

Economywide Simulations of Ethiopian MDG Strategies

by

Hans Lofgren
Carolina Diaz-Bonilla*

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*Development Economics Prospects Group, World Bank, Washington, D.C.
Hans Lofgren, Senior Economist: hlofgren@worldbank.org. Carolina Diaz-Bonilla,
Consultant: cdiazbonilla@worldbank.org. This paper reflects the views of the authors and
not necessarily those of the World Bank.

1. Introduction and Summary¹

As an input to the development of Ethiopia's MDG strategy, this paper presents a set of simulations that analyze the consequences of alternative scenarios. The scenarios were designed in consultation with the Ethiopian government. The analysis is based on the MAMS² model, an economywide simulation model that the World Bank has developed to analyze MDG strategies in different countries, with Ethiopia as a pilot case study.³ Many of the policies and foreign aid flows targeting MDGs have strong effects throughout the economy that feed back on the MDG indicators through markets for labor, goods, services, and foreign exchange. Therefore, economywide analysis of MDG strategies is a necessary complement to sectoral studies.

More specifically, the simulations explore the consequences of alternative MDG strategies that differ in terms of foreign aid requirements and their emphasis on growth, poverty reduction, and human development. All scenarios suggest that a considerable expansion in government consumption and investment is required to meet the different MDGs. Under our core MDG scenario, the share of government demand in GDP doubles from 29 percent in 2005 to 58 percent in 2015, while foreign aid per capita reaches US\$79 in 2015, which is almost five times the level in 2005.

Given that the amount of foreign financing required for this scenario may not be available and/or considering that such a rapid expansion in government services may not be feasible, our analysis explores two alternative scenarios that attempt to address the relative merits of a focus on public infrastructure versus a focus on human development in a resource-constrained setting. For both simulations, the government is constrained to

¹ In this paper, the section on model structure and database draws on earlier MAMS papers on Ethiopia, including Lofgren and Diaz-Bonilla (2005) and Bourguignon et al. (2004). The simulations addressing trade-offs between infrastructure and human development are new. The model and database were revised in anticipation of this new round of analysis.

² Maquette for MDG Simulations – MAMS

³ This core CGE model is an extension of the static, standard CGE model in Lofgren et al. (2002). See the technical documentation in Lofgren and Diaz-Bonilla (2006). The model is currently being applied in different regions, including some fifteen countries in Latin America and the Caribbean in the context of a joint World Bank – UNDP project.

receive 85 percent of the aid received in the core MDG scenario (that is, the present value of total foreign aid during the period 2006-2015 reaches around US\$ 26 billion as compared to US\$ 32 billion). Both simulations are therefore constrained to \$66 in foreign aid per capita in 2015. The scenario with a human development focus reaches the non-poverty MDGs but falls short of the poverty target (with a 2015 rate of 22 percent as against the target of 19 percent) and requires supplementary domestic taxation (raising the tax share in GDP from about 19 to 22 percent). The scenario focused on infrastructure produces more rapid GDP growth, reaches the poverty target (with a 2015 rate of 18.6 percent) and realizes more than 90 percent of the gain required for the other MDGs relative to the situation in 1990.

In Section 2, we briefly describe the MAMS model. In Section 3, we present the simulations and analyze their results. Readers who already are familiar with the model or primarily are interested in the results may skip Section 2.

2. Model structure and database

The MAMS model integrates a relatively standard (recursive) dynamic general equilibrium (GE) model with an additional MDG module that links specific MDG-related interventions to MDG achievements. The core GE model follows the disaggregation indicated in Table 1. As shown, the model has a relatively detailed treatment of government activities, which are classified into 10 functions: four types of education (1st and 2nd cycle primary, secondary, and tertiary), three types of health services (low-, medium- and high-tech, divided into government and non-government), water-sanitation, (other) infrastructure, and other government.⁴ Like other production activities, they use production factors, and intermediate inputs to produce an activity-specific output (in the case of the government, different types of services). The factors of production include three types of labor (those with less than high school, high school, and more than high

⁴ This classification is driven by the analytical needs of this study. The category “other government” covers other government programs, some of which also may be essential for growth and/or MDG achievements, for example measures promoting agricultural growth and targeted efforts directed at the poor and the hungry both in rural and urban areas.

school education), public capital stocks by government activity, and a private capital stock. The government finances its activities from domestic taxes, domestic borrowing, and foreign aid (borrowing and grants). Provision of education, health, and water-sanitation services contribute directly to the MDGs. Growth in the stock of public infrastructure capital (including roads, energy and irrigation) contribute to overall growth by adding to the productivity of other production activities. In health, the model accounts for the fact that NGOs and the private sector provide part of the services and the investments. The rest of the economy (representing agriculture, industry, and private, non-health services) is treated as a single production sector. Its output is exported and sold domestically, competing with imports.⁵ Apart from the government, the institutions of the economy are divided into (health) NGOs, a household, and the rest of the world.

The model is intended to capture key interactions between the pursuit of the MDGs and economic evolution. To keep it relatively simple, it does not cover all MDGs. It focuses on the ones with the greatest cost and the greatest interaction with the rest of the economy: universal primary school completion (MDG 2; measured by the net primary completion rate), reduced under-five and maternal mortality rates (MDGs 4 and 5), halting and reducing the incidence of HIV/AIDS (part of MDG 6), and increased access to improved water sources and sanitation (part of MDG 7). We also address achievements in terms of poverty reduction (MDG 1).

These different MDGs are covered in an additional set of functions that link the level of each MDG indicator to a set of determinants, as summarized in Table 2. The determinants include the delivery of relevant services (in education, health, and water-sanitation) 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. Outside education, 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 four cycles. In each year, students will successfully complete their grade,

⁵ In the model and the underlying database, production in the rest of the economy is currently being disaggregated into agriculture, industry, and private (non-health) services, drawing on Seyoum (2004) and the World Bank CEM Report No. 29383 (2004d).

repeat it, or drop out of their cycle. Student performance depends on educational quality (quantity of services per student), household welfare (measure by per-capita household consumption), the level of public 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). The achievement of MDG 2 requires that (very close to) all students in the relevant age cohort enter the 1st primary cycle (four years) and successfully complete each year within this cycle. The functions for education and the other MDGs have been calibrated to assure that, under base-year conditions, base-year performance is replicated and that, under a set of other conditions identified by sector studies, the target is fully achieved.

The model is built around an Ethiopian database for 2002, much of which is organized in a Social Accounting Matrix (SAM), supplemented by more detailed data related to the different MDGs and the labor market (including levels of service delivery required to meet the different MDGs, stocks of students at different educational levels and of labor by educational level, and student behavioral patterns in terms of graduation rates and other indicators) as well as elasticities in production, trade, consumption and in the different MDG functions. The data is primarily based on government and World Bank studies and data sources, including sector studies [see for example: MOFED (2005), Soucat (2005), Tan (2005), World Bank (2003), World Bank (2004a-2004e), World Bank and Ministry of Health Ethiopia (2004)]. The model is simulated for the period 2002-2015. For the initial period, 2002-2005, the model is tuned to available data so as to provide a starting point in 2005 that reflects the current state Ethiopia's economy according to preliminary data.

The model includes several links between the MDG module and the rest of the economy. An important link is that the provision of the additional government services needed to reach the MDGs requires additional resources – capital and investment, labor, and intermediate inputs – that become unavailable to the rest of the economy. The effects of any program very much depend on how the program is financed: from foreign sources,

from domestic taxes (which will reduce consumption), and/or from domestic borrowing (which will crowd out private investment). Even if foreign sources supply the finance, resources available for the rest of the economy are affected as increased demand for labor with a relatively high education withdraw this labor from employment elsewhere. Increased foreign aid may lead to exchange rate appreciation with economywide repercussions, including consumers benefiting from lower prices of imports and a loss of competitiveness for producers of tradables (exporters or producers of import-substitutes). At the same time, the pursuit of the MDGs generates additional resources as it influences the educational composition of the labor force, raising its average level of education. The performance of the rest of the economy will also influence the ease with which different MDGs can be achieved. Higher private incomes provide additional resources that enable private households to draw more benefit from government health and education programs. More rapid growth raises government revenues, strengthening the ability of governments to finance and operate efficient programs.

3. Simulations

The Base Simulation and General Model Assumptions

The BASE simulation is a business-as-usual moderate growth scenario in which specific MDG targets are not pursued. In terms of domestic policy, the different components of government consumption all grow at an exogenous rate of 4 percent per year, slightly above the rate of real GDP, and similar to the over-all growth trend of the economy in recent years.

For the other scenarios, growth rates for selected government services are endogenous, driven by the objective of achieving specified MDGs, while some of the exogenous growth rates are more rapid. Apart from the treatment of government consumption, the features of the BASE simulation are identical to those of the other three simulations. Starting from 2006, the (effective) direct and domestic indirect tax rates increase exogenously over time while foreign borrowing is assumed to stay constant at the 2005

level. Government investment is determined by the need to expand the government capital stock in proportion to the expansion in government service provision. Domestic borrowing from the Central Bank and others is exogenous. For the government account, foreign grants are flexible, over time increasing sufficiently to assure full coverage of the government financing gap. A flexible real exchange rate assures equality between inflows and outflows of foreign exchange. In the savings-investment balance, private investment is determined residually. All other savings and investment components are either exogenous (as is the case for foreign direct investment) or determined endogenously by various other rules.⁶ In the factor markets, supplies are driven by investment (for private capital) or a combination of demographic factors and the functioning of the educational system (for the different labor types). Flexible wages or rents clear the market for each factor. The CPI is the model numéraire – nominal income and price changes should be interpreted in the context of a fixed CPI.

The results of the different simulations are summarized in Tables 3-5 and Figures 1-25, with the following content: MDG indicators (Figures 1-6), major macro indicators (Figures 7-15), foreign aid (Figures 16-17), labor and capital wages and stocks (Figures 18-25).⁷ The results all pertain to the period 2005-2015. For the BASE scenario, annual real growth is roughly 3.5-4 percent for GDP and most other macro aggregates, i.e. a continuation of current trends (Table 3). The growth rate for government investment is the same as for government consumption. Private investment grows at a slightly higher rate than the rest of the economy. Wage growth is slightly negative for the period as a whole for private capital, labor with secondary education, and labor with less than secondary education (as the supplies of these factors grow relatively rapidly). Foreign aid per capita reaches around \$18, slightly more than the \$16 value of 2005. Aid channeled through the government budget decreases from around 11 to less than 10 percent of

⁶ For example, the private savings rate (out of post-tax private income) depends on per-capita income in a constant-elasticity formulation; the product of this rate and total private income defines private savings.

⁷ Appendix tables show additional simulation results and selected other data on Ethiopia and other countries.

GDP.⁸ The endogenous annual rate of growth in total factor productivity (TFP) is around 2 percent for the private sector and 0.5 percent for the different government sectors. This scenario registers significant improvements relative to the situation in 2005 for all MDG targets; however, it falls short of achieving any one of them. The incremental capital-output ratio (ICOR) for this scenario is relatively low, at 3.7, reflecting that, for this scenario, growth in the two parts of capital that contribute most directly to GDP growth (private capital and public infrastructure capital) is high relative to other (government) capital.⁹

Core MDG scenario

The simulation MDG-BASE targets the full achievement of MDGs 2, 4, 5, 7a, and 7b through an expansion of 1st cycle primary education, the different health services, and water and sanitation services. The provision of health services is also sufficient to reach the MDG target of halting the increase in HIV/AIDS via preventive services.¹⁰ Spending on higher educational cycles and public infrastructure expands rapidly to generate balanced growth in the educational system as a whole and to provide the infrastructure services (roads, energy, and irrigation) that are needed to support more rapid growth. MDG 1 is not targeted but monitored (assuming an elasticity of minus one for the headcount poverty rate with respect to real per-capita consumption). In the areas of health and water-sanitation, the service growth rate from 2005-2015 is constant, at a level that is sufficient to meet the MDG targets. Apart from the 1st cycle of primary schooling, educational expansion also takes place at a constant rate. For public infrastructure, expansion is front loaded with growth twice as rapid in the years 2005-2009 as during the remaining years. The rationale for this scenario is the need to build up the critical

⁸ In the different simulations, per-capita non-government aid increases from around US\$5 in 2005 to US\$7 in 2015, i.e. the share of aid that passes through the government budget increases from around 70 to 90 percent.

⁹ The ICOR is defined as the ratio between the change (from 2005 to 2015) in the total physical capital stock (both private and government; value at the base-year prices of new capital stock) and the change in real GDP at factor cost.

¹⁰ If donor support is available, these services could be supplemented by HIV/AIDS treatment programs. Given that such programs would be relatively import-intensive, their presence would not substantially alter the current analysis.

minimum in infrastructure that is needed for productivity-raising network effects. For 1st cycle primary education, frontloading is needed to make sure that, by 2012, (close to) every child in the proper cohort enters school and that (close to) every one in this group is able to graduate from the 1st grade in 2012 and successfully complete the remaining three grades in 2013-2015. Foreign grants grow in pace with government financing needs, while domestic financing is the same as under the BASE scenario.

The results for MDG-BASE indicate that a rapid expansion of government services is needed to achieve the MDG targets. The different government services related to the MDGs all grow at very high rates, ranging between 11 and 21 percent per year. Government MDG investment expands even more rapidly, by 21 to 40 percent, in response to the need to expand the government capital stock in proportion to service expansion. Growth in total government consumption and investment is kept in check due to the fact that “other government” (which is not directly related to MDG services) continues to grow at annual rates of 4 percent for each. Expressed as shares of GDP, the sum of government consumption and investment increases from 29 percent in 2005 to 58 percent in 2015.

This government expansion gives rise to a similarly drastic increase in foreign aid requirements, as foreign aid in the government budget increases from 11 percent of GDP in 2005 to 37 percent in 2015. In per-capita terms, total foreign aid reaches \$79 in 2015, almost five times the 2005 level. Compared to the BASE scenario, the present value (PV) of foreign aid is 4.5 times larger, reaching US\$ 31 billion (on the basis of a discount rate of 5 percent). Higher incomes and more rapid productivity growth (at 3.3 percent, attributable to the increase in public infrastructure) permit real GDP growth to accelerate by close to 2 percent, reaching a growth rate of 5.5 percent. The increase in aid inflows imposes a strong increase in the trade deficit, with a drastic appreciation of the real exchange rate (by 3.2 percent per year) providing the incentives for import and export growth to accelerate and decelerate, respectively. The combination of an increase in the trade deficit and more rapid GDP growth permits total absorption (the sum of private and government consumption and investment demand) to expand at 8.5 percent per year,

including private consumption and investment growth at annual rates of 5.4 and 8.3, respectively. Growth in private consumption leads to a fall in the headcount poverty rate from about 34 percent in 2005 to less than 19 percent in 2015. Across the different scenarios, the private sector grows at rates that are respectable, although clearly slower than MDG-related government services. This result reflects that the availability of foreign aid permits government expansion to take place without any significant crowding out of private investment. For this and the following scenarios, the ICOR is considerably higher than for BASE, between 6 and 7, given the allocation of a large share of investment to human development with a relatively low payoff in growth during the simulation period.

Focusing on human development

Given that the amount of foreign financing required for MDG-BASE may not be available and/or that such a rapid expansion in government services may not be considered feasible, our analysis explores two alternative scenarios that attempt to address the relative merits of a focus on public infrastructure versus a focus on human development in a resource-constrained setting.

The simulation MDG-INFCUT introduces a cut in public infrastructure spending that, in the context of an increase in effective domestic tax rates, is sufficient to limit foreign aid per capita in 2015 to about \$66, roughly four times the 2005 level. The achievement of the targeted (non-poverty) MDGs is not compromised. However, preliminary simulations indicated that reduced growth in infrastructure services alone is not sufficient to limit final-year per-capita aid to \$66 in the context of full achievement of the targeted non-poverty MDGs. This is due to the negative impact of less infrastructure on growth in incomes and government tax revenues; beyond a certain point, less spending on infrastructure increases the need for foreign aid. Given this result, this scenario combines a cut in infrastructure spending with an (additional) increase in direct tax rates (relative to the other scenarios).

The over-all result is a decline in growth rates to levels between BASE and MDG-BASE for all macro aggregates except government consumption, as a marginal increase is needed in the different government service sectors to achieve the MDGs. This increase is due to declining growth of household consumption and a lower level of infrastructure compared to the scenario MDG-BASE (both are factors that, along with government services, contribute positively to MDG achievements). The fact that the economy fails to achieve the poverty target points to the presence of a short- and medium-run trade-off between expanded human development and poverty reduction. The PV of foreign aid 2006-2015 falls by 15%, to about US\$ 26 billion. The GDP share for government demand reaches almost 57 percent, a slight decrease compared to MDG-BASE. Relative to GDP, tax revenue in 2015 reaches 21.5 percent of GDP, while the other scenarios remain between 16 and 18.8.¹¹

Focusing on growth and infrastructure

The simulation MDG-HDCUT stays within the same foreign aid constraint as MDG-INFCUT by reducing the targets that are imposed for the MDGs (other than MDG 1) to a uniform share of the improvement needed to fully achieve these MDGs (relative to the 1990 rate). This scenario generates a reduction in the expansion of the different government services that are directly related to the different MDGs (1st cycle primary education services, the different health services, and water-sanitation services), with an ensuing reduction in government spending and foreign aid requirements. As in MDG-INFCUT, aid levels reach US\$ 66 per capita in 2015.

The results for this simulation further demonstrates a trade-off between human development versus growth and poverty reduction in a setting where foreign aid is constrained or country absorptive capacity is limited. Compared to MDG-BASE, growth in government consumption and investment shifts down by 1.7 percentage points whereas growth in private consumption stays about the same and growth in investment declines

¹¹ In 2002, among the 75 countries for which the World Bank Development Data Platform includes information on total tax revenues, 10 had a tax share exceeding 26 percent. The unweighted average for the 75 countries was 17 percent.

by 0.1 percentage points. The GDP growth rate is virtually unchanged. Private capital grows by slightly less than in the MDG-BASE scenario, but growth for the infrastructure capital stock remains the same. The fact that, compared to MDG-INFCUT, export growth increases noticeably is due to more rapid GDP growth and productivity increases resulting from successful infrastructure investments.

In terms of the MDGs, the poverty target is achieved, although by a smaller margin. For the non-poverty MDGs, this simulation achieves 91 percent or more of the gain required relative to the situation in 1990. During the simulation period, it reaches the levels of MDG-BASE and MDG-INFCUT with a lag of only a few years.

The last two scenarios are comparable also in terms of the present value (PV) of foreign aid for 2006-2015, which reaches US\$ 26.3 billion, or about 85% of the US\$ 30.9 billion for MDG-BASE. The fact that MDG-HDCUT is less costly than MDG-BASE is primarily due to two factors: lower wages of workers with secondary education and more (slower expansion in human development leads to less pressure on this segment of the labor market); and considerable real resource savings from falling slightly short of achieving the non-poverty MDG targets by the 2015 deadline.

Given more rapid growth than for MDG-INFCUT and a slightly less ambitious agenda than for MDG-BASE, the 2015 GDP share for government demand, at around 52 percent, is slightly lower for this simulation than for the other two, which both landed at close to 57 percent of GDP. This observation leads to the related observation that the simulated scenarios involve an expansion in government demand relative to GDP that is extreme by international standards (in spite of relatively optimistic scenarios for GDP growth).¹²

One common feature of the different scenarios presented in this paper is that the GDP share for total government consumption is only slightly larger than the GDP share for total tax revenues – between 17 and 25 percent for the former and between 16 and 21.5

¹² In 2002, among the 84 countries for which the World Bank Development Data Platform included information on both government consumption and investment, only two had a combined share in excess of 50 percent of GDP while only four exceeded 40 percent. (See Appendix Table A.3.)

percent for the latter. This outcome suggests that, in spite of rapid government expansion, the Ethiopian government need not rely on foreign aid to cover the costs of its recurrent activities.

4. Conclusions

This paper presents a set of simulations that analyzes the consequences of alternative scenarios for Ethiopia's MDG strategy. The analysis is based on the MAMS model, an economywide simulation model developed to analyze MDG strategies in different countries, with Ethiopia as a pilot case study. The simulations explore the consequences of alternative MDG strategies that differ in terms of foreign aid requirements and their emphasis on growth, poverty reduction, and human development. All scenarios suggest that a considerable expansion in government consumption and investment is required to meet the different MDGs: the share of government demand in GDP for the core MDG scenario doubles to 58 percent in 2015 while foreign aid per capita increases five-fold to US\$79 in 2015 as compared to 2005.

Two alternative scenarios address the trade-offs between human development versus infrastructure spending in the case of resource constraints. For both simulations, the government is constrained to receive 85 percent of the aid received in the core MDG scenario, therefore foreign aid per capita is held at US\$66 in 2015. The scenario with a human development focus reaches the non-poverty MDGs but falls short of the poverty target (with a 2015 rate of 22 percent as against the target of 19 percent) and requires supplementary domestic taxation (raising the tax share in GDP from about 19 to 22 percent). The scenario focused on infrastructure produces more rapid GDP growth, reaches the poverty target and realizes more than 90 percent of the gain required for the other MDGs relative to the situation in 1990. While the parameters underlying these simulations are highly uncertain, the findings nevertheless point to trade-offs that should be considered in the development of Ethiopia's MDG strategy.

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Table 1. Model disaggregation

Activities/Commodities (11)

Non-government (4)

Private
Health sector low tech
Health sector medium tech
Health sector high tech

Government (10)

Education 1st primary cycle
Education 2nd primary cycle
Education secondary
Education tertiary
Health sector low tech
Health sector medium tech
Health sector high tech
Water & sanitation
Public infrastructure
Other government

Factors (17)

Labor with less than completed secondary education
Labor with completed secondary education
Labor with completed tertiary education
Capital (14) - one stock for each model activity

Institutions (4)

Household
NGO
Government
Rest of the World

Table 2. Determinants of MDG achievements

MDG	Determinants				
	Level of service delivery*	Per-capita household consumption	Wage incentives	Public infrastructure	Other MDGs
1		x			
2	x	x	x	x	4
4	x	x		x	7a, 7b
5	x	x		x	7a, 7b
7a	x	x		x	
7b	x	x		x	

Note: (*) The services covered are 1st cycle public education services (MDG2), different types of health services (both public and private) (MDGs 4 and 5), and public water-sanitation services (MDGs 7a and 7b). Education services are expressed per student, reflecting amount of class-room space, teacher time, and materials inputs per student (an indicator of educational quality).

Table 3. Real growth and MDG data 2006-2015 (various units) (1)

	2005	base	mdg-base	mdg-infcut	mdg-hdcut	target
Macro totals	mn US\$	real annual growth 2006-2015 (%)				
Absorption*	10150.4	3.4	8.5	7.4	7.9	
GDP at market prices	8524.4	3.5	5.7	5.1	5.7	
Private consumption	6731.4	3.1	5.4	4.4	5.4	
Government consumption	1453.2	4.0	8.4	9.1	6.7	
Private investment	946.3	4.2	8.3	6.9	8.2	
Government investment	1019.5	4.0	20.0	17.7	18.3	
Exports	1284.1	3.8	-0.8	-0.9	0.7	
Imports	2910.0	3.3	12.6	11.0	11.2	
GDP at factor cost (total)	7700.0	3.6	5.5	4.9	5.5	
GDP at factor cost (private sector)	7102.3	3.5	5.2	4.4	5.4	
GDP at factor cost (government)	597.7	4.0	8.7	9.6	7.3	
Real exchange rate (indexed)	1.0	0.3	-3.2	-2.9	-2.3	
Government Consumption	mn US\$	real annual growth 2006-2015 (%)				
1st cycle primary education	94.5	4.0	15.6	19.1	9.2	
2nd cycle primary education	67.5	4.0	12.9	12.9	12.9	
Secondary education	55.6	4.0	11.2	11.2	11.2	
Tertiary education	51.2	4.0	13.1	13.1	13.1	
Low-tech health	22.0	4.0	14.7	16.4	8.0	
Medium-tech health	31.0	4.0	11.9	13.3	6.6	
High-tech health	110.6	4.0	15.5	17.3	8.5	
Water and sanitation	16.3	4.0	21.4	22.0	20.4	
Public infrastructure	17.0	4.0	15.4	11.6	15.4	
Other government	987.7	4.0	4.0	4.0	4.0	
Government Investment	mn US\$	real annual growth 2006-2015 (%)				
1st cycle primary education	18.6	4.0	24.1	30.1	12.3	
2nd cycle primary education	13.7	4.0	24.4	24.4	24.4	
Secondary education	26.6	4.0	21.1	21.1	21.1	
Tertiary education	36.7	4.0	24.9	24.9	24.9	
Low-tech health	16.3	4.0	28.0	31.2	14.3	
Medium-tech health	23.9	4.0	22.6	25.3	10.8	
High-tech health	45.3	4.0	29.6	32.9	15.3	
Water and sanitation	15.4	4.0	40.4	41.3	38.5	
Public infrastructure	378.5	4.0	24.6	17.4	24.6	
Other government	444.4	4.0	4.0	4.0	4.0	
Factor wages (unit rents)	'000 birr/yr	nominal annual growth 2006-2015 (%)				
Labor (< secondary education)	0.8	-0.4	3.8	3.0	3.3	
Labor (secondary education)	2.1	-0.8	1.4	1.1	0.9	
Labor (tertiary education)	9.5	1.9	3.1	3.1	2.3	
Private capital	2.7	-0.3	0.4	0.0	0.6	
Factor quantities	mn	real annual growth 2006-2015 (%)				
Labor (< secondary education)	29.8	3.5	1.9	1.8	2.2	
Labor (secondary education)	2.3	3.9	5.0	5.0	4.8	
Labor (tertiary education)	0.2	1.9	4.4	4.2	4.4	
Private capital	7.7	3.5	4.9	4.5	4.7	
ICOR		3.7	6.8	6.5	6.2	
MDG indicators (4)	rate in 2005	rate in 2015				
MDG 1: headcount poverty rate (%)	33.8	27.8	18.6	21.7	18.6	19.2
MDG 2: 1st cycle primary net completion rate (%)	29.1	48.0	99.9	100.0	93.5	100.0
MDG 4: under-5 mortality rate (per 1000 live births)	156.1	110.1	68.0	67.8	79.4	68.0
MDG 5: maternal mortality rate (per 100000 live births)	579.8	385.7	217.5	216.7	261.7	217.5
MDG 7a: access to safe drinking water (%)	24.4	26.4	62.5	62.5	59.4	62.5
MDG 7b: access to improved sanitation (%)	12.0	14.1	54.0	54.1	50.5	54.0

Note:

1. Simulation names and description: BASE = business-as-usual scenario; MDG-BASE = core MDG scenario

BASE = business-as-usual scenario

MDG-BASE = core MDG scenario

MDG-MIX = MDG scenario with smaller increase in foreign aid

MDG-INFCUT = MDG scenario with reduced spending on infrastructure (human-development focus)

MDG-HDCUT = MDG scenario with reduced spending on human-development (growth focus)

2. Macro closures: Government: fixed tax rates and borrowing; flexible foreign grants. Rest of World: flexible real exchange rate
Savings-Investment: fixed MPS, flexible *private* investment. CPI is the numeraire

3. 2005 values are simulated; the model is solved for 2002-2015

4. The 1990 values are: 38.4 (MDG 1); 24.0 (MDG 2); 204.0 (MDG 4); 870 (MDG 5); 25.0 (MDG 7a); 8.0 (MDG 7b)

The targeted changes relative to the 1990 value: 50% cut (MDG 1); reach 100% in 2015 (MDG 2); 2/3 cut (MDG 4); 3/4 cut (MDG 5); 50% cut in share without (MDG 7a); 50% cut in share without (MDG 7b).

Table 4. Macro and government data in 2005 and by simulation in 2015 (% of GDP)

	2005	2015			
		base	mdg-base	mdg-infcut	mdg-hdcut
Macro totals (% of GDP)					
Absorption*	119.1	118.4	141.7	138.6	138.5
Private consumption	79.0	76.0	72.2	70.6	74.4
Government consumption	17.0	17.6	21.6	24.7	18.6
Private investment	11.1	12.1	12.0	11.3	12.5
Government investment	12.0	12.7	35.9	32.0	33.0
Exports	15.1	15.9	5.9	6.4	7.5
Imports	-34.1	-34.3	-47.6	-44.9	-46.0
Government incomes (% of GDP)					
Direct taxes	6.3	6.0	5.8	8.7	3.5
Import taxes	6.4	6.2	7.0	6.9	6.9
Other indirect taxes	3.3	6.3	6.0	5.9	6.1
Central bank borrowing	1.2	1.4	1.1	1.1	1.1
Other domestic borrowing	2.0	2.5	1.9	2.1	2.0
Foreign borrowing	5.8	4.2	2.5	2.7	2.7
Foreign grants	5.1	5.4	34.5	30.5	30.5
Net other capital inflows and errors	0.0	0.0	0.0	0.0	0.0
Total	30.1	32.0	58.7	57.9	52.8
Foreign aid per capita (US\$) (2)	16.2	18.1	79.4	66.4	66.4
Government recurrent spending (% of GDP)					
1st cycle primary education	1.1	1.1	2.6	3.7	1.4
2nd cycle primary education	0.8	0.8	1.4	1.6	1.4
Secondary education	0.7	0.7	1.1	1.2	1.1
Tertiary education	0.6	0.6	1.2	1.3	1.2
Low-tech health	0.3	0.3	0.6	0.7	0.3
Medium-tech health	0.4	0.4	0.6	0.7	0.4
High-tech health	1.3	1.4	3.0	3.8	1.6
Water and sanitation	0.2	0.2	0.8	0.9	0.7
Public infrastructure	0.2	0.2	0.5	0.4	0.5
Other government	11.6	12.0	9.9	10.5	9.9
Domestic interest payments	0.2	0.7	0.5	0.5	0.5
Foreign interest payments	0.8	1.1	0.6	0.7	0.7
<i>Total recurrent government spending</i>	<i>18.1</i>	<i>19.3</i>	<i>22.8</i>	<i>25.9</i>	<i>19.8</i>
Government capital spending (% of GDP)					
1st cycle primary education	0.2	0.2	0.9	1.6	0.4
2nd cycle primary education	0.2	0.2	0.7	0.7	0.7
Secondary education	0.3	0.3	1.0	1.1	1.1
Tertiary education	0.4	0.5	1.9	2.1	2.0
Low-tech health	0.2	0.2	1.1	1.5	0.4
Medium-tech health	0.3	0.3	1.0	1.4	0.4
High-tech health	0.5	0.6	3.4	4.8	1.1
Water and sanitation	0.2	0.2	2.6	3.0	2.4
Public infrastructure	4.4	4.7	19.4	11.6	20.5
Other government	5.2	5.5	3.7	4.0	4.0
<i>Total capital government spending</i>	<i>12.0</i>	<i>12.7</i>	<i>35.9</i>	<i>32.0</i>	<i>33.0</i>
Total government spending (recur. + capital)	30.1	32.0	58.7	57.9	52.8

Note:

1. The simulations are defined under Table 1.
2. Foreign aid per capita includes allowance for aid outside the government budget. In per-capita terms, aid in the government budget was around US\$11 in 2005.

Table 5. Total government spending and incomes 2006-2015 (US\$mn 2005)

	total 2006-2015			
	base	mdg-base	mdg-infcut	mdg-hdcut
Government incomes				
Direct taxes	6,372.4	7,299.2	7,423.3	6,864.1
Import taxes	6,517.9	8,510.5	8,018.7	8,240.3
Other indirect taxes	5,042.7	5,832.8	5,500.4	5,818.5
Central Bank borrowing	1,353.8	1,353.8	1,353.8	1,353.8
Other domestic borrowing	2,517.1	2,517.1	2,517.1	2,517.1
Foreign Borrowing	5,038.0	4,141.6	4,201.2	4,338.1
Foreign grants	5,424.5	35,903.3	30,313.6	31,233.9
Net other capital inflows	0.0	0.0	0.0	0.0
Total	32,266.4	65,558.3	59,328.2	60,365.7
PV of foreign aid	6,789.9	30,938.1	26,297.3	26,297.3
Government recurrent spending				
1st cycle primary education	1,132.0	2,481.9	3,046.4	1,655.7
2nd cycle primary education	810.4	1,404.4	1,398.5	1,367.5
Secondary education	718.2	1,105.6	1,108.4	1,080.3
Tertiary education	645.9	1,084.6	1,084.4	1,070.7
Low-tech health	274.4	491.2	538.3	341.6
Medium-tech health	386.5	591.4	636.9	442.9
High-tech health	1,387.2	2,598.3	2,870.5	1,763.8
Water and sanitation	200.1	558.3	571.2	514.8
Public infrastructure	208.9	456.4	357.4	447.4
Other government	12,205.7	12,841.2	12,762.7	12,676.2
Domestic interest payments	454.0	454.0	454.0	454.0
Foreign interest payments	1,030.9	842.6	853.2	885.7
Government capital spending				
1st cycle primary education	233.5	1,180.0	1,718.6	540.8
2nd cycle primary education	171.6	662.4	665.4	678.5
Secondary education	334.9	1,046.6	1,051.5	1,071.6
Tertiary education	461.3	1,838.5	1,846.8	1,883.3
Low-tech health	205.4	989.5	1,204.9	413.8
Medium-tech health	299.8	1,029.5	1,227.9	471.1
High-tech health	569.2	3,019.4	3,699.3	1,229.9
Water and sanitation	194.0	1,931.2	2,046.2	1,780.3
Public infrastructure	4,757.1	23,853.9	15,059.0	24,387.0
Other government	5,585.4	5,097.3	5,126.7	5,208.7
Total government spending (recur. + capital)	32,266.4	65,558.3	59,328.2	60,365.7

**Table A.1. Balance of payments in 2005 and final year by simulation
(% of GDP)**

	2005	base	mdg-base	mdg-inf	mdg-hd
Payments					
Imports	22.3	21.6	22.2	22.0	22.1
Factor payments	0.2	2.2	1.7	1.7	1.8
Interest payments	0.9	1.1	0.6	0.7	0.7
Total	35.2	37.6	49.9	47.4	48.5
Receipts					
Exports	15.1	15.9	5.9	6.4	7.5
Private Transfers	8.5	10.6	6.2	6.8	6.8
FDI	0.7	1.6	0.9	1.0	1.0
Foreign borrowing	5.8	4.2	2.5	2.7	2.7
Foreign grants	5.1	5.4	34.5	30.5	30.5
Net other*	0.0	0.0	0.0	0.0	0.0
Total	35.2	37.6	49.9	47.4	48.5

*Net other includes changes in Central Bank reserves and exceptional financing.

**Table A.2. Aggregate savings-investment balance in 2005 and final year
by simulation (% of GDP)**

	2005	base	mdg-base	mdg-inf	mdg-hd
Savings					
Private	13.6	14.4	14.1	13.5	14.6
Government	2.9	7.9	1.1	1.1	2.3
Rest of world*	6.6	2.4	32.8	28.6	28.6
Total	23.1	24.8	47.9	43.3	45.5
Investment					
Public	12.0	12.7	35.9	32.0	33.0
Private	11.1	12.1	12.0	11.3	12.5
Total	23.1	24.8	47.9	43.3	45.5

Table A.3. Government consumption and investment as shares of GDP, available countries, 2002 (%)

Country	gov c+i % of GDP	pub GFCF % of GDP	gov cons % of GDP	Country	gov c+i % of GDP	pub GFCF % of GDP	gov cons % of GDP
Eritrea	65.5	21.7	43.7	Bolivia	20.8	5.4	15.4
West Bank and Gaza	54.8	3.0	51.7	Uganda	20.8	5.3	15.5
Mauritania	45.9	27.4	18.4	Gambia, The	20.4	7.5	12.9
Botswana	44.7	11.4	33.3	Burkina Faso	20.4	7.2	13.1
Grenada	38.6	21.8	16.8	South Africa	20.1	1.4	18.7
Guyana	38.5	12.6	25.9	Mauritius	19.8	7.0	12.8
Sao Tome and Principe	37.9	14.8	23.1	Benin	19.4	6.4	13.0
Suriname	37.6	3.1	34.5	Central African Republic	19.4	7.6	11.8
St. Lucia	36.9	9.9	26.9	Turkey	19.3	5.3	14.0
Namibia	36.6	9.2	27.4	Burundi	19.2	4.6	14.6
Antigua and Barbuda	35.7	7.4	28.3	Rwanda	18.9	6.9	12.0
Seychelles	35.3	9.4	25.9	Russian Federation	18.8	1.8	17.0
Nigeria	34.9	10.2	24.7	Zimbabwe	18.7	1.7	16.9
St. Vincent and the Grenadines	33.3	12.0	21.2	Honduras	18.6	4.8	13.8
China	31.1	17.9	13.2	Jamaica	18.4	2.1	16.3
Ethiopia	30.9	11.5	19.3	Yemen, Rep.	18.3	4.3	13.9
St. Kitts and Nevis	30.2	11.3	18.9	Thailand	18.1	7.0	11.2
Jordan	29.4	6.7	22.7	Chad	17.7	10.1	7.6
Lesotho	28.8	9.9	18.9	Mali	17.7	7.0	10.7
Dominica	28.3	6.6	21.7	Ghana	17.5	6.1	11.4
Congo, Rep.	27.0	8.6	18.4	Singapore	17.5	5.4	12.1
Macedonia, FYR	26.9	4.6	22.4	Tanzania	17.2	7.6	9.6
Malawi	26.3	8.0	18.4	Chile	16.6	4.6	12.0
Belize	25.6	12.9	12.7	Egypt, Arab Rep.	16.0	5.7	10.3
Algeria	25.5	10.2	15.3	Cambodia	16.0	10.2	5.8
Croatia	25.4	4.4	21.0	Trinidad and Tobago	15.9	4.7	11.2
Mozambique	25.3	14.3	11.0	Mexico	15.4	3.3	12.1
Morocco	25.1	5.0	20.1	Uruguay	15.3	2.5	12.9
Barbados	24.9	8.2	16.7	Dominican Republic	15.2	7.0	8.3
Sierra Leone	24.8	5.2	19.6	Albania	14.7	6.2	8.5
Zambia	24.8	11.8	13.0	Venezuela, RB	14.6	6.5	8.1
Syrian Arab Republic	24.1	12.9	11.2	Tajikistan	14.1	5.4	8.7
Comoros	24.0	4.8	19.3	Lebanon	14.0	1.2	12.9
Kenya	23.8	4.6	19.1	Cameroon	13.6	1.6	12.1
Cape Verde	23.7	11.7	12.0	El Salvador	13.5	3.4	10.1
Iran, Islamic Rep.	23.3	8.8	14.6	Argentina	13.1	0.9	12.2
Nicaragua	22.7	6.8	15.9	Madagascar	13.0	4.8	8.2
Swaziland	22.6	5.9	16.6	Paraguay	11.8	4.1	7.7
Guinea-Bissau	22.5	9.6	12.8	Guinea	11.6	4.0	7.5
Senegal	22.3	7.9	14.5	Cote d'Ivoire	10.8	3.2	7.7
Serbia and Montenegro	21.9	3.6	18.3	Togo	9.8	1.4	8.4
Niger	21.0	8.8	12.2	Congo, Dem. Rep.	3.9	0.1	3.8

Source: World Bank, Development Data Platform, July 2005

Figure 1. MDG 1: Share of Population Living on \$1 (PPP) per day or less (%).

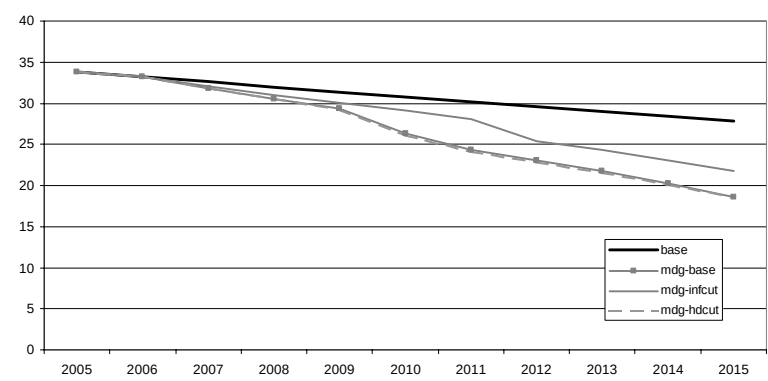


Figure 2. MDG 2: Net Primary School Completion Rate (%).

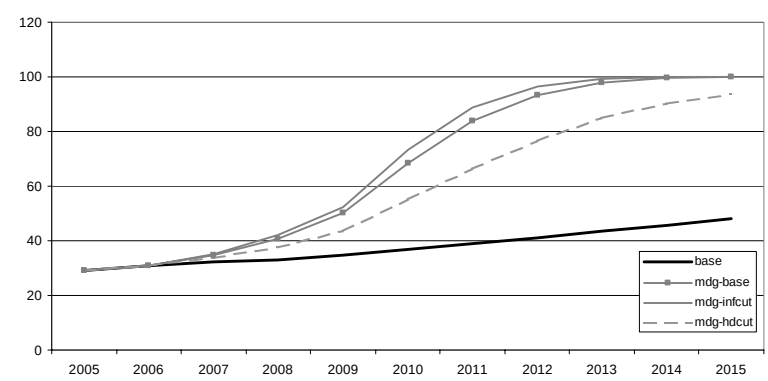


Figure 3. MDG 4: Under-Five Mortality Per 1,000 Live Births.

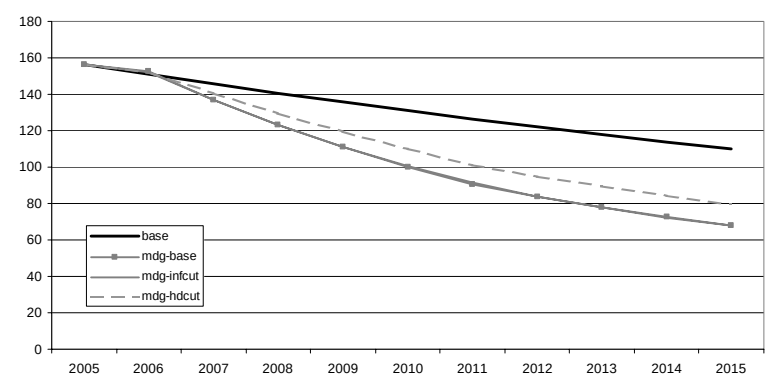


Figure 4. MDG 5: Maternal Mortality per 100,000 Live Births.

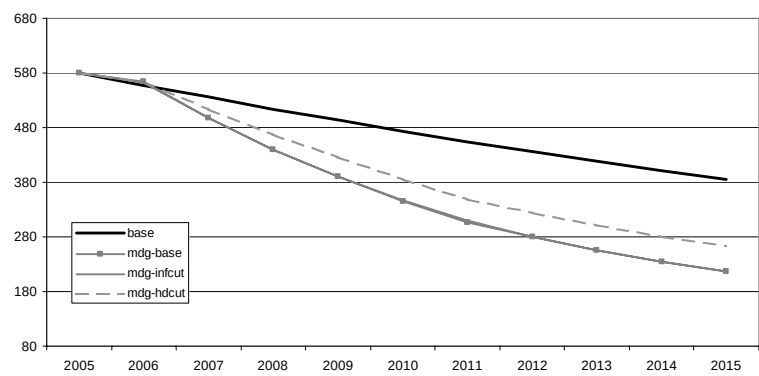


Figure 5. MDG 7a: Share of population with access to improved water (percent).

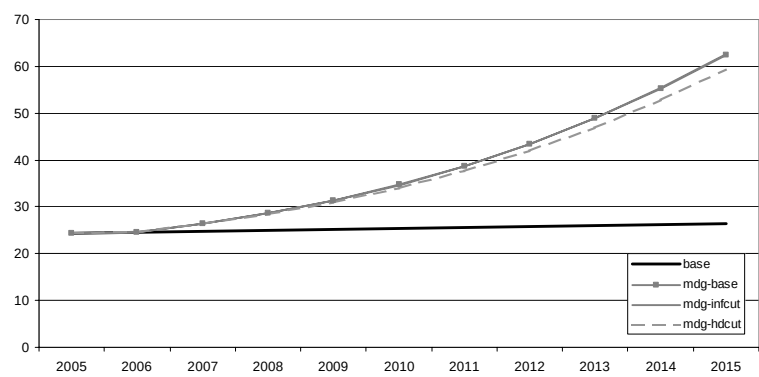


Figure 6. MDG 7b: Share of population with access to improved sanitation (percent).

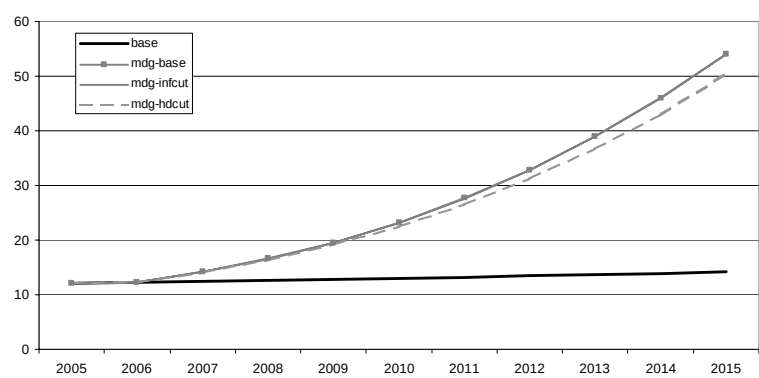


Figure 7. Absorption (Gross National Expenditure) (Index 2005 = 100).

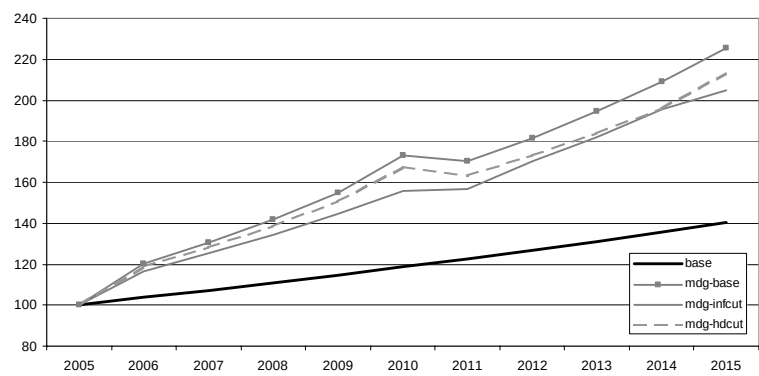


Figure 8. Real GDP at market prices (Index 2005 = 100).

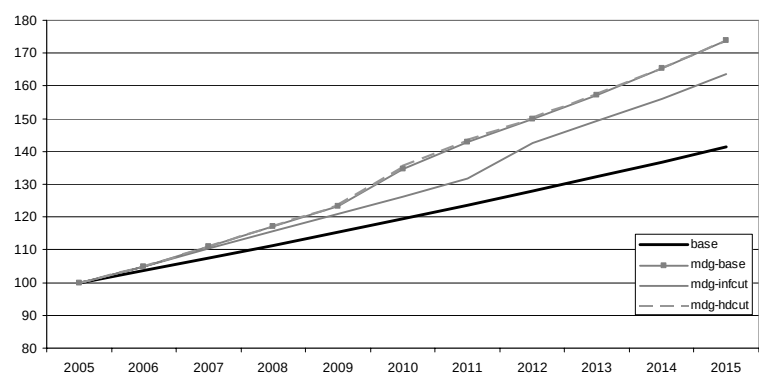


Figure 9. Private Consumption (Index 2005 = 100).

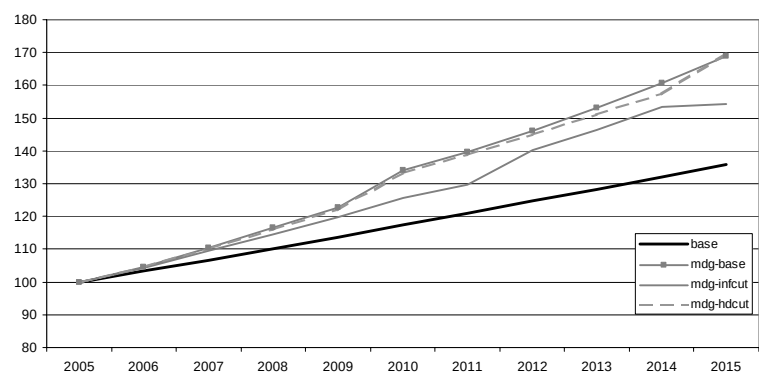


Figure 10. Government Consumption (Index 2005 = 100).

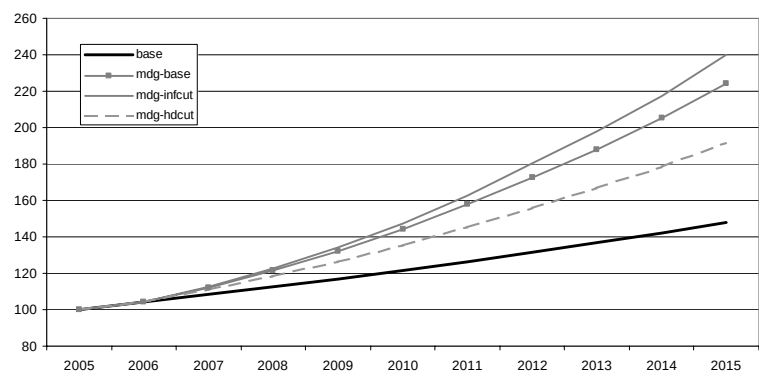


Figure 11. Private Investment (Index 2005 = 100).

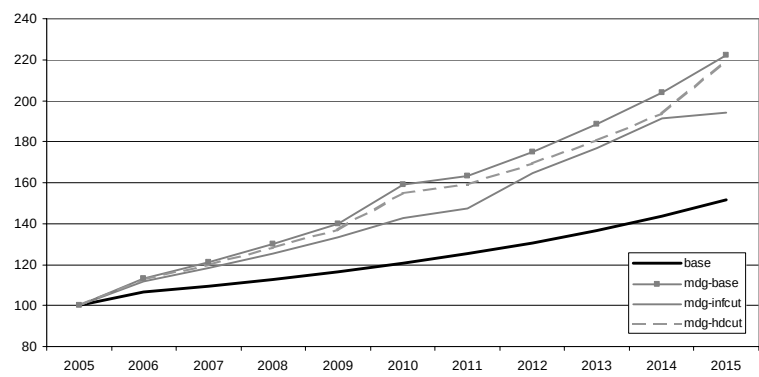


Figure 12. Government Investment (Index 2005 = 100).

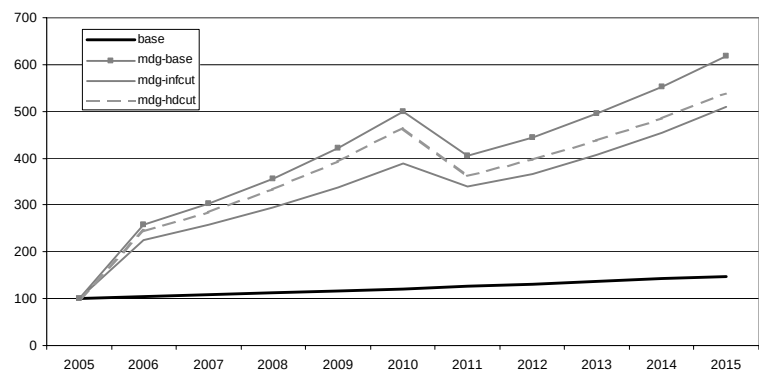


Figure 13. Exports (Index 2005 = 100).

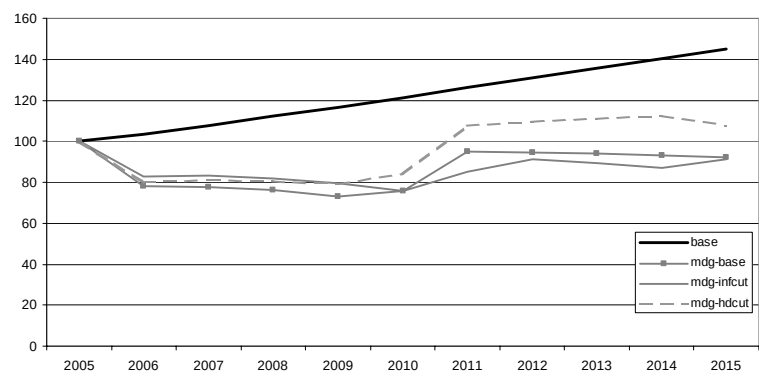


Figure 14. Imports (Index 2005 = 100).

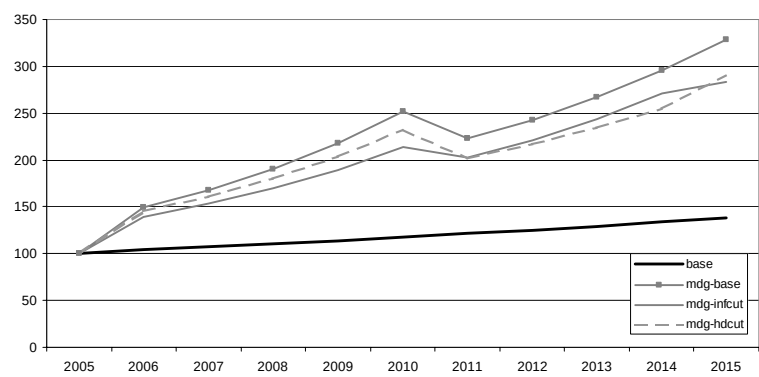


Figure 15. Real Exchange Rate (Index 2005 = 100).

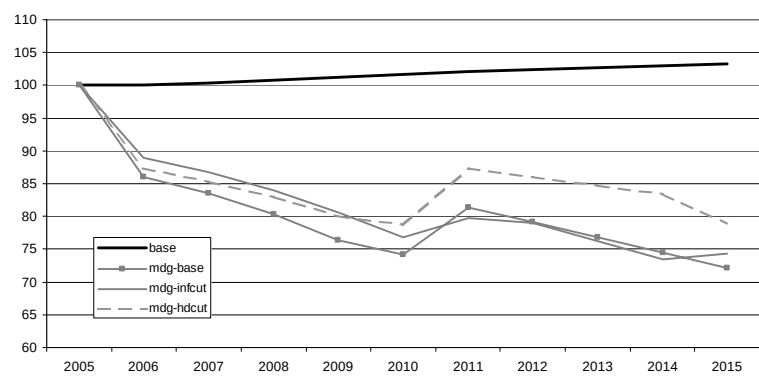


Figure 16. Present Value of Foreign Aid 2006-2015 (2005 US\$ bn)

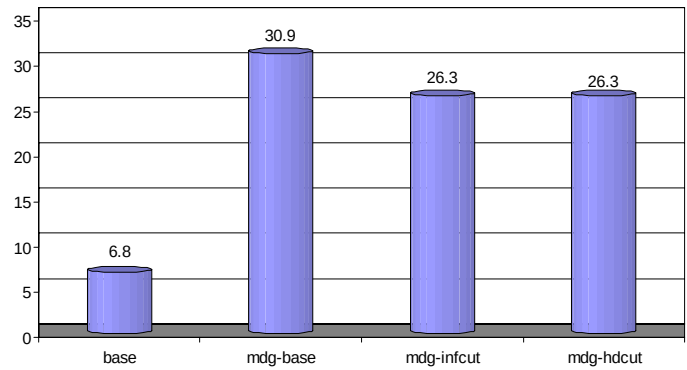


Figure 17. Foreign Aid Per Capita (2005 US\$)

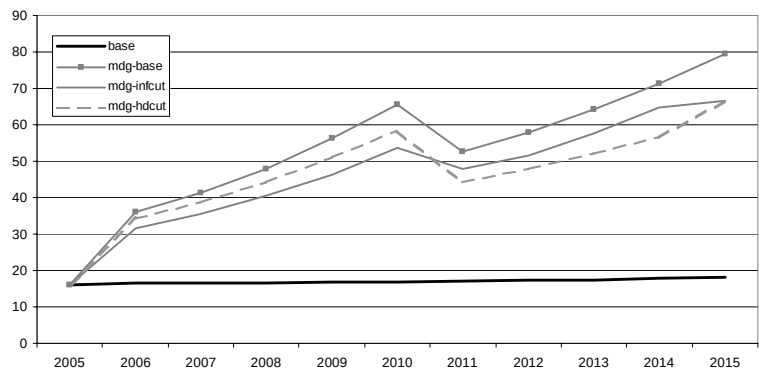


Figure 18. Workers with less than Secondary-School Education (millions).

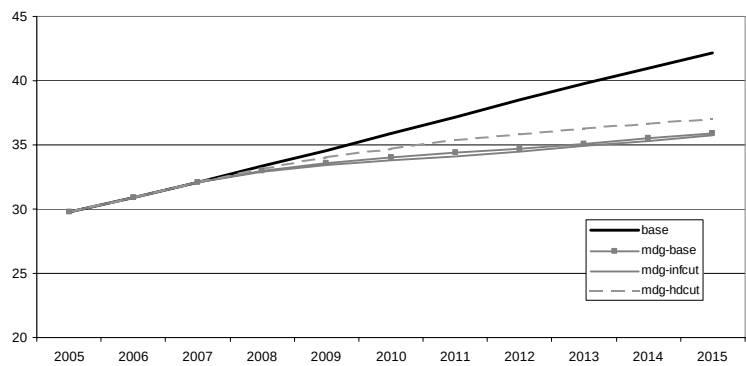


Figure 19. Secondary-School Educated Workers (millions).

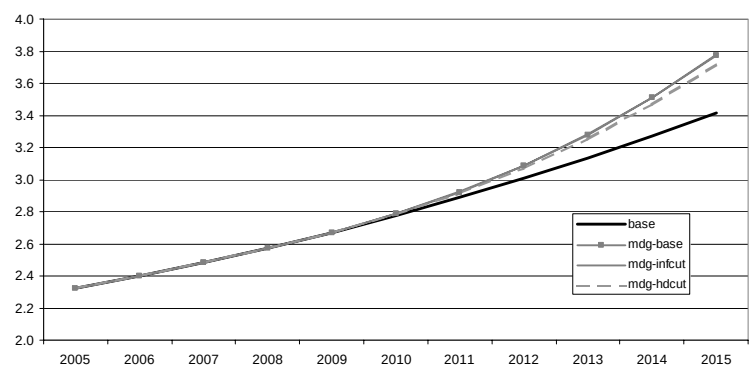


Figure 20. Workers with more than Secondary-School Education (millions).

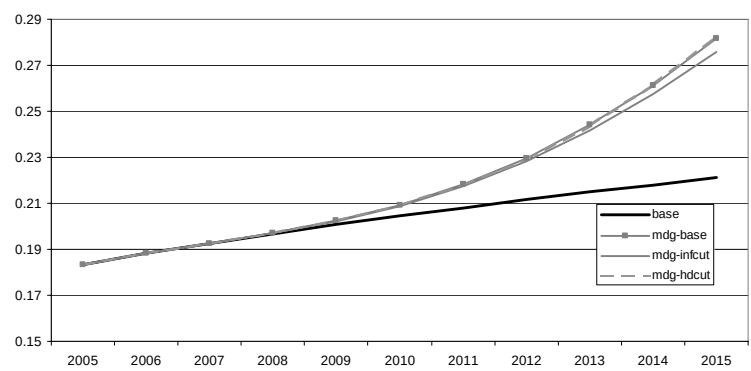


Figure 21. Stock of Private Capital (Index: 2005 = 100).

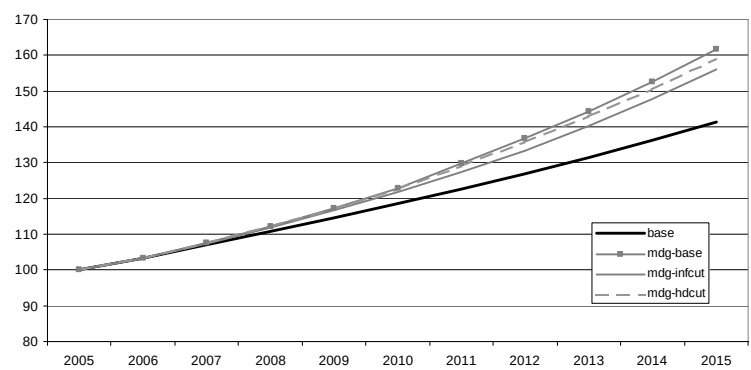


Figure 22. Wage for Workers with Less Than Secondary-School Education (Index 2005 = 100).

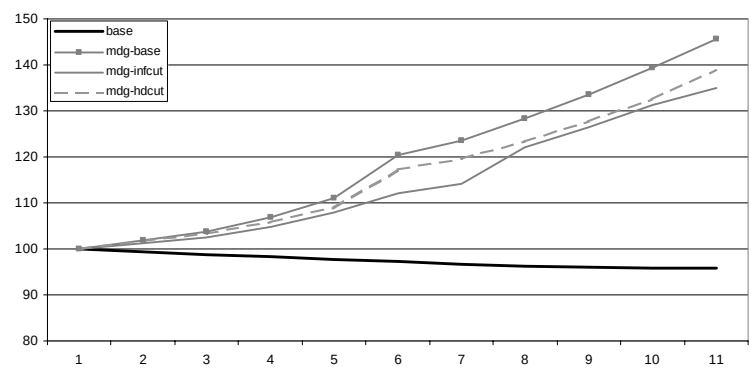


Figure 23. Wage for Workers with Secondary-School Education (Index 2005 = 100).

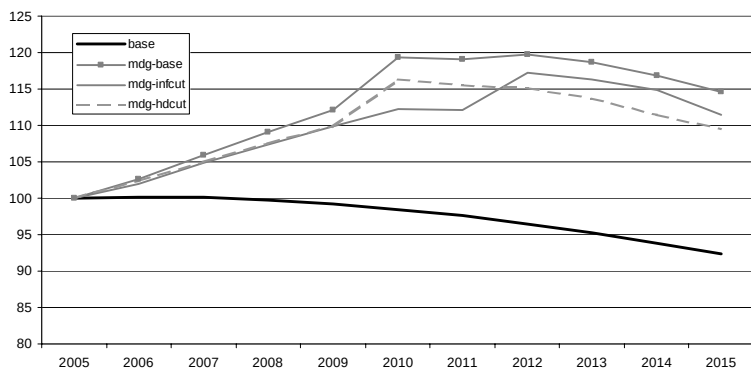


Figure 24. Wage for Workers with more than Secondary-School Education (Index 2005 = 100)

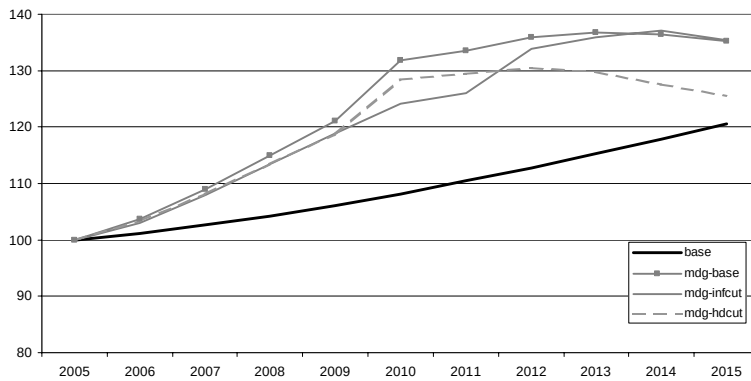


Figure 25. Rent for Private Capital (Index 2005 = 100).

