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Millennium Development Goals Scenarios to 2015 and Beyond: An Integrated Micro-Macro Modelling Approach

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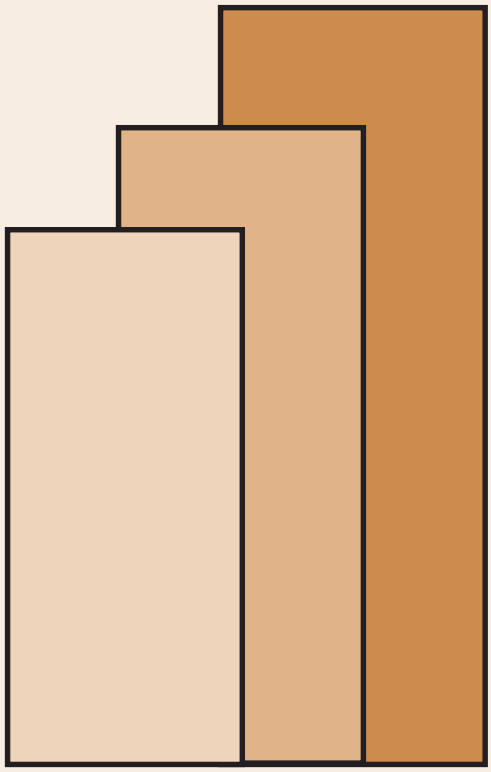

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MILLENNIUM DEVELOPMENT GOALS SCENARIOS TO 2015 AND BEYOND: AN INTEGRATED MICRO-MACRO MODELLING APPROACH

Roehlano M. Briones[1]

Abstract. The Philippines has made considerable progress in attaining the Millennium Development Goals (MDGs). However achieving all the targets remains a daunting challenge, with goals for poverty, education and maternal mortality unlikely to be attained by 2015. Focus has now shifted to informing the post-2015 development agenda, based on future scenarios for the macroeconomy and the MDGs. In this study, such assessment is done using an integrated macro-micro modeling approach, using the Maquette for MDG Simulation (MAMS), calibrated to Philippine data, over the period 2009 – 2025.

Findings for the scenario analysis are as follows: In the Base or business-as-usual scenario, MDG targets for household water and sanitation, as well as child health, will be met (or approximated) by 2015. However, those for education and maternal health will be attained in 2025 and 2021, respectively. The goal for poverty will not be achieved even by 2025. The national debt follows a downward trajectory over the simulation period.

Meanwhile in the alternative scenarios, significantly higher outlays for primary education, health, and infrastructure (equivalent to 2% of GDP) leads to earlier attainment of the education and maternal health goals (2019 and 2016, respectively); likewise significant gains will be realized in terms of per capita income and poverty reduction by 2025. Tax financing of higher outlays maintains the debt reduction path in the Base; however financing through increased borrowing from abroad leads to persistent escalation of foreign debt. Hence, government should be cautious about proposals for dramatic increases in social spending and infrastructure to more quickly close development gaps, unless it is able to accompany increases in spending with commensurate tax effort.

Keywords: Millennium Development Goals, inclusive growth, poverty reduction, human development, fiscal sustainability, computable general equilibrium

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1. OVERVIEW

The Philippines has made considerable progress in attaining the Millennium Development Goals (MDGs). There is high likelihood of achieving targets for child mortality and household sanitation by 2015. The country has also overcome serious macroeconomic difficulties since the start of the MDG period, when it still struggled with erratic growth, inflation, and balance of payments deficits. In the 2000s it entered a period of relatively stable and moderate growth. Over the past three years, economic growth has accelerated to an unprecedented pace, with credible signs that high growth can be sustained.

The current government has reaped significant economic pay-offs from governance reforms, as savings from anticorruption and improved program efficiency were plowed back to education, health, and food support programs for the poor. As well, government has been responsive to the infrastructure requirements of a fast-growing economy (NEDA, 2013).

Nevertheless closing all development gaps remains a daunting challenge. By the government's own reckoning, some of the MDGs are unlikely to be achieved by 2015. Policymakers and the rest of the development community are aiming at both sustained rapid growth, and one that is more inclusive, translating increasing wealth to improved quality of life of the poor. Hence even as 2015 approaches, the post-2015 agenda looms large. A number of research questions can help inform this agenda:

i) Under current levels of government investment and fiscal performance, what are the likely scenarios for the social MDGs to 2015 and beyond? Can the government's expenditure program for inclusive growth be sustained?

ii) What targets will likely be missed? When will they likely be achieved?

iii) Can government significantly accelerate MDG attainment by increasing outlays on social spending and public infrastructure? What are its implications of this strategy for public finance?

Conventional analysis to answer these questions generally extrapolates from trends of the abovementioned variables in isolation, or at most in relation to one or two other variables (such as fiscal deficit in relation to government spending and revenues). Such a piecemeal approach has its uses, but cannot guarantee consistency across variables.

To avoid this problem, this study answers these questions using an **integrated** micro-macro modeling approach by applying the Maquette for MDG Simulation or MAMS (Lofgren, Cicowiez, and Diaz-Bonilla, 2013) to the Philippines. This version represents an update over the first application reported in Briones et al (2013), which contains a detailed discussion of the construction and calibration of the Philippine data set. As a computable general equilibrium model, MAMS is able to generate projections over the horizon 2009 – 2025, for macroeconomic variables such as GDP, government spending and venue, and national debt, as well as for the various economic sectors, namely: supply (production), demand (consumption), imports, and exports; together with their respective prices.

As an MDG scenario model, MAMS can project changes in social MDGs, namely: enrollment rates; child mortality rates; maternal mortality rates; household access to sanitary toilet; and household access to safe water. Consistency across projections is guaranteed, subject to accuracy of baseline data and model structure. Lastly, MAMS in combination with a microsimulation model that is able to translate macro results into in poverty and income distribution results using survey data.

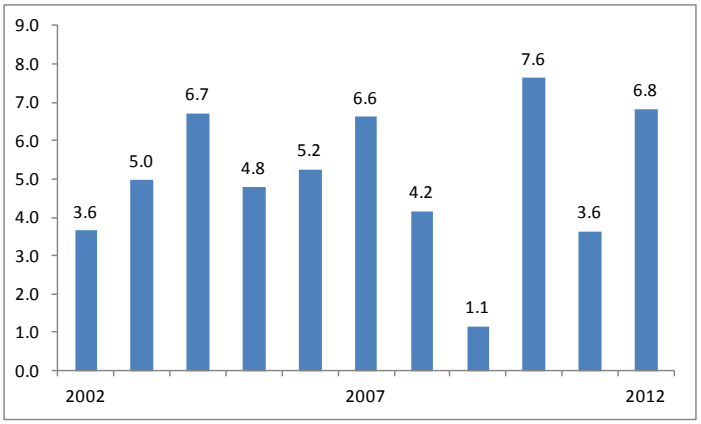
The basic data of the model corresponds to Philippine economy and households in 2009. It will be applied to analyze base and alternative scenarios related to the preceding questions over the horizon 2009 – 2025. The base scenario addresses questions i) and ii) above, and adopts the policy targets stated in the Philippine Development Plan Results Matrix 2010 – 2016 (NEDA, 2013). The alternative scenarios address question iii), and pertain to increased government spending to attain the MDGs, while positing alternative sources of financing the spending increase.

2. THE PHILIPPINE ECONOMY AND THE MDGS: A REVIEW

State of the economy

The Philippines has historically been prone to balance of payments crises, leading to chronic macro instability (Gochoco-Bautista and Canlas, 2003). GDP growth averaged only 3% in the 1980s and 3.8% in the 1990s. In the 2000s the growth rate rose to 5%; in the past decade growth has also been more consistent, remaining – well above 3%, except in 2009 due to the global financial crisis (Figure 1).

Figure 1: GDP in constant 2000 prices, growth rates (%)

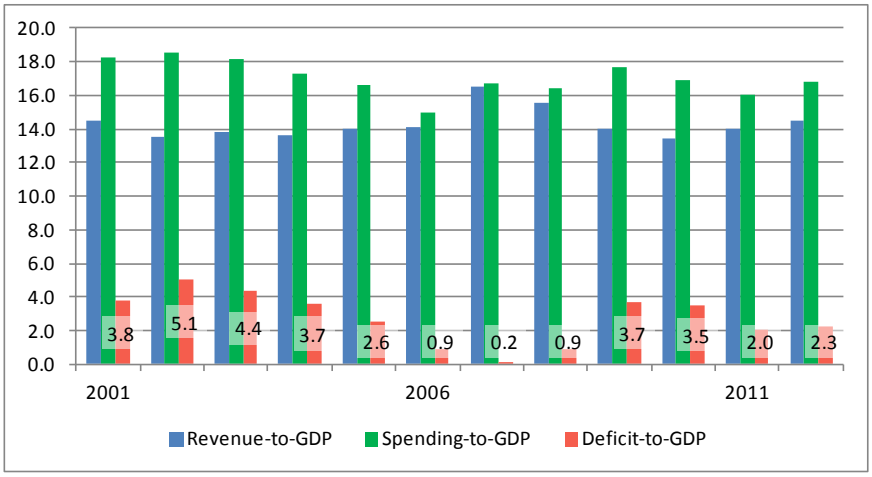


Source: NSCB.

Other macro-indicators have likewise improved. The budget deficit, which peaked at 4.4% of GDP in 2003, fell to 2.3% of GDP in 2012 (Figure 2). This decline was accomplished by reducing the share of expenditure to GDP, from 18.2% in 2003 to 16.8% of GDP in 2012, and by raising revenue-to-GDP from 13.8% to 14.5% over the same period. As a result of improved revenue and growth performance, the government managed to reduce its debt-to-GDP ratio from a peak of 75% in 2004 to 51% in 2012 (Figure 3). The decline is concentrated in foreign debt, falling from 35% to just 18% of GDP over the same period. The share of domestic debt in national debt meanwhile increased from 54% to 63%.

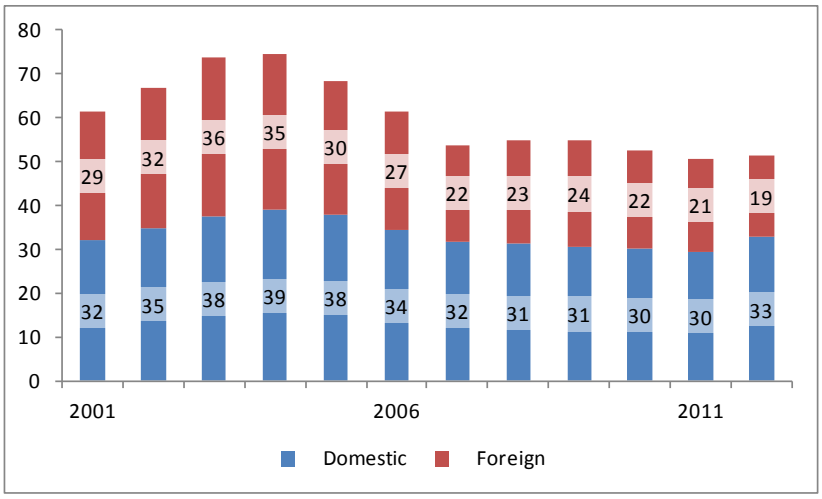
Owing to the improved fiscal space, the government is able to finance its inclusive growth strategy. This is most clear in the National Expenditure Program of 2013, reviewed in Manasan (2013): in 2013, programmed expenditure is higher than that of 2012 by 190 billion, a 10.5% increase, equivalent to 1.8% of 2012 GDP. Fifty-three percent of this expansion is programmed for increased social services spending, divided as follows: 35% for education; 6% for health; 4% for social welfare spending; and 8% for housing.

Figure 2: Deficit-to-GDP and related ratios, 2001 – 2012 (%)



Source: NSCB.

Figure 3: Debt-to-GDP ratios, 2001 – 2012 (%)



Source: Bureau of Treasury.

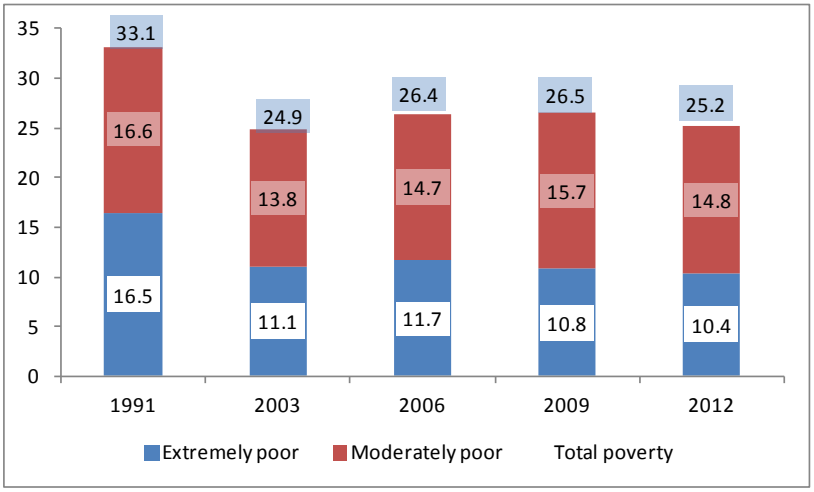
Progress towards the MDGs

MDG 1 pertains to both income poverty and hunger. The subsistence incidence (indicator of extreme poverty) was 16.1% in 1991, declining to 10.4% by 2012, around two percentage points away from half of its baseline value (Figure 4). The PDP target is stated in terms of the official (or moderate) poverty incidence. The target is 16.6% in 2015, half of its 1991 value of 33.1%, and 8.6 percentage points below the 2012 poverty incidence. Note there was a "lost sexennial" (2003 – 2009) in which poverty incidence rose by 1.9 percentage points despite an average GDP growth of 5.6%, a serious setback in the country's poverty reduction drive. From 1991, the reduction in official poverty averages just 0.37 percentage points per year; hence closing the 8.6 percentage point gap by 2015 is highly unlikely.

In relation to MDG 2, Table 1 presents the cohort survival rate, which is the percentage of new entrants of primary school who reach the final grade. The current levels remain far below the target level of 85%, though it has climbed up to 75.4% in 2009, from just 66.5% in 1990. NEDA (2010) evaluates the likelihood of reaching MDG 2 as Low. Meanwhile the on-time completion rate for primary education in 2009 estimated from Basic Education

Indicators System (BEIS) data is only 25.1%, owing to low enrollment of children aged six (the mandatory age of entry into primary school).

Figure 4: Extreme and moderate poverty incidence of the population, 1991 – 2012 (%)



Source: NSCB

Table 1: Indicators for the Social MDGs, 1990, 2009, and target

	1990	2009	2015 (target)
Cohort survival rate at primary level (%)	66.5	75.4	84.7
Under-5 mortality rate (per 1,000 live births)	80.0	30.0	26.7
Maternal mortality rate (per 100,000 live births)	209.0	130.0	52.2
Households with access to potable water (%)	73.8	88.6	86.9
Households with sanitary toilet (%)	71.8	81.4	85.9

Note: The figure for maternal mortality an interim estimate; one survey (e.g. the 2011 Family Health Survey) gives an estimate of 211 deaths per 100,000 .

Sources: NEDA (2010, 2012)

For MDG 4, the Table reports number of deaths for children aged five and below, per 1,000 live births. In contrast to the education goal, the country is approaching its under-5 mortality target of 26.7 per thousand live births. On the other hand, the country is far from its maternal mortality rate target of 52.2 maternal deaths per 100,000 live births. Lastly, as with the child mortality goal, the likelihood of reaching housing sanitation goals is rated High by the most recent MDG Progress Report (NEDA , 2010), whether for drinking water or access to sanitary toilet.

3. DATA AND SPECIFICATION OF SCENARIOS

Data

The basic data for the Philippines application of MAMS is summarized in a 2009 Social Accounting Matrix (SAM) for the Philippines. A SAM is a set of accounts that shows the flows and payments across sectors and institutions of the economy. The institutions of the SAM are: government, households, business firms, and the rest of the world. The sectors of the SAM are listed as follows:

1) Beverages and tobacco
2) Chemicals
3) Communications (telecommunications, postal and wireless services)
4) Construction
5) Corn (maize)
6) Coconut, sugar, fruits, and vegetables
7) Dairy
8) Education, primary, government
9) Education, primary, private
10) Education, secondary, government
11) Education, secondary, private
12) Education, tertiary, government
13) Education, tertiary, private
14) Electricity
15) Fisheries
16) Processed fish
17) Forestry
18) Health, government
19) Health, private
20) Leather
21) Livestock
22) Meat
23) Other government services
24) Oil and gas
25) Other infrastructure
26) Other agriculture
27) Other food
28) Other manufactures
29) Other mining
30) Other services
31) Palay (paddy rice)
32) Paper
33) Petroleum, refined
34) Plastic
35) Poultry
36) Rice, milled
37) Rubber
38) Textiles
39) Trade services
40) Transport services
41) Wood
42) Water and sanitation

Data for the SAM is derived from several sources. The main source is the official input-output (I-O) table, which is updated by updating the inter-industry structure from the year 2000 to national accounts data of 2009. Other data are obtained from official sources such as Tariff Commission, Bangko Sentral ng Pilipinas (BSP), Budget of Expenditure and Sources of Financing (BESF), Bureau of Treasury, NEDA, Philippine Statistical Yearbook, Department of Education, and so on. Calibration to the base year data involves elasticities drawn from the 2006 version of the MAMS for Philippines (Briones et al, 2013), with some adjustments based on related literature.

Meanwhile data for microsimulation merges the 2009 Family Income and Expenditure Survey (FIES) with the 2009 Labor Force Survey (October round). Both are official sources bases for calculating poverty, employment, and inequality. Note that the merging leads to loss of observations which preclude exact reproduction of official figures, hence scenario results are reported in terms of differences from baseline indicators.

The scenarios

The *Base* or "business-as-usual" scenario represents a trajectory of economic and human development outcomes for the Philippines following past trends, data up to 2012, as well as projections and targets from the PDP Results Matrix (NEDA, 2013). The most salient of these are summarized as follows (Table 2):

- Assumed growth rate of GDP, derived from World Bank (2013), which is consistent with the government target.
- Shares of government spending and taxes in GDP, derived from the PDP Results Matrix.

- Population growth to 2025 adopts UN estimates by age.
- There are no serious global financial crises or world price shocks.

Table 2: Assumptions for GDP growth, government spending, and government revenues, 2009 – 2025 (%)

	2009	2010	2011	2012	2013	2014	2015	2016-24
GDP growth (Base)	-	7.6	3.9	6.6	6.2	6.4	6.3	6.3
Base: spending (share of GDP)								
Education, primary	0.99	0.92	0.84	0.91	0.97	1.03	1.10	1.16
Education, secondary	0.42	0.39	0.36	0.39	0.42	0.44	0.47	0.49
Education, tertiary	0.08	0.08	0.07	0.08	0.08	0.09	0.09	0.10
Health	0.39	0.36	0.33	0.36	0.39	0.41	0.43	0.46
Other government	4.07	3.76	3.44	3.73	3.99	4.24	4.49	4.75
Other infrastructure	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Investment, water & sanitation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Investment, education, primary	0.05	0.05	0.04	0.05	0.05	0.05	0.06	0.06
Investment, education, secondary	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Investment, education, tertiary	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Investment, health	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.05
Investment, other government	0.65	0.60	0.55	0.59	0.63	0.67	0.71	0.76
Investment, other infrastructure	4.02	3.72	3.40	3.69	3.94	4.19	4.44	4.69
Base: revenues (share of GDP)								
Direct taxes	6.41	5.92	6.74	6.95	7.11	7.27	7.43	7.59
Import taxes	3.26	3.39	3.25	3.26	3.26	3.26	3.26	3.49
Other indirect taxes	3.96	3.74	3.66	3.97	3.97	3.97	3.97	4.29
HDInfra: spending (shares in GDP)								
Education, primary	0.99	0.92	0.84	0.91	0.97	1.53	1.60	1.66
Health	0.39	0.36	0.33	0.36	0.39	0.91	0.93	0.96
Investment, other infrastructure	4.02	3.72	3.40	3.69	3.94	5.19	5.44	5.69

Notes:
1. Shares rounded off to two decimal places.
2. Differences from Base case indicated in the shaded cells.

Source: Various official data, 2009 – 2012; author's assumptions for 2013 – 2025.

The *HDInfra-borrow* scenario is the same as the Base scenario, except with increases in government spending as shares in GDP, summarized in Table 3. Higher expenditures target both human development and infrastructure; the former targets primary education and health; the latter aims at higher and more sustained growth. The scenario involves a 1 percentage point increase per annum in government spending distributed between primary education and health expenditure, for years 2014 to 2025; and another 1 percentage point increase per annum in government outlay for infrastructure for the same years. (Note that in 2012, 1% of GDP is approximately 105 billion pesos or $2.5 billion). The fiscal gap is closed by foreign borrowing.

The *HDInfra-tax* scenario meanwhile is identical to the HDInfra-borrow scenario, except the closure rule for government finance is changed, from foreign borrowing to tax revenues. This scenario examines the option of financing the increase in spending on human development

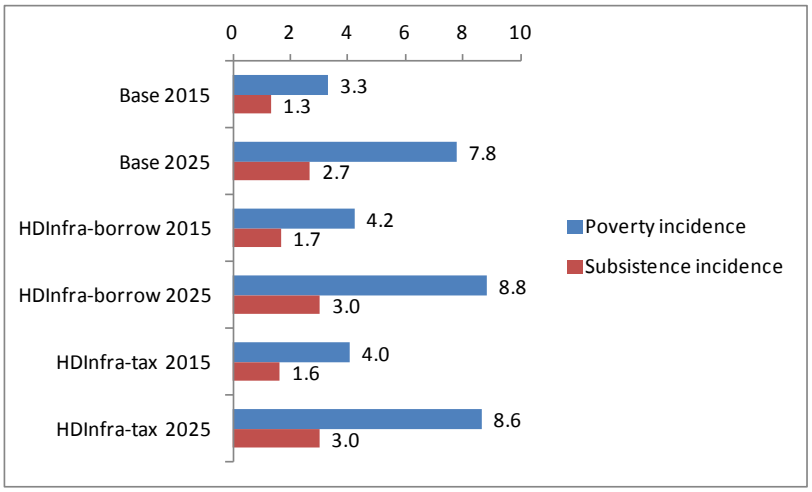
and infrastructure using tax revenue, assuming the government is successful in raising revenue effort, whether by new taxes, or by improved collection efficiency.

4. RESULTS OF SIMULATIONS

Scenarios for human development

Figure 5 presents the scenarios for poverty and extreme poverty. Poverty incidence is projected to decline by 3.3 percentage points in the Base scenario by 2015. This is much faster than the historic pace of poverty reduction, yet far below the MDG target of 8.6 percentage points. Similarly the decline in subsistence incidence falls short of what is needed to reach half of the 1991 level of subsistence poverty. Poverty will be lower by 7.8% by 2025, i.e. under business-as-usual the target will not be attained even a decade past the milestone year. What will be attained – but only by 2025 – is a 2.7 percentage point reduction in extreme poverty, sufficient to attain half of the 1991 level.

Figure 5: Poverty and subsistence incidence, differences from base year in percentage points, by scenario



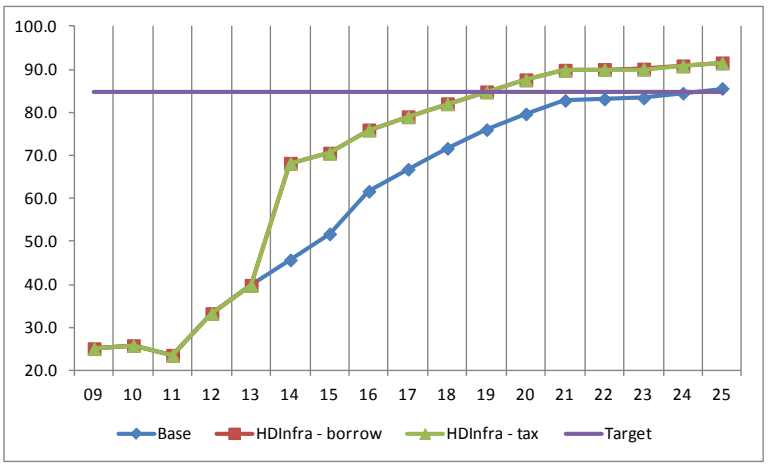
Source: Author's calculations.

On the other hand, with increased spending under the HDInfra scenarios, reduction in both official and subsistence poverty is faster than under the Base scenario. The alternative scenarios are similar, though the pace of reduction is slightly faster for the borrowing scenario compared to the tax scenario; the reason is that higher tax rates in the latter reduce the disposable incomes of households. By 2025 the decline in official poverty even in the HDInfra-tax scenarios is sufficient to attain the MDG target.

Meanwhile for the on-time primary completion rate, under the Base, attainment of the target must wait until 2025 (Figure 6). Under the HDInfra-borrow scenario, the goal for the completion rate will be attained much earlier, though not fast enough to reach the 2015 milestone. Instead, attainment is expected by 2019. Results for the HDInfra – tax scenario are similar (though not identical) to those of the HDInfra – borrow scenario.

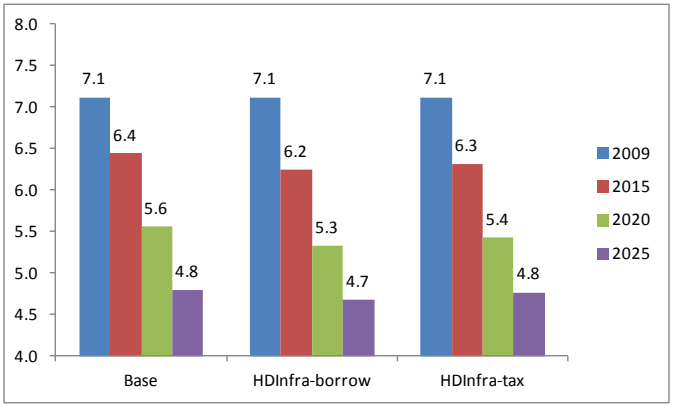
Despite rising enrollment and completion rates implicit in these projections, the economy's absorptive capacity for school graduates appears adequate at the assumed growth rates (Figure 7. In the Base, the unemployment rate declines gradually, from 7.1 to 4.8%. The decline is slightly faster in the HDInfra scenarios.

Figure 6: On-time primary completion rate, 2009 – 2025 projections, by scenario (%)



Source: Author's calculations.

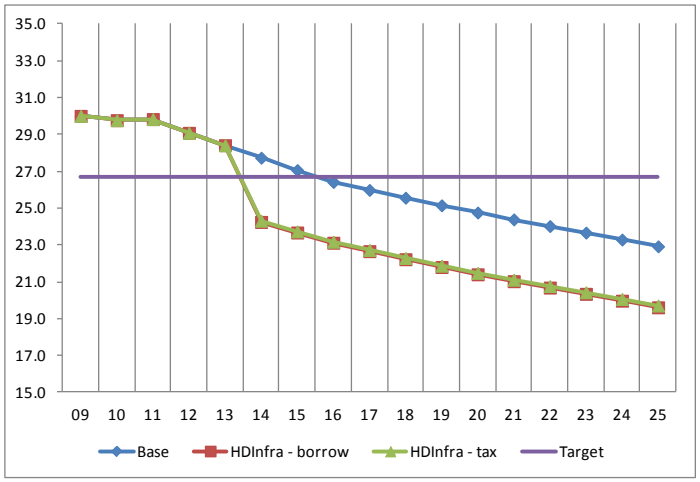
Figure 7: Unemployment rates, 2009 – 2025 projections, by scenario (%)



Source: Author's calculations.

With respect to child mortality (Figure 8), the MDG target is nearly attained in 2015, though the critical value is actually passed in 2016.

Figure 8: Under-five mortality rate, 2009 – 2025 projections, by scenario (deaths per 1,000 live births)

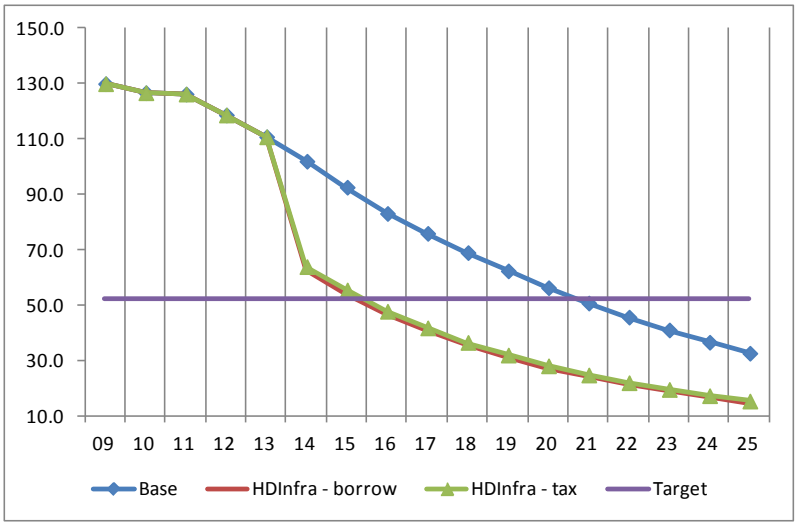


Source: Author's calculations.

Meanwhile under the HDInfra scenarios, attainment of the Goal is moved earlier to 2014. The massive increase in spending in health is successful in closing the MDG gap well within the current MDG period. However, the Goal for maternal mortality is not attained for the Base by 2015 (Figure 9), consistent with expectation. Rather, the Goal is realized in 2021. Under the HDInfra scenarios, attainment of the maternal mortality MDG can be moved earlier to 2016, just one year past the first MDG period. Moreover the maternal mortality rate under the HDInfra scenarios are lower than under Base by about 17 – 18 deaths by 2025.

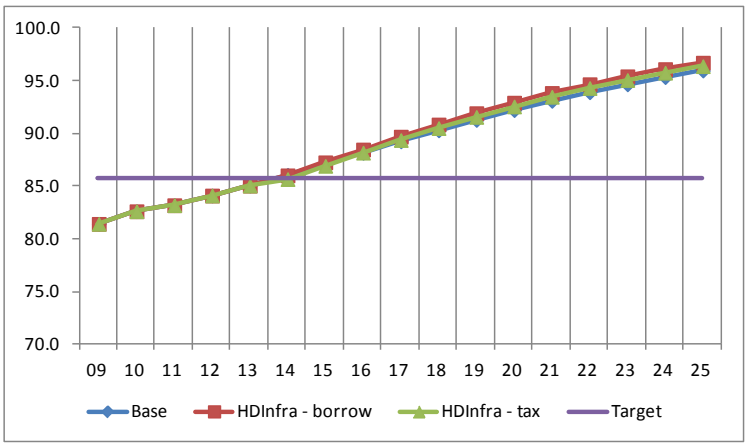
Lastly for MDG 7, the analysis considers only the Goal for sanitary toilet (as the Goal for safe drinking water had already been attained at the base year.) The scenario shows attainment of the Goal by 2013, two years ahead of the milestone (Figure 10). The improvement in MDG 7 under alternative scenario relative to Base is imperceptible, primarily as the added expenditure in these scenarios is limited to primary education and economic infrastructure.

Figure 9: Maternal mortality rate, 2009 – 2025 projections, by scenario (deaths per 100,000 live births)



Source: Author's calculations.

Figure 10: Share of households with sanitary toilet, 2009 – 2025 projections, by scenario (%)

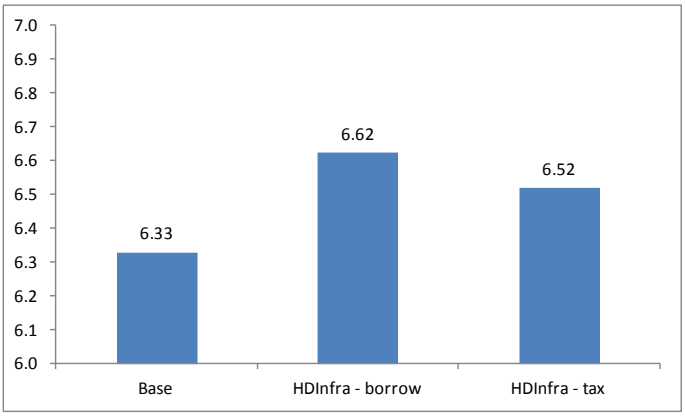


Source: Author's calculations.

Macroeconomic variables

In the Base, GDP is projected to grow as assumed (Figure 11). Additional spending under HDInfra-borrow yields a perceptible difference in terms of higher GDP growth (0.29 percentage points per year). Though the difference is small on an annual basis, this translates to a per capita income higher by around 50% in 2025 under the HDInfra-borrow scenario. Growth rate under HDInfra-tax lies in between, as tax financing displaces some of the additional demand from households.

Figure 11: Projected GDP growth, 2010 – 2025 projections, by scenario (%)



Source: Author's calculations.

Results for fiscal variables are reported in Table 3 as shares in GDP. By assuption, tax revenues under the Base and HDInfra-borrow scenarios rise from 2009 levels; revenues are larger under the HDInfra-tax scenario relative to the Base, with the difference widening at most by 3 percentage points in 2015, then narrowing to 2.5 percentage points in 2025.

Table 3: Fiscal variables as shares to GDP, 2009 – 2025 projections, by scenario (%)

		2009	2015	2020	2025
Tax revenue	Base	13.6	15.1	15.4	15.4
	HDInfra - borrow	13.6	15.1	15.4	15.4
	HDInfra - tax	13.6	18.1	17.9	17.9
Government consumption spending	Base	6.0	6.6	7.0	7.0
	HDInfra - borrow	6.0	8.1	8.5	8.5
	HDInfra - tax	6.0	8.1	8.5	8.5
Government investment spending	Base	4.8	5.6	5.2	5.2
	HDInfra - borrow	4.8	7.1	6.3	6.3
	HDInfra - tax	4.8	7.1	6.3	6.3
Government borrowing	Base	2.6	1.9	1.4	0.8
	HDInfra - borrow	2.6	5.3	4.9	5.3
	HDInfra - tax	2.6	1.9	1.4	0.8
Domestic government debt	Base	29.5	24.6	22.0	18.9
	HDInfra - borrow	29.5	24.4	21.5	18.2
	HDInfra - tax	29.5	24.5	21.8	18.6
Foreign government debt	Base	23.7	18.8	17.7	13.1
	HDInfra - borrow	23.7	25.3	34.2	44.4
	HDInfra - tax	23.7	18.6	17.4	12.8

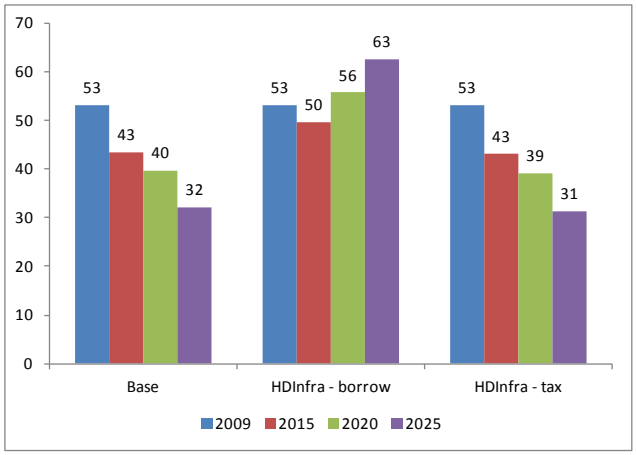
Source: Author's calculations.

By assumption, government spending for consumption and investment all rise across scenarios, with the HDInfra scenarios corresponding to greater levels spending for both consumption and investment. The assumptions for the Base imply a declining fiscal deficit, falling to under 1% in 2025; a similar deficit path is projected for the HDInfra-tax scenario. However the deficit path is sharply higher for the HDInfra-borrow scenario.

For Base, both domestic and foreign debt declines over the projection period, by about 10 – 11 percentage points for each component. Manasan (2013) likewise projects a reduction in national debt based on a different method (debt simulation); her estimate is a debt-to-GDP ratio of 40% of GDP by 2017, which seems close to this paper's estimate of 42% for the same year.

The HDInfra-tax scenario corresponds to a nearly identical path for national debt as with Base. Likewise the trajectory for domestic debt is similar to that of Base (and therefore of HDInfra-tax scenario). The big difference is seen in terms of foreign debt; for the HDInfra-borrow scenario foreign debt climbs to over twenty percentage points relative to Base. In terms of total national debt (Figure 12), total debt falls to 32% by 2025 in the Base; despite increased spending in the HDInfra-tax scenario, total debt declines slightly faster compared with the Base. The downward trajectory for total debt is slower in the case of HDInfra-borrow, and only up to 2015; subsequently it reverses and rises to 63% of GDP by 2025.

Figure 12: Debt-to-GDP ratios, 2009 – 2025 projections, by scenario (%)



Source: Author's calculations.

5. CONCLUSION AND POLICY IMPLICATIONS

To summarize: consistent with expectation, scenario analysis indicates that, under current trends and policies, the country is on track to attaining several MDGs, namely: safe drinking water (attained), sanitary toilet (2014), and child mortality (borderline by 2015). However, it will likely miss targets for poverty, as well as the education and maternal health MDGs. The country is on its way to attain the education and maternal health MDGs, but beyond the first MDG period, i.e. 2025 for the former and 2021 for the latter. The target for poverty incidence is unattainable even by 2025.

Massive increases in primary education, health, and economic infrastructure, will have the desired effect of hastening attainment of MDGs and accelerating growth. Under the higher spending scenario, the education MDG can be attained in 2019, and the maternal mortality

MDG by 2016. The growth rate is higher with greater outlays for infrastructure spending, translating to a significantly higher per capita income by 2025. Poverty reduction is not fast enough to attain the MDG target by 2015, though an additional decade of sustained poverty reduction is enough to close the poverty MDG gap.

Under business-as-usual, the national debt (as a share of GDP) is expected to track a downward trajectory from half of GDP to about one-third. Under the higher spending scenario, the same debt reduction path can be maintained with tax financing of the added spending, which translates to a significantly higher tax effort (2 to 3 percentage points of GDP). However, under the higher spending scenario financed by foreign borrowing, the national debt rises from to nearly two-thirds of GDP. The analysis suggests that government should be cautious about proposals for dramatic increases in social spending and infrastructure to more quickly close development gaps, unless it is able to accompany increases in spending with commensurate tax effort.

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