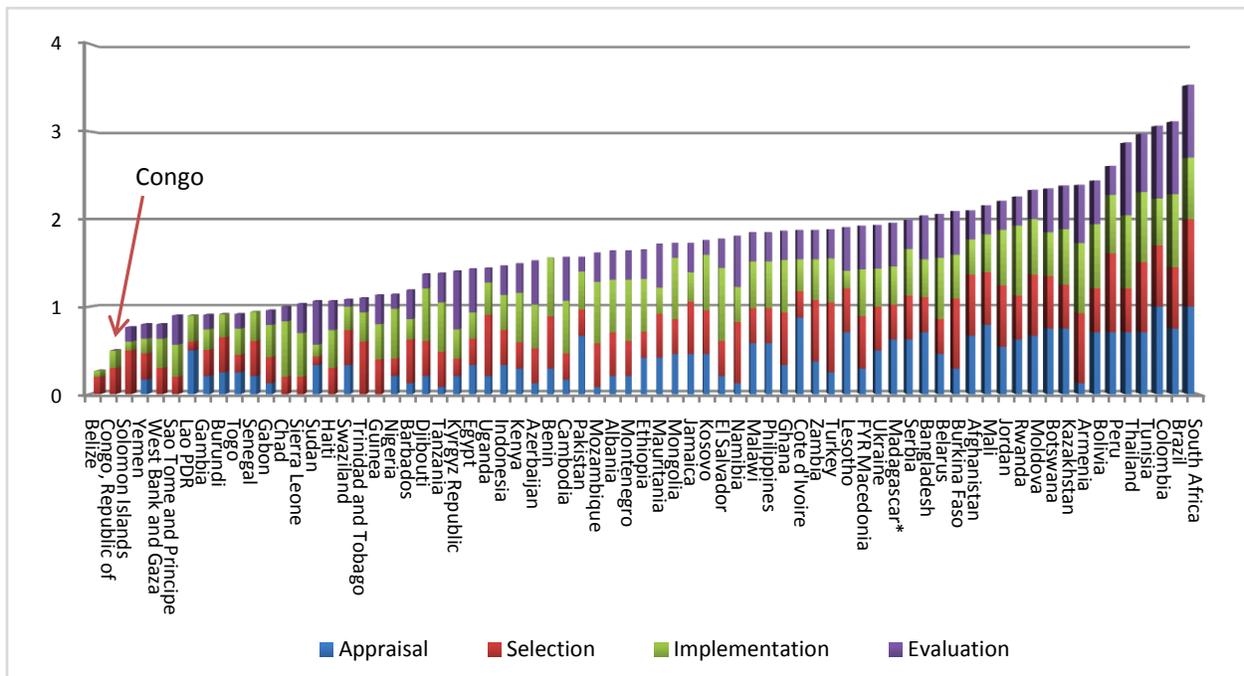
Table 3: Public investments in the Republic of Congo

	2004	2005	2006	2007	2008	2009	2010	2011
Total in CFAF billion	160.7	200.6	381.1	417.8	453.2	484.8	589.4	981.4
domestically financed	128.4	153.9	352.9	372.0	389.6	469.3	514.6	690.0
% of GDP	6.5	6.2	9.4	10.4	8.6	10.7	10.1	14.0
US\$ million	304.6	380.9	729.4	873.0	1,016.8	1,029.4	1,192.2	2,113.9

Source: World Bank 2010d, IMF and authors' calculations; 2010 and 2011: estimates as of March 2011

This investment program, however, could pose a challenge to the country's limited absorptive capacity. Public investment remains heavily constrained by poor efficiency; according to the Public Investment Management Index (PIMI) developed by the IMF, the Republic of Congo ranked 70th out of 71 surveyed countries (Dabla-Norris et al. 2011, see Figure 5 and Table 4). The PIMI measures the performance of public investment management on a scale of 1 to 4 along four dimensions: appraisal, selection, implementation and evaluation. The Republic of Congo ranks second to last, just ahead of Belize with an overall score of 0.50 while the median score for all countries is 1.65. Congo fares particularly bad in the appraisal and evaluation category with a score of 0 each. In order to use the country's resources effectively and efficiently, public investment management needs to be improved in all areas of the project cycle.

Figure 5: PIMI overall index: Decomposition by Sub-Index



Source: Dabla-Norris et al. (2011)

Table 4: PIMI score – comparison with other countries in the region

Country	Appraisal score	Selection score	Implementation score	Evaluation score	Overall score
Republic of Congo	0.00	1.20	0.80	0.00	0.50
Chad	0.00	0.80	2.53	0.67	1.00
Gabon	0.50	1.20	1.47	0.67	0.96
Sao Tome and Principe	0.00	0.80	1.47	1.33	0.90
South Africa (highest score)	4.00	4.00	2.80	3.33	3.53
Median of all 71 countries	1.33	1.60	2.00	1.33	1.65

Source: Dabla-Norris et al. (2011)

3. Development of MAMS

The impact of government investments and the efficiency of their management are assessed by means of MAMS. The Maquette for MDG simulations (MAMS), developed by researchers at the World Bank, is a computable general equilibrium (CGE) model that simulates the impact of development strategies on the economic and social development of a country in the medium and long run (i.e. with simulation periods that typically are five years or longer). MAMS has been applied to some 45 countries, typically addressing policy issues related to public spending (in terms of total resource envelope, sector priorities, and sequencing), financing (including taxation and foreign aid), and efficiency of public service production and delivery. Like other CGE models, it captures the circular flow of income, linking output markets, production, factor markets, households, the government, and the balance of payments (reflecting the rest of the world). For each link in the chain, a budget constraint is operative, i.e., total receipts, including borrowing (if any), must equal total spending, including savings (if any). The structure of MAMS is derived from basic economics: producers maximize profits; the demand functions of consumers are derived from utility maximization; and prices (or wages) clear domestic markets. The distinguishing characteristic of MAMS is an embedded module that links disaggregated government services and other relevant variables to selected education and MDG indicators.³

In spite of a common general structure, MAMS does not presume that one size fits all: the simulations and the underlying assumptions are tailor-made for each case study; the structure and disaggregation of the database reflect country characteristics and the purpose of the case study. For the MAMS application to the Republic of Congo, private and government production are each disaggregated into six sectors, for the government corresponding to different functions – three types of education (primary, secondary and tertiary), health, infrastructure, and other government services.⁴ The development of the MAMS for Congo required extensive data collection. The key component of the database is a social accounting matrix (SAM), complemented by elasticities (related to production, consumption, trade and MDG functions) stock data (covering factors, population, and school enrollment), productivity impacts of changes in infrastructure capital stocks, as well as various education and MDG indicators.⁵ The model has been carefully calibrated to ensure the robustness of the results.

4. The impact of more efficient investment on growth and employment

MAMS is here used to assess the impact of increased efficiency on growth and employment. A baseline scenario serves as benchmark to measure the effect of higher productivity and efficiency of investment as well as the timing of the investment program. The baseline scenario assumes that past trends will continue, but also takes recent information into account, especially on government finances.

Different scenarios have been developed assessing the impact of productivity gains, the timing of scaled-up investment and improved government efficiency in managing public investments. The scenarios are defined as follows; a detailed description is given in the following sections:

³ Appendix 2 provides a non-technical description of MAMS. For more technical descriptions, see Bourguignon et al. (2008), Lofgren et al. (2011), and Lofgren (2010).

⁴ See Table A2.1 for a full account of the disaggregation of the Congo database.

⁵ The necessary information has been obtained, among others, from the IMF, the PRSP, the World Development Indicators, from World Bank (2010a), Guetsop Nangue (2009), budget information and UN Population Forecasts.

- BASE: Moderate growth; variables follow their historical trend; no additional investment or productivity gain.
- INF-FL: Front-loading of additional infrastructure investments (CFAF 2,000 billion in 2013-2015); no productivity gain.
- INF-BL: Back-loading of additional infrastructure investment (CFAF 2,000 billion in 2016-2022); no productivity gain.
- INF-BL(15), INF-BL(30), INF-BL(45): Delayed additional infrastructure investment similar to INF-BL with an annual investment productivity gain of 1.5 percent, 3.0 percent and 4.5 percent, respectively.
- GOVEFF-INF: Improved government efficiency; gains are used to scale up government services for infrastructure.
- GOVEFF-HE: Improved government efficiency; gains are used to scale up government services for health and education.
- GOVEFF- HE+INF: Improved government efficiency; gains are used to scale up government services for health, education and infrastructure.

4.1 Baseline scenario

Under the baseline scenario (BASE), it is assumed that growth remains moderate with on average 5.6 percent per year between 2010 and 2025 and with most variables following their historic paths. The base year of the model is 2009, but all available information and estimates for 2010 and 2011 have been taken into account, especially regarding the government budget.

Table 5: Real macro indicators by simulation (average annual growth from 2010 to 2025, percent)

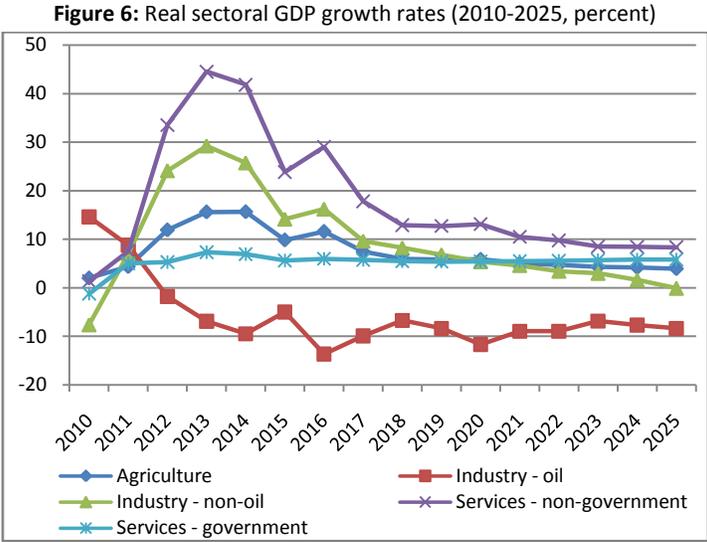
	BASE	Front-loading INF-FL	Back-loading (BL)				Increased government efficiency		
			0	15	30	45	HD	HD-INF	INF
GDP at factor cost	5.6	6.1	6.3	6.5	6.6	6.8	5.5	6.5	7.0
Private consumption	6.4	6.9	7.2	7.3	7.5	7.6	6.2	7.1	7.5
Government consumption	5.7	5.9	6.0	6.1	6.1	6.2	7.1	6.6	6.3
Private investment	2.6	3.0	3.2	3.3	3.4	3.5	2.5	3.1	3.4
Government investment	4.3	4.4	4.5	4.5	4.5	4.6	3.2	5.2	6.3
Exports	3.4	3.9	4.1	4.2	4.4	4.5	3.3	4.2	4.6
Imports	5.6	6.0	6.2	6.3	6.5	6.6	5.5	6.2	6.7
Absorption	5.5	6.0	6.1	6.3	6.4	6.5	5.5	6.3	6.6
Real exchange rate (index)	2.1	2.1	2.1	2.1	2.1	2.1	2.4	2.3	2.3

Source: Authors' calculations

According to the latest available projections, oil production is going to decline starting in 2012. To maintain an average real GDP growth rate of 5.6 percent until 2025, rapid growth is required in the other sectors to compensate for the decline in oil growth. In the baseline, growth for agriculture and forestry is constrained by the land supplies, which are assumed to grow by 1 percent annually for each of the two sectors. Given the small share of industry, high growth in the services sector has to be the main contributor to overall growth (Figure 6). Growth in the services sector will be driven to some extent by the investment projects of the government, especially the construction sector.

The real exchange rate depreciates due to the reduction in oil production and related export receipts, encouraging production of non-oil tradables and discouraging production of non-tradables. However, this effect is mitigated by a reduction in Congo's net foreign assets, aimed at smoothing Congo's

transition toward a future without oil. Most macroeconomic aggregates grow at real rates quite close to the rate of GDP at factor cost. The main exceptions are exports (which suffer from the decline in the oil sector) and private investment (which are hurt by the combination of high import intensity and depreciation).



Source: Authors' calculations

On the fiscal side, government spending increases from 28 to 32 percent of GDP in 2025, mainly due to an increase in consumption caused by a rapid wage increase. Government revenues decline significantly to 21 percent of GDP. The fall in oil revenues, however, is mitigated by a rise in domestic non-oil taxes, both direct and indirect, relative to GDP.

GDP growth is accompanied by a relatively rapid expansion of employment. The unemployment is subsequently reduced from 19.4 percent (last country-wide assessment in 2005) to 13.5 percent in 2025. Real wages grow relatively evenly across the educational levels; between 4.1 and 5.0 percent per year on average. Wage growth is quite even across educational levels, reflecting the combined impact of differences in productivity and supply growth between labor types.

Poverty declines substantially and the other social indicators improve as well. In the baseline scenario, the poverty rate falls to about 24 percent in 2025, down from 51 percent measured by a household survey in 2005 (see Table 6). The under-5 mortality rate is reduced significantly from 128 to 67 per 1,000 live births. In the education sector, the performance is improved according to all indicators, i.e. promotion, repetition, drop-out and continuation rates. The only exception is a decrease in the gross primary completion rate, which, however, does not indicate worse performance, but rather that fewer older and out-of-cohort students enter primary school.

4.2 Front-loading versus back-loading

Under an alternative set of scenarios, the government is scaling up infrastructure spending even more than currently planned. It is assumed that an additional CFAF 2,000 billion (about USD 4 billion) are spent either over 3 years (2013 to 2015), equaling CFAF 667 billion additional investment each year, or over 7 years (2016 to 2022), amounting to CFAF 286 billion annually. We assume that the delay in

investing the additional resources in the second set of scenarios permits the government to improve the productivity of infrastructure investments.

Different scenarios have been developed to assess the effect of productivity gains related to the additional investment. These gains are modeled as an increase in the quantity of new capital that is produced from a given quantity of inputs, i.e. more can be produced with unchanged resources. This productivity gain can, for example, be realized by more efficient project selection and implementation or improved procurement processes that ensure competition. Given the current low efficiency in the management of government investment (cf. section 2.3), there is significant room for improvement.

The scenarios are therefore defined as described above: INF-FL, INF-BL, and INF-BL(15), INF-BL(30), INF-BL(45). The scenarios assuming back-loading of investment are identical except for the suggested productivity increase.

The choice of productivity gain for the scenarios is linked to the achievable improvement in the internal rate of return (IRR) for infrastructure investments. A productivity gain of 1.5 percent in the base year, for example, implying that 1.5 percent more capital can be produced with a given input, will lead to an increase of the IRR by about 0.5 percentage points. The same productivity gain for ten years, however, would increase the IRR by more than 60 percent compared to the baseline. A productivity increase of 4.5 percent annually over ten years implies an IRR that is about four times as high as in the baseline.

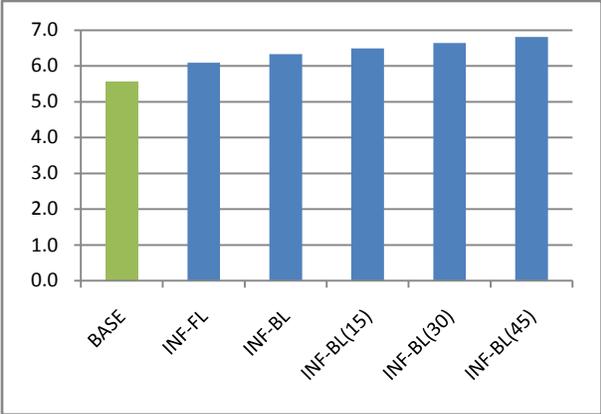
The range of assumed IRR is in line with findings in the literature. Empirical data indicate that the IRR for government investment varies quite widely, but that values in the range of 15-20 percent are typical across a wide range of country categories (Foster and Briceño-Garmendia, 2010; Estache 2005; Prud'homme 2005; IMF 2008; and World Bank 2007). Values at the lower end may be expected for broader aggregates; for example, on the basis of a cross-country analysis for developing countries, Dessus and Herrera (2000) generate an average internal rate of return of 14.2 percent for aggregate government capital, a rate that is very similar to the return calculated for private capital, 14.9 percent. There is some indication that, for the period 2000-2003, returns from infrastructure investment in Sub-Saharan Africa and elsewhere were higher than in previous decades (Estache, 2005). Given the current low base of infrastructure provision in Congo, a higher than average IRR can be expected. In fact, estimates by Briceño-Garmendia and Foster (2009) yield an IRR ranging between 6 and 100 percent for isolated interventions and between 5 and 30 percent for country-level investments in the Republic of Congo.

Compared to the baseline, additional infrastructure investments lead to improvements in the macroeconomic situation for all scenarios (Table 5). This includes growth, private consumption and investment and trade indicators. Poverty rates and MDG indicators are also lower than in the baseline scenario (Table 6).

The results of the model show that delaying investments and improving their efficiency pays off. Higher growth rates and lower unemployment rates can be achieved when slightly delaying investment and simultaneously improving efficiency compared to frontloading investment with low efficiency. As described in section 2.3, Congo's public investment management is far from being efficient. The brief delay in large investment projects could be used to improve government systems, especially in project

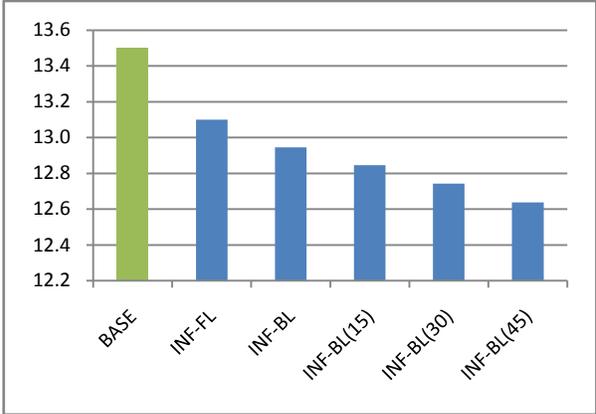
appraisal, selection and implementation that could significantly increase the productivity of the investment in the selected projects. According to Figure 7, the highest average annual growth rate (of almost 7 percent) is achieved with scenario INF-BL(45), i.e. by gradually scaling up investment and ensuring high productivity gains. Compared to the baseline scenario this implies an additional 1.2 percent of real GDP growth per year over 15 years. Figure 8 shows that the unemployment rate in 2025 will be lowest for that scenario as well.

Figure 7: Real GDP growth rate (average 2010-2025, percent)



Source: Authors' calculation

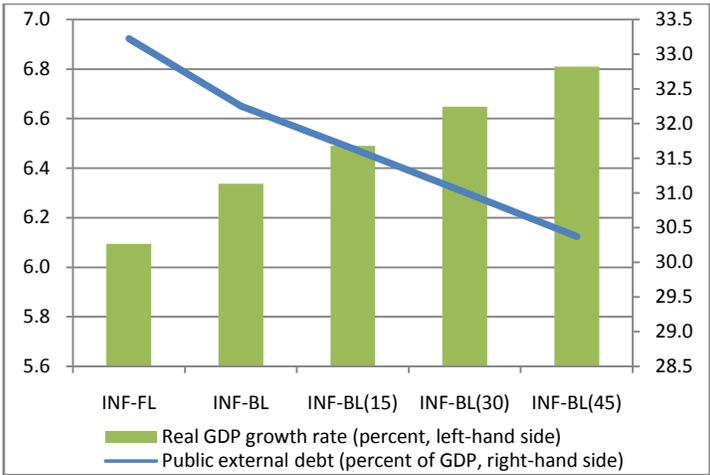
Figure 8: Unemployment rate in 2025 (percent)



Source: Authors' calculation

In addition to the increased productivity, another reason for the better outcome for the scenario with a delayed expansion of investment spending is the lower pressure on domestic markets and the resulting lower price increase for relevant investment commodities, concluding construction services. This adds to the effectiveness of the spending in terms of generating new capital. The timing of investments for infrastructure improvement therefore needs to be considered carefully and measures taken to ensure that the country's resources are used as productively as possible.

Figure 9: Front-loading investment versus back-loading with improved productivity (Average real GDP growth 2010-2025; public external debt as percent of GDP in 2025)



Source: Authors' calculation

Back-loading of investment will also lead to a lower public debt burden. Investments are financed by drawing down of assets, which have been accumulated in recent years because of high oil revenues, and covering any shortfalls through external borrowing. As can be seen in Figure 9, not only does investing later and more gradually with increased productivity lead to higher growth, it also implies lower public external debt in 2025. Especially scenario INF-FL would lead to a rapid depletion of foreign assets.

4.3 Improved efficiency without scaled up investment

In an alternative scenario, it is assumed that government efficiency is increased, but without a scaling-up of government investment. Improved efficiency implies that less capital and labor is needed per unit produced. More specifically, it is assumed that, from 2012 and onwards, (i) government service productivity increases by 2 percent annually and (ii) new government capital produced increases by 2 percent annually from a given amount of investment spending. This implies that the same amount of recurrent spending produces 1 percent more services, applying to all inputs (labor, capital and intermediate), thereby reducing investment needs. Starting from a low level, efficiency gains in the short- and medium-term can be expected and could result from improved processes for investment management (project selection and implementation in particular), but also through better cost recovery for the provision of public services (Estache, 2005).

The efficiency gains are then invested in different sectors. Three different scenarios are considered, GOVEFF-INF, GOVEFF-HE and GOVEFF-HE+INF, as defined above.

In terms of reaching the MDGs, the results are mixed. Table 6 shows that more resources dedicated to infrastructure investment lead to lower poverty rates than focusing purely on health and education, while health outcomes are clearly better when more is invested in the health and education sector. Regarding education outcomes, the best performance in terms of net primary school enrolment can be achieved when combining efforts and investing the efficiency gains in both infrastructure and human development, highlighting the links between the sectors.

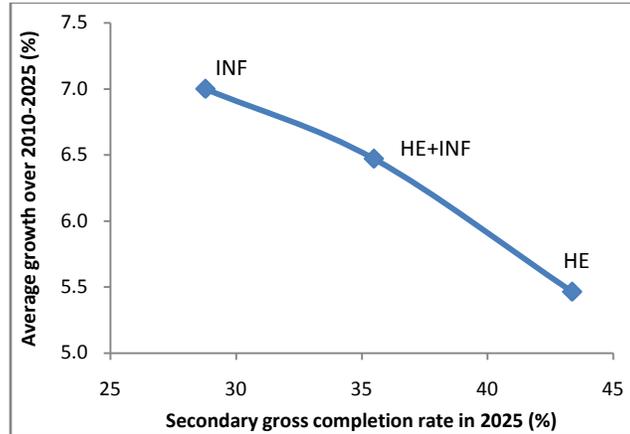
Table 6: Summary of MDG indicators in 2025

	Reference value (2009)				Infrastructure backloading				Increased government efficiency		
		BASE	INF-FL		0	15	30	45	HE	HE+INF	INF
MDG 1 (Poverty rate, percent)	51	24	21	20	19	18	18	24	20	18	
MDG 2 - net (Primary school completion rate, net, % of relevant age group)	12	44	49	52	53	55	56	82	72	56	
MDG 2 – gross (Primary school enrollment rate, gross, % of relevant age group)	102	93	92	92	92	92	92	90	91	92	
MDG 4 (Under-5 mortality rate, per 1,000 live births)	128	67	64	63	63	62	62	53	56	61	

Source: Authors' calculations

The trade-off between spending on health and education versus spending on infrastructure is also illustrated by Figure 10. Clearly, the highest average growth rates are achieved when using additional resources for infrastructure projects, while best education outcomes result from spending predominantly on health and education. Not focusing exclusively on one sector, but rather allocating the fruits from efficiency gains across both areas leads, thereby benefitting from positive feedback loops between the sectors, can lead to improved outcomes in growth as well as human development.

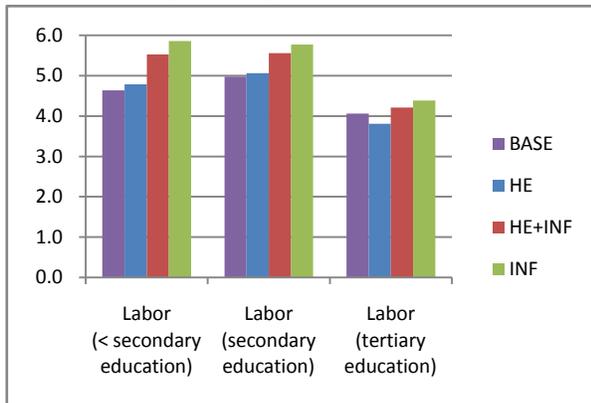
Figure 10: Trade-off between spending on infrastructure and health and education: secondary gross completion rate in 2025 versus average growth over 2010-2025



Source: Authors' calculations

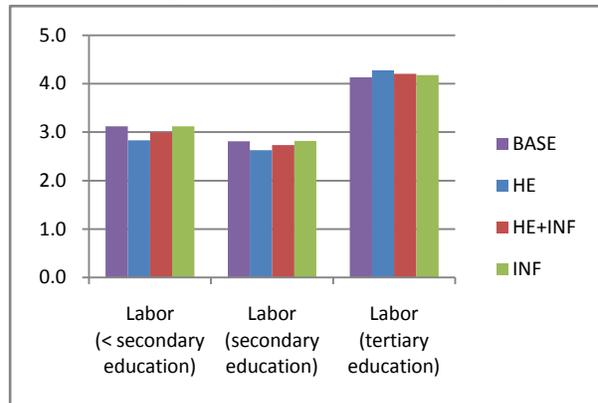
Regarding the effect on employment and wages, additional investments in infrastructure lead to the highest increases in real wages. The effect on employment levels, on the other hand, is mixed. The scenario GOVEFF-INF has a similar effect on employment levels as the baseline scenario, whereas increased spending in health and education implies more demand and employment growth for the highly educated (mainly teachers and doctors) and less employment growth for those with secondary education and less, compared to the baseline scenario

Figure 11: Development of real wages by educational level (average annual growth rate 2010-2025)



Source: Authors' calculations

Figure 12: Development of employment by educational level (average annual growth rate 2010-2025)



Source: Authors' calculations

The findings highlight that increased government efficiency can lead to significant improvements in outcomes, but the type and extent of improvement depend on which areas of government spending and services are scaled up as a response to increased government efficiency. The results also point to trade-offs between achieving higher growth and less poverty versus improving health and, especially, education outcomes.

5. Conclusion

This paper analyzes the impact of improving the efficiency of the government investment program on growth and employment in the Republic of Congo. The middle-income country disposes of a large amount of resources, mostly stemming from oil, but faces serious developmental challenges. One of the main constraints is the lack of provision of reliable infrastructure by the government. The authorities have, therefore, embarked on an ambitious investment plan to improve basic service provision, particularly targeting the transport and energy sectors. However, the capacity of the government to implement these infrastructure projects efficiently can be called into question, especially in the light of the recent very low ranking of the Republic of Congo in the Public Investment Management Index.

The results of the analysis show that the management of public investments is critical to maximize the impact of using the resource wealth of the Republic of Congo. Different scenarios have been developed to compare the effect of scaled-up infrastructure investments on employment and growth, depending on their timing and efficiency. By ensuring higher efficiency while slightly delaying investments, an increase in average annual growth rates by up to 1.3 percent can be realized.

A second set of simulations addresses the question in which sector resources that are freed by increased government efficiency should be invested. The results of the MAMS demonstrate the linkages and synergies between the different sectors. However, trade-offs between higher growth and improved social indicators need to be taken into account when considering spending on social sectors versus spending on infrastructure.

Recent efforts by the Congolese government to improve public finance management including procurement are steps in the right direction. However, in order to use the country's resources effectively and efficiently, public investment management needs to be improved in all areas of the project cycle.

Annex 1: Additional tables

Table A1.1. Government receipts and spending in 2009 and by simulation in 2025 (% of nominal GDP)

	2009	BASE	INF-FL	Infrastructure backloading				Increased government efficiency		
				0	15	30	45	HD	HD-INF	INF
Revenues and grants	28.3	20.9	20.5	20.3	20.2	20.1	20.0	21.0	20.6	20.4
Direct taxes	21.3	8.6	8.3	8.1	8.0	7.9	7.8	8.6	8.2	8.0
Import tariffs	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Other indirect taxes	4.8	9.0	9.0	8.9	8.9	8.9	8.9	9.1	9.1	9.1
Private transfers	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Other income	0.5	1.2	1.2	1.2	1.2	1.1	1.1	1.2	1.2	1.2
Total expenditure	27.5	31.6	30.5	30.0	29.7	29.4	29.1	32.0	30.3	29.6
Consumption	11.8	16.9	16.2	15.9	15.8	15.6	15.4	18.6	15.1	13.2
Fixed investment	10.3	9.7	9.2	9.1	8.9	8.8	8.7	8.3	10.3	11.5
Private transfers	3.9	4.8	4.8	4.7	4.7	4.7	4.7	4.8	4.7	4.7
Domestic interest payments	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Foreign interest payments	1.4	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Overall balance / Financing	0.8	-10.7	-10.0	-9.7	-9.5	-9.3	-9.2	-11.0	-9.8	-9.2
Domestic borrowing	-1.3	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.3
Foreign borrowing	0.4	10.3	9.6	9.3	9.2	9.0	8.8	10.6	9.4	8.9

Table A1.2. Real GDP at factor cost -- annual growth from base year to final year (%)

	2009	BASE	INF-FL	Infrastructure backloading				Increased government efficiency		
				0	15	30	45	HD	HD-INF	INF
Agriculture		7.3	7.8	8.0	8.2	8.3	8.5	7.2	8.0	8.5
Industry		-3.2	-3.1	-3.0	-3.0	-3.0	-3.0	-3.2	-3.0	-3.0
Oil		-5.9	-5.9	-5.9	-5.9	-5.9	-5.9	-5.9	-5.9	-5.9
Non-oil		9.1	9.3	9.4	9.5	9.6	9.6	9.0	9.4	9.6
Services		13.1	13.8	14.1	14.3	14.5	14.7	13.0	14.3	15.0
Non-government		17.1	17.9	18.3	18.5	18.7	18.9	16.8	18.4	19.1
Government		5.3	5.5	5.7	5.8	5.8	5.9	5.9	6.3	6.5
Total		5.6	6.1	6.3	6.5	6.6	6.8	5.5	6.5	7.0

Real GDP at factor cost -- contribution to GDP growth (%)

	2009	BASE	INF-FL	Infrastructure backloading				Increased government efficiency		
				0	15	30	45	HD	HD-INF	INF
Agriculture		1.0	1.1	1.1	1.1	1.1	1.2	1.0	1.1	1.2
Industry		-2.5	-2.5	-2.5	-2.5	-2.4	-2.4	-2.5	-2.5	-2.5
Oil		-3.1	-3.1	-3.1	-3.0	-3.0	-3.0	-3.1	-3.0	-3.0
Non-oil		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Services		7.1	7.5	7.7	7.8	8.0	8.1	7.0	7.8	8.3
Non-government		6.2	6.6	6.8	6.9	7.0	7.1	6.0	6.9	7.4
Government		0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	0.9
Total		5.6	6.1	6.3	6.5	6.6	6.8	5.5	6.5	7.0

Real GDP at factor cost -- shares in 2025 (%)

	2009	BASE	INF-FL	Infrastructure backloading				Increased government efficiency		
				0	15	30	45	HD	HD-INF	INF
Agriculture	9.2	11.6	11.7	11.7	11.7	11.7	11.7	11.8	11.7	11.6
Industry	67.2	27.9	26.8	26.4	26.1	25.8	25.5	28.4	26.8	26.1
Oil	63.2	21.6	20.7	20.4	20.2	20.0	19.8	21.9	20.8	20.4
Non-oil	4.1	6.3	6.1	6.0	5.9	5.8	5.8	6.5	6.0	5.7
Services	23.6	60.4	61.4	61.9	62.2	62.5	62.8	59.9	61.5	62.3
Non-government	11.3	46.5	48.0	48.7	49.1	49.5	49.9	46.2	49.7	51.4
Government	12.3	13.9	13.5	13.3	13.1	13.0	12.9	13.6	11.8	10.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table A1.3. Government recurrent expenditure -- annual growth from base year to final year (%)

		BASE	INF-FL	Infrastructure backloading				Increased government efficiency		
				0	15	30	45	HD	HD-INF	INF
Primary education		3.4	3.4	3.4	3.4	3.4	3.4	7.8	5.6	3.4
Secondary education		5.2	5.2	5.2	5.2	5.2	5.2	9.6	7.4	5.2
Tertiary education		10.2	10.2	10.2	10.2	10.2	10.2	14.6	12.4	10.2
Health		5.6	5.6	5.6	5.6	5.6	5.6	10.0	7.8	5.6
Infrastructure		5.8	6.9	7.5	7.9	8.3	8.6	5.8	7.8	8.8
Other government		5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
Total recurrent expenditure		5.7	5.9	6.0	6.1	6.1	6.2	7.1	6.6	6.3

Government recurrent expenditure -- share of GDP in 2025 (%)

	2009	BASE	INF-FL	Infrastructure backloading				Increased government efficiency		
				0	15	30	45	HD	HD-INF	INF
Primary education	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.8	0.5	0.3
Secondary education	0.5	0.8	0.7	0.7	0.7	0.7	0.7	1.3	0.8	0.5
Tertiary education	0.4	1.1	1.0	0.9	0.9	0.9	0.9	1.6	1.0	0.6
Health	1.3	1.8	1.7	1.7	1.6	1.6	1.6	3.4	2.1	1.4
Infrastructure	1.7	2.5	2.8	3.0	3.1	3.2	3.3	2.2	2.5	2.6
Other government	7.5	10.2	9.6	9.3	9.1	8.9	8.7	9.4	8.2	7.6
Total recurrent expenditure	3.9	4.8	4.8	4.7	4.7	4.7	4.7	4.8	4.7	4.7

Table A1.4. Government investment -- annual growth from base year to final year (%)

		BASE	INF-FL	Infrastructure backloading				Increased government efficiency		
				0	15	30	45	HD	HD-INF	INF
Primary education		8.1	8.1	8.1	8.1	8.1	8.1	12.3	9.9	3.4
Secondary education		14.2	14.2	14.2	14.2	14.2	14.2	18.2	15.8	9.8
Tertiary education		17.8	17.8	17.8	17.8	17.8	17.8	21.0	18.5	14.8
Health		2.5	2.5	2.5	2.5	2.5	2.5	6.0	3.8	-1.1
Infrastructure		3.0	3.2	3.3	4.5	5.6	6.7	3.0	7.3	9.5
Other government		6.1	6.1	6.0	6.0	6.1	6.1	2.3	2.5	2.6
Total investment		2.6	3.0	3.2	3.3	3.4	3.5	2.5	3.1	3.4

Government investment -- share of GDP in 2025 (%)

	2009	BASE	INF-FL	Infrastructure backloading				Increased government efficiency		
				0	15	30	45	HD	HD-INF	INF
Primary education	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0
Secondary education	0.2	0.8	0.7	0.7	0.7	0.7	0.6	1.3	0.9	0.4
Tertiary education	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1
Health	0.7	0.5	0.5	0.4	0.4	0.4	0.4	0.9	0.6	0.2
Infrastructure	7.1	5.5	5.3	5.3	5.2	5.2	5.1	4.2	7.2	9.4
Other government	2.2	2.7	2.6	2.5	2.4	2.4	2.4	1.6	1.5	1.4
Total investment	27.5	31.6	30.5	30.0	29.7	29.4	29.1	32.0	30.3	29.6

Annex 2: Brief description of MAMS⁶

MAMS (Maquette for MDG Simulations) is an economy-wide simulation model developed at the World Bank to analyze medium and long-run development strategies. The model integrates a relatively standard dynamic recursive computable general equilibrium (CGE) model with an additional module that links specific MDG or poverty-related interventions to poverty and other MDG achievements. We here provide a non-technical description of the structure of MAMS, using Figure A2.1 as our reference point.

The major building blocks of the model may be divided into activities (the entities that carry out production), commodities (activity outputs or, exceptionally, imports without domestic production; linked to markets), factors (also linked to markets), institutions (households, the government, and the rest of the world). In Figure A2.1, private investment financing also has its own box given the multiple links that exist between private investment demands and their financing. In any MAMS application (and database), most blocks in Figure A2.1 are disaggregated – the disaggregation in the Congo MAMS application is shown in Table A2.1.

In any year, the MAMS version of Congo's economy has the following structure. Activities produce, selling their output at home or abroad, and using their revenues to cover their costs (of intermediate inputs, factor hiring and taxes). Their decisions to pursue particular activities with certain levels of factor use are driven by profit maximization. The shares exported and sold domestically depend on the relative prices of their output in world and domestic markets.

MAMS includes three types of institutions: households, government, and the rest of the world. Households earn incomes from factors, transfers and interest from the government (with the interest due to loans from the households to the government), and transfers from the rest of the world, net of interest on household foreign debt, if any.⁷ These are used for direct taxes, savings, and consumption. The savings share depends on per-capita incomes. Their consumption decisions change in response to income and price changes. By construction (and as required by the household budget constraints), the consumption value of the households equals their income net of direct taxes and savings. The government gets its receipts from taxes and transfers from abroad; it uses these for consumption, transfers to households, and investments (providing the capital stocks required for producers of government services), drawing on domestic and foreign borrowing for supplementary investment funding. To remain within its budget constraint, it either adjusts some part(s) of its spending on the basis of available receipts or mobilizes additional receipts of one type or more in order to finance its spending plans. In the BASE scenario of the current analysis, additional receipts in the form of domestic taxes are mobilized to finance government spending plans. In the non-BASE simulations, government spending adjusts to fully exhaust available receipts. The rest of the world (which appears in the balance of payments) sends foreign currency to Congo in the form of transfers to its government and households (for the government net of interest payments on its foreign debt), FDI, loans, and export payments.

⁶ For more on MAMS, see Bourguignon et al. (2008). This paper and additional materials are available at www.worldbank.org/mams.

⁷ The household may lend to the government and borrow from the rest of the world; given this, it may receive interest payments from the government and make interest payments to the rest of the world.

Congo uses these inflows to finance its imports. The balance of payments clears (inflows and outflows are equalized) via adjustments in the real exchange rate (the ratio between the international and domestic price levels) which take place when the balance is in surplus or deficit.⁸ Private investment financing is provided from domestic private savings (net of lending to the government) and foreign direct investment (FDI). Private investment spending adjusts in response to changes in available funding.

In domestic commodity markets, flexible prices ensure balance between demands for domestic output from domestic demanders and supplies to the domestic market from domestic suppliers. The part of domestic demands that is for imports faces exogenous world prices – Congo is viewed as a small country in world markets without any impact on the import and export prices that it faces. Domestic demanders decide on import and domestic shares in their demands on the basis of the relative prices of commodities from these two sources. Similarly, domestic suppliers (the activities) decide on the shares for exports and domestic supplies on the basis of the relative prices received in these two markets.⁹

Factor markets reach balance between demands and supplies via wage (or rent) adjustments. Across all factors, the factor demand curves are downward-sloping reflecting the responses of production activities to changes in factor wages. On the supply side of the labor markets, unemployment is endogenous – for each labor type, the model includes a wage curve (a supply curve) that is upward-sloping until full employment is reached, at which point it becomes vertical (see Figure A2.2; its supply curve assumes a minimum unemployment rate of 5%). Unemployment is defined more broadly than in official statistics to include un- and under-employment. In the simulations, a broad definition of unemployment increases the scope for the existing labor force to generate a larger (smaller) amount of effective labor if the incentives to work were to improve (deteriorate); typically, this seems realistic. For non-labor factors, the supply curves and total employment are vertical in any single year.

The above discussion refers to the functioning of model economy in a single year. In MAMS, growth over time is endogenous. The economy grows due to accumulation of capital (determined by investment and depreciation), labor (determined by share of the population in labor force age, the labor force participation rate, and the educational system), other factors (on the basis of exogenous growth data), as well as because of improvements in total factor productivity (TFP). The educational system is important as it drives the evolution of the educational attainments of the labor force, influencing their productivity, but keeps the population who is enrolled in schools away from the labor force. Apart from an exogenous component, TFP depends on the levels of government capital stocks.

⁸ For example, starting from a balanced situation, a balance of payments surplus could arise from increases in foreign exchange receipts (perhaps due to an increase in foreign aid or the world price of an export). In this situation, the exchange rate would tend to appreciate, reducing the domestic prices of exports and imports relative to the prices of domestic output sold domestically. This relative price change would encourage domestic producers to switch part of their outputs from exports to domestic sales and induce domestic demanders to switch part of their demands from domestic sources to imports. This process would continue until the balance of payments surplus is eliminated. The opposite would happen in the case of a balance of payments deficit.

⁹ Individual production activities do not respond to changes in relative prices for exports and domestic sales if their output only has one destination, either exported in full or sold domestically in full. In the Congo database, construction and all types of government services are only sold domestically. By the same token, domestic demanders do not have a choice between imports and domestic output for commodities that only have one source; in the Congo database, this is the case for the forestry, oil and government service sectors. Such structural features reduce the flexibility of Congo's economy.

In addition to the relationships referred to in the preceding, the Congo MAMS application includes an additional set of functions that link education indicators and MDG 4 (under-five mortality) to a set of determinants. The determinants include the delivery of relevant services (in education and health) and other indicators, also allowing for the presence of synergies between MDGs, i.e. the fact that achievements in terms of one MDG can have an impact on other MDGs. For health, service delivery is expressed relative to the size of the population. In education, the model tracks base-year stocks of students and new entrants through the different grades of the three levels (primary, secondary, and tertiary). In each year, students will successfully complete their grade, repeat it, or drop out of their level. Student performance (rates of intake to the 1st grade of each cycle among the qualified population and rates of promotion) depends on educational quality (quantity of services per student), household welfare (measured by per-capita household consumption), the level of “other infrastructure”, wage incentives (expressed as the ratio between the wages for labor at the next higher and current levels of education for the student in question; an indicator of payoff from continued education), and health status (proxied by MDG 4). A built-in poverty module assumes that the distribution of per-capita consumption follows a lognormal distribution parameterized on the basis of the observed Gini coefficient. This information and data on the national poverty rate (in 2008) is used to compute standard Foster-Green-Thorbecke poverty indicators.

Figure A2.1. Aggregate payment flows in MAMS

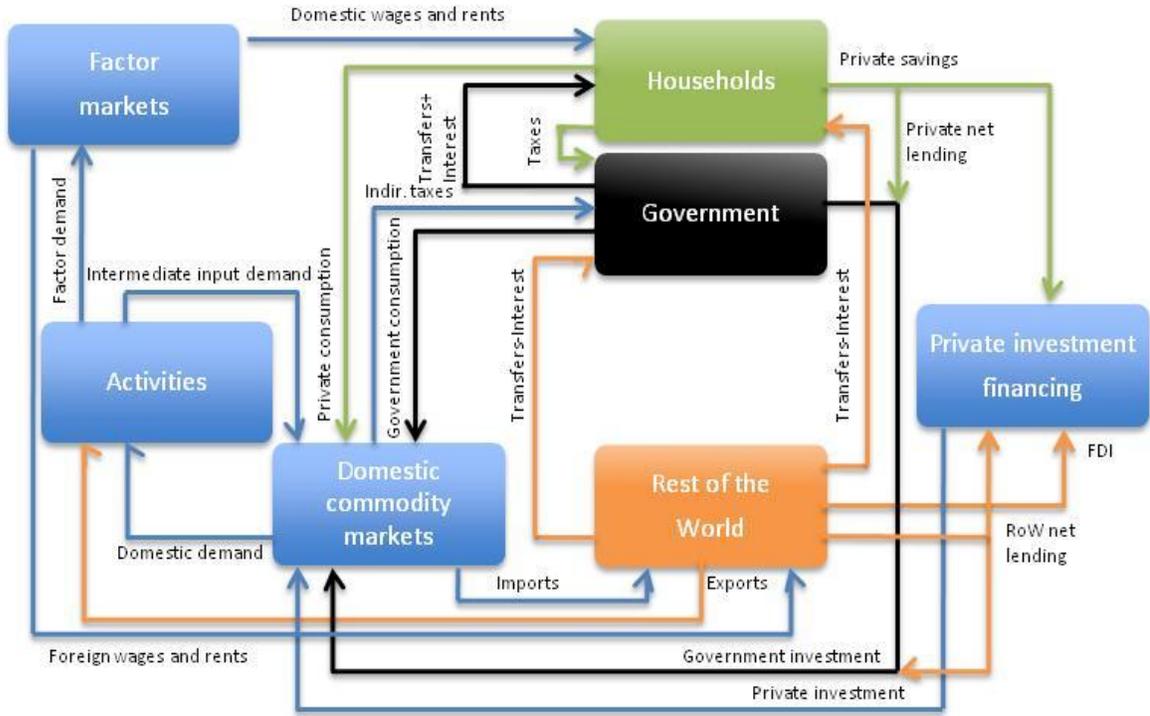


Figure A2.2. The labor market in MAMS

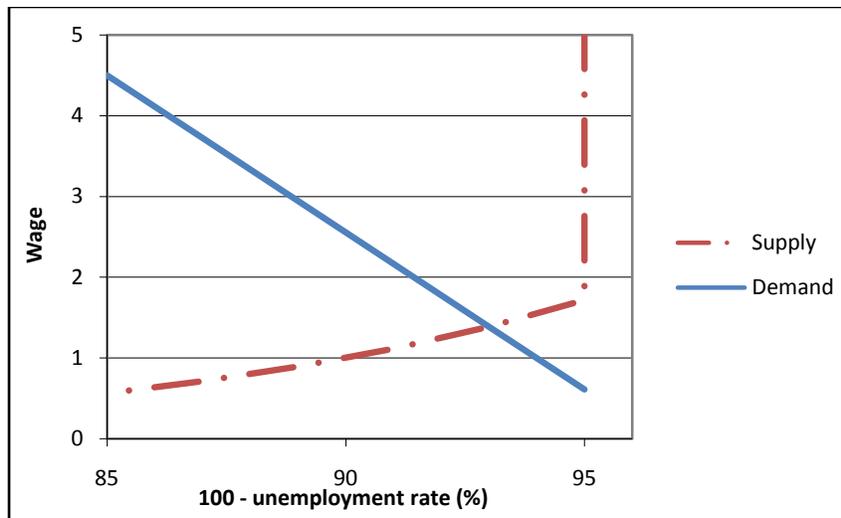


Table A2.1. Disaggregation of Congo MAMS

<i>Private sectors</i>	agriculture forestry oil construction other industry private services
<i>Government sectors</i>	education (divided into primary, secondary, and tertiary) health other infrastructure other government
<i>Factors</i>	labor - unskilled (< completed secondary) labor - skilled (completed secondary) labor - high-skilled (completed tertiary) crop land forestry land oil natural resource private capital government capital stocks (one per government sector)
<i>Institutions -- current accounts</i>	household government rest of world
<i>Auxiliary institutional Accounts</i>	taxes -- direct, import, other indirect domestic interest -- on domestic government debt foreign interest -- on foreign government debt
<i>Institutions -- capital accounts</i>	one account for every institution with a current account
<i>Investment</i>	private capital one investment account for each government service/capital stock stock change

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