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Creating and Using Fiscal Space for Accelerated Development in Liberia

Hans Lofgren

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Abstract

This paper presents simulations for the period 2013–2030 of measures that permit increased spending on infrastructure and human development, the priority areas in Liberia's 2013–2017 "Agenda for Transformation" and for its national vision, Liberia Rising 2030. The simulations are carried out with a Liberian version of MAMS (Maquette for Millennium Development Goals Simulations), a Computable General Equilibrium model. According to the results, among the key sources of fiscal space, foreign grants generate the best outcomes followed by improved government allocative efficiency. Taxes tend to involve trade-offs since they reduce resources for private consumption and investment, both of which tend to contribute to stronger macro and Millennium Development Goals performance. Increased foreign borrowing is less attractive since, in order to make a substantial difference, it would quickly add to the foreign debt, making the economy more crisis-prone and less flexible. The preferred balance between different uses of fiscal space depends on payoffs from different government functions, typically unknown or only appearing with a lag. Under the parameters used in the simulations, determined in light of fragmentary evidence, the outcomes were marginally stronger under a balanced approach with scaling up of both infrastructure and human development services. Balanced expansion may also contribute to efficiency and be easier for political reasons. A final finding is that it is possible to consider fiscal space issues in isolation from the mining sector: simulations suggest that the marginal effects of creating additional fiscal space are very similar irrespective of the level of mining export prices.

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Hans Lofgren*

World Bank

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1. INTRODUCTION AND SUMMARY[1]

For most countries, and Liberia is no exception, it is a high priority to increase fiscal space for spending in priority areas. For the case of Liberia, this note presents a set of simulations that, for the period 2013-2030, explore the effects of measures aimed at increasing the room for spending on infrastructure and human development (HD), the priority areas that are identified in Liberia's "Agenda for Transformation" (AfT) for the period 2013-2017.[2] Such measures should also contribute to bringing Liberia close to the achievement of middle-income status, the objective that underlies its national vision, Liberia Rising 2030, which currently is being finalized.

The main findings are that, among the sources of fiscal space that are considered, foreign grants generate the best development outcomes followed by improvements in government allocative efficiency. Taxes (on domestic households and firms) are likely to involve trade-offs since they make less resources available for private consumption and investment, both of which contribute to stronger macro and MDG performance. However, if taxes can be targeted to avoid these drawbacks and if the uses to which additional resources are put have high payoffs, then these trade-offs may be avoidable. Foreign borrowing is a less attractive source of fiscal space: in order to make a substantial difference, the amounts borrowed would quickly add to the foreign debt, making the macro economy more prone to future crisis and reducing its flexibility. Striking the right balance between different uses of fiscal space is difficult as it depends on the marginal payoffs of different government functions; typically, they are not known and they may only appear with a considerable lag. Nevertheless, under the parameters used in the model simulations, determined in light of fragmentary evidence, the outcomes were marginally stronger under a balanced approach with scaling up of both infrastructure and HD services. Balanced expansion may also be conducive to higher efficiency and easier to undertake for political-economy reasons. A final finding is that, even though the analysis indicates that disappointing developments in the mining sector (in this note represented by a decline in export prices) would have a negative impact on Liberia's development, it should be possible to consider fiscal space issues in isolation from the mining sector: model simulations suggest that the marginal effects of creating additional fiscal space are very similar irrespective of the level of mining export prices.

The simulations are generated by a Liberian version of a single-country Computable General Equilibrium (CGE) model, MAMS (Maquette for MDG Simulations).[3] The scenarios include a base scenario, designed to represent a central case for the evolution of Liberia's economy up to 2030, and a set of alternative scenarios that modify the base scenario by introducing one or more changes that create fiscal space and use this space for spending on infrastructure and/or

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[2] In this paper, years refer to fiscal years. For example, 2013 refers to the period July 1, 2012 – June 30, 2013.

[3] For an earlier MAMS-based analysis of Liberia, see Dessus et al. (2012).

HD. In addition, we test the impact of lower mining export prices on Liberia's development up to 2030 and how they may impinge on efforts to increase fiscal space for priority spending.

In this note, Section 2 presents the base scenario, preceded by a brief summary of the model and the database. Section 3 covers the alternative non-base scenarios. Section 4 offers some concluding observations. Three appendices provide more detail on model structure, the database, and simulation results (in a set of tables and figures).

2. MODEL, DATA AND BASE SCENARIO

MODEL AND DATABASE[4]

MAMS (Maquette for MDG Simulations) is a CGE (Computable General Equilibrium) model designed for country-level analysis of medium- and long-run development policies, including strategies for reducing poverty and achieving the Millennium Development Goals (MDGs). Technically, it is made up of a set of simultaneous equations. The model is economywide, providing a comprehensive and consistent view of the economy, including linkages between production and the income it generates, households, the government (its budget and fiscal policies), and the balance of payments. The different agents (producers, household, government, and the nation in its dealings with the outside world) are subject to budgets and their constraints: in each budget, receipts and spending, the latter including savings and net borrowing, are by definition equal. The decision rules of each agent – for producers and households, the objective is to maximize profits and utility, respectively – ensure that these budgetary constraints are respected: for example, in a stepwise process households set aside parts of their incomes to direct taxes and savings, allocating what is left to consumption. For the nation, adjustments in the real exchange rate (in the dollarized model economy via adjustments in the domestic price level) ensure that its external accounts are in balance. Wages, rents and prices play a crucial role by clearing markets for factors and commodities; for commodities that are traded internationally (exported and imported), domestic prices are influenced by international price developments, typically (as in the case of Liberia) assuming that international markets will demand and supply the exports and imports of the country at given world prices.

Over time, production growth is determined by growth in factor employment and changes in factor productivity; growth in capital stocks is endogenous while exogenous growth is imposed for labor and other factors (for labor determined by growth in the population of labor-force age). TFP growth is made up of two components, one that responds positively to growth in government capital stocks and one that, unless otherwise noted, is exogenous.

[4] For a more detailed presentation of the structure of MAMS and its database, see Appendices 1 and 2, respectively. For a detailed, general presentation of MAMS, see Lofgren et al. (2013).

For the case of Liberia, MAMS is applied to a database for 2009, developed from Supply and Use Tables for 2008, complemented by data from other sources (including the Government of Liberia, IMF, and the World Bank), and balanced to ensure consistency. The database is disaggregated into multiple sectors, factors, institutions, including auxiliary accounts for different tax types; see Table A2.1 for details). One important feature is that government budget and (off-budget) donor-financed activities are integrated under the government heading. This reflects the fact that on- and off-budget spending in different areas serve similar purposes and often are complementary (for example with the government covering a larger share of O&M [Operations and Maintenance] and donors a larger share of investments). The integration underlines the need to align and harmonize their activities.[5]

In terms of model adjustments, the main changes in Liberia MAMS compared to more standard versions of MAMS are related to the mining sector, where investment and production projections are exogenous. The simulations , which are focused on the period 2012-2030, incorporate information about the development of the economy starting from 2009 (to ensure that the 2012 starting point is realistic), including developments related to growth, foreign grants, foreign borrowing, and the mining sector.

The simulations include a base scenario, a set of policy scenarios, and an export price shock scenario. The base scenario is designed to generate a plausible projection into the future to which the other scenarios can be compared. The policy scenarios are designed to address the consequences of additions to fiscal space from alternative sources (taxes, foreign grants, or government efficiency) and alternative uses of this fiscal space (infrastructure, human development or a combination of the two). The export price shock scenario explores the impact of a decline in the price of mining exports. In addition, we briefly discuss additional scenarios that were designed to test the sensitivity of our findings to alternative combinations of assumptions related to financing, priority spending, and iron export prices.

BASE SCENARIO

Our presentation of the base scenario starts with an overview of key assumptions, followed by an analysis of the simulation results. The presentation emphasizes developments during the full period 2013-2010; Tables with detailed simulation results singles out two sub-periods, 2013-

[5] The distinction between on- and off-budget aid is important for some purposes. However, keeping the two separate in the MAMS database would impose an additional data requirement and complicate the analysis given that these two activity types are complementary; for example, the government carries out the bulk O&M for infrastructure while donors are responsible for most new investments. At the same time, it would not yield any significant insights, in particular given limited knowledge about how input structures and output quality differ between donor- and government-operated activities. Given the questions posed, it would be a mistake to limit the analysis to on-budget government; to exemplify, in 2012, donor on-budget transfers only represented 7.3 percent of total donor transfers (excluding UNMIL). Out of total government revenues (including on- and off-budget grants and domestic revenues but excluding UNMIL), in 2012 around 53 percent (433 out of 822 million US$) was on-budget; the on-budget share of total non-UNMIL grants share was only around 7 percent (IMF 2012, pp. 41-42).

2017 (the AfT period) and 2018-2030 (the rest of the period covered by Liberia's vision of the future).

Key Assumptions

The key assumptions of the base scenario reflects that this period is expected to be eventful for two main reasons: strong expansion in the mining sector (with associated consequences in terms of exports, FDI, government revenue, and profit remittances) and the virtual elimination of the United Nations Mission in Liberia (UNMIL) (reflected in a drastic decline in transfers from abroad, UNMIL consumption, much of which is made up of imports). Both events are expected to take place during relatively brief time periods. In other respects, the base scenario is less eventful; among other things, government spending and (non-mining) taxation are assumed to reflect a scaling up of the current situation without drastic structural change. One key feature of the base scenario is that, as opposed to all other scenarios, it treats GDP as exogenous.[6] GDP growth and other aspects of macro performance under the base scenario (including foreign grants, foreign borrowing, and mining developments) are primarily based on IMF (2012), including the World Bank – IMF debt sustainability analysis up to 2033 that is included in this source. This information is complemented by other sources, among others drawing on IMF (2010) for mining developments beyond 2015.

The receipts of the government include direct taxes (from households and mining, the latter imposed on the operating surplus of the sector), indirect taxes, and non-tax receipts. The direct tax rate on mining capital VA changes over time on the basis of data on projected mining sector government revenue and mining capital VA. Other tax rates – direct taxes on households, and indirect taxes on market sales, activity gross revenues, and imports – are based on the Social Accounting Matrix (SAM) and do not change over time. Among non-tax receipts, domestic transfers, domestic government borrowing, grant aid, and (concessional) borrowing from abroad are exogenous, either as shares of GDP or in real US dollars; changes in levels and GDP shares are fine-tuned to be consistent with IMF projections up to 2015 as well as World Bank – IMF debt sustainability analysis.

On the government spending side, interest payments depend on the levels of the government foreign and domestic debt stocks (the evolution of which depends on net foreign and domestic borrowing) as well as the levels of real interest rates, which are exogenous. Transfers to households are an exogenous share of GDP (like the transfer that goes in the opposite direction). Government final demands (consumption and investment) are disaggregated by function; for the functional disaggregation of the government, see Table A2.1. For each function, the government capital stocks and consumption grow in tandem. Given this, an expansion of consumption (a measure of service provision) must be preceded, in one or more

[6] Technically, the level of GDP is fixed, removing one variable from the model for each solution year. At the same time, a variable that introduces a uniform adjustment in TFP in each production activity is flexed, assuring that the exogenous GDP level is reached and that the model continues to have an equal number of equations and variables. For non-base scenarios, the GDP level is flexible whereas the productivity adjustment variable is fixed.

preceding years (the details depend on the gestation lags), by investments that sufficiently raise the level of the capital stock. This ensures that O&M costs are scaled up after the completion of roads and that additional teachers are not employed without already having a new school in place. Each year, the government budget clears via adjustments in real government consumption and capital stock growth rates in a manner that is unbiased across the different government functions.

In addition to payments involving the government (as payer or payee), the model covers payments involving from the rest of the world to domestic non-government actors. FDI (split between mining and other private capital), and transfers from abroad to UNMIL and households – all of these payments are exogenous in US dollars. Mining and non-mining FDI follow time profiles that are extracted from IMF (2010) and consistent with more recent data (IMF 2012). Transfers to households from the rest of the world (remittances and other) grow gradually over time (at a rate similar to GDP). Transfers to UNMIL decline rapidly during the period up to 2017, after which they continue at a very low level. Other non-government payments include investment and private savings. The rest of the world finances its investment (FDI) via the balance of payments. The household (marginal and average) savings rate is gradually increased (from 7.7 percent of household disposable income in 2012 to 13.0 percent in 2030) on the assumption that the investment climate will improve, encouraging domestic private savings and investment. As a result, by 2030, the GDP share for private investment is around 16 percent with domestic and FDI GDP shares of 12 and 4 percent, respectively; these figures are similar to recent averages for low- and middle-income countries.

Results for the Base Scenario

The results for the base scenario are summarized in Figures 2.1-2.8. Tables A3.1-A3.7 in Appendix 3 provide additional simulation results focused on the base scenario.

The evolution of Liberia's economy during the AfT period (2013-2017) is dominated by two events: (a) very high levels of mining FDI; these permit strong expansion in mining production and in government receipts from mining; and (b) the near-elimination of UNMIL transfers; this dampens import growth and domestic consumption (as UNMIL today represents large shares of both). By contrast, the post-AfT period (2018-2030) is less eventful with more uniform growth across sectors and macro aggregates. With respect to mining, the base scenario is based on IMF (2010 and 2012); earlier data were adjusted in light of more recent projections.

Figures 2.1-2.4 summarize the evolution of key macro aggregates under the base. Figures 2.1-2.2 show absorption, GDP, exports and imports in constant 2009 US$ and indexed to 100 in 2012. From both Figures it can be gleaned that export grow is strongly relative to imports, thus narrowing the export-import and absorption-GDP gaps.[7] In the background, the narrowing of

[7] Note that, in the different Tables and Figures of this paper, (exponential) growth rates are computed on the basis of two data points, those of an initial and a final year. This is a good summary of developments for indicators that grow at a regular pace. However, for variables that vary significantly from year to year (in this case investment and

the export-import gap responds to real exchange rate depreciation and reflecting the need to further reduce the trade deficit after considering the net change in the balance of payments from changes in mining exports, FDI, mining profit remittances, UNMIL transfers, and other foreign aid (in the form of grants and concessional borrowing; cf. Tables A3.1, A3.2, and A3.4).[8] However, the slow growth in both imports and absorption is in part due to the rapid contraction of UNMIL transfers, imports, and consumption. Figure 2.3 shows that, among the items that make up absorption (the domestic final demand aggregates), the two largest components, household consumption and government consumption grow at a steady pace. The different investment flows and UNMIL consumption are smaller; the latter is projected to reach close to zero during the period up to 2017. In terms of indexed expansion (Figure 2.4), during the full period private investment other than mining grows most strongly followed by government consumption and household consumption; mining investment grows rapidly for a few years before shrinking to close to zero. The fact that UNMIL is able to exit without any major repercussions for the government and the households demonstrates its economic position as an enclave vis-à-vis the national economy.

In the background to the real macro aggregates shown in the preceding Figures, the model accounts for the evolution of the government budget and the balance of payments (see Tables A3.3 and A3.4). In the government budget, expressed relative to GDP, the major receipt changes over time are declines in the reliance on foreign transfers and increases in the reliance on direct taxes, although the latter increase is mainly due to the mining sector – in the model, its revenues are treated as direct taxes. On the spending side, the changes are more modest; the major change changes, which take place during the second period, are a decline for other, revealing a stronger emphasis on priority areas. The foreign government debt increases considerably during the AfT period but less so during the post-AfT period (staying at 25-30 percent of GDP during most of the simulation period; the increase in government domestic debt is more modest (Table A3.2). On the outflow side of the balance of payments (showing uses of foreign exchange), the main changes during the AfT period (2017 compared to 2012) are a strong decline in non-competitive imports (the heading under which most of UNMIL imports fall) and an increase in mining profit remittances. On the side of inflows (sources of foreign exchange), mining exports increase drastically whereas UNMIL and, to a lesser extent, government (non-UNMIL donor) transfers decline. During the post-AfT period, outflows related to various imports become more important where mining profit remittances shrink. Among the sources of foreign exchange, mining exports and FDI decline whereas agricultural and service exports expand strongly.

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the real exchange rate), it may be misleading if one or both years is off the long-run trend, positively or negatively. With regard to investment, the capital stocks that are employed by the different sectors, determined by investment and depreciation, grow at rates that are very close to the rates of production growth; i.e. irrespective year-to-year variations, investment is sufficient to maintain required growth in the different capital stocks.

[8] With regard to some of the accounting relationships that underpin Tables A3.1 and A3.2, recall that, by definition, the following holds: GNI = GDP + net factor income from abroad; GNDI = GNI + net current transfers from abroad; absorption = consumption + investment = GNDI + current account deficit of the balance of payments = GDP + imports - exports. For more on these relationships, see for example IMF (2007).

Among the production sectors (Figures 2.5-2.6; Tables A3.5-A3.6), agriculture is largest, followed by private services, government services and mining, with the latter being larger than government services during part of the simulation period. Other industry remains less important. In terms of indexed expansion (Figure 2.6), mining is projected to grow very fast for a few years after which it stagnates; other sectors grow at a steadier pace.[9]

The MDG indicators that are covered – poverty, under-five mortality, water access, and sanitation access – are all simulated to make progress at fairly even and uniform rates with the exception of water access, which already is quite high (Figures 2.7-2.8; Table A3.1). The poverty computation assumes unchanged and relatively high inequality with a Gini coefficient of 52.6; shown by Figure 2.5, if Liberia's Gini coefficient were to decrease to the world-wide average (40.9), progress on poverty reduction would be stronger, by 2030 declining to 36 percent instead of 42 percent.

3. ALTERNATIVE SCENARIOS: FISCAL SPACE AND EXPORT PRICES

The non-base scenarios are constructed to address questions about the effects on Liberia's development up to 2030 of efforts to increase the fiscal space for spending on infrastructure and/or HD. In addition, they explore the consequences of lower mining export prices. A common feature of all non-base scenarios is the GDP growth is endogenous, not exogenous as was the case for the base scenario. Apart from that, the non-base scenarios are identical to the base scenarios except for the features that are highlighted in our discussion of each scenario.

FISCAL SPACE SCENARIOS

In order to better understand the consequences of alternative developments in terms of sources and uses of additional fiscal space, we constructed a set of scenarios that differ in terms of sources and uses of fiscal space. However, measured as a share of GDP, they all raise and use same amount of fiscal space, making it straightforward to compare results across simulations. The simulations are defined as follows:

- *infhd+tx*. Domestic (non-trade) taxes, excluding taxes on mining profits, are gradually raised by 1 percent of GDP per year during the period 2014-2017 (i.e. in 2019 by 6 percent of GDP); this increase is kept in place throughout the simulation period. The resulting increase in government revenues is used to scale up government spending in the areas of infrastructure (energy, roads and other infrastructure) and HD (education, health and water-sanitation); more specifically, within the limits of the space that is available in the government budget, the growth rate for government consumption and

[9] In Table A3.5, the GDP shares of the more tradable sectors, especially mining and but also agriculture, are boosted by the depreciation of the real exchange rate (the prices of tradables increases relative to non-tradables); as a result, their performance over time is stronger in this Table than what is suggested by Table A3.6 and Figures 2.5 and 2.6, all of which are based on real GDP changes.

capital stocks in each of these functions is adjusted by a uniform number of percentage points.

- *infhd+eff*. The higher government growth rates of *infhd+tx* are imposed with one exception, "other government". Instead of financing this increase in fiscal space with higher taxes, it is financed by an improvement in allocative government efficiency, represented by an endogenous reduction in growth for the function "other government". This is an improvement in allocative efficiency since, as opposed to HD and infrastructure, the other government function does not have any direct positive effects (in terms of productivity, HD or other consequences).
- *infhd+fg*. The growth rates for the government functions of *infhd+tx* are imposed, this time without exception (i.e., also for "other government"). Instead of financing this increase in fiscal space with higher taxes or improved efficiency, it is financed by an endogenous increase in foreign grants.
- *infhd+mix*. The government growth rates of *infhd+tx* are imposed without exception also for this scenario. However, instead of relying on a single source of the needed fiscal space, this simulation mixes the three sources that were singled out in the preceding simulations (taxes, efficiency and grants). The increases in tax rates, foreign grants and efficiency are now one third of the increases under *infhd+tx*, *infhd+eff*, and *infhd+fg*, respectively, *i.e.*, getting 2 percent of GDP from each. This seems more realistic than mobilizing 6 percent of GDP from a single source.
- *inf+mix*. The sources of fiscal space are the same as for *infhd+mix*. However, the growth in government spending is limited to the infrastructure area; for HD, the growth rates are the same as under *base*.
- *hd+mix***.** Here, the increase in fiscal space is used to increase spending on HD; for infrastructure, the growth rates are the same as under *base*.

The results for these simulations are summarized and contrasted with those of the base scenario in Figures 3.1-3.4; the discussion also refers to Appendix Tables A3.8-A3.13, which contain more detailed numerical results on macro indicators (real growth and GDP shares), MDG indicators, the government budget, the balance of payments, and sector GDP (growth and shares).

Tax-financed expansion in infrastructure and HD spending (*infhd+tx*). Figure 3.1 shows the resulting change in government final demands (measured as shares of GDP) in an average year in the period 2020-2030, i.e. the period when the tax increase is implemented in full. As expected, the tax increase (at 6 percent of GDP) leads to a spending increase in the priority areas that is similar in magnitude. In terms of real growth, government consumption and investment increase by 0.9 and 1.3 percentage points, respectively, compared to *base* (Table A3.8; Table A3.10 shows the government budget as share of GDP). Very small growth gains, of around 0.1 percentage points, are recorded for GDP and absorption, while household consumption growth declines by 0.3 percentage points, leading to a higher poverty rate (Figures 3.2 and 3.3; Tables A3.8 and A3.9 show growth rates and GDP shares for macro indicators, respectively). Other MDG indicators improve thanks to the increase in government services, but only to a minor extent. Among the production sectors, the strongest GDP growth

increase is for targeted government services (Figure 3.4; Tables A3.12 and A3.13 show growth rates and GDP shares for production sectors). The fundamental reason for this moderate and partly negative impact is the opportunity cost of taxes: other things being equal, the households and the private sector have fewer resources available for private consumption and investment, with negative repercussions not only on poverty but also on other MDGs as well as savings, capital accumulation, and production growth. The positive MDG and productivity effects of government spending on infrastructure and HD explain why, in spite of this, some indicators improve, albeit to a minor extent.

Efficiency-financed expansion in infrastructure and HD spending (*infhd+eff*). Instead of raising the GDP share of the government, this simulation cuts the GDP share and the growth rate of non-priority spending (Figures 3.1 and 3.4). As a result of the high consumption share of other government, this leads to more rapid government investment growth while government consumption growth slows down slightly. Annual growth increases by around 0.1-0.2 percentage points are recorded for absorption, GDP and household consumption (Figure 3.1). The increase in total GDP growth is a bit stronger than for *infhd+tx*; moreover, in this case aggregate government service growth is unchanged (while the growth rates of different parts of government services change significantly) whereas private non-mining sectors enjoy slightly more rapid growth (Figure 3.4). Among the MDG indicators, all improve more strongly than under *infhd+tx*; for example, in 2030, the poverty rate is more than 3 percentage points lower.

Foreign-grant-financed expansion in infrastructure and HD spending (*infhd+fg*). Under this scenario, real government consumption and investment evolve in the same way as under *infhd+tx*. However, thanks to reliance on foreign grants instead of domestic taxes, the trade deficit expands, permitting stronger growth in absorption (domestic consumption and investment, including household consumption) and GDP (Figure 3.2) than for any of the preceding scenarios (Figure 3.2). All MDG indicators also show stronger progress than for any preceding scenario (Figure 3.3). Real sector GDP growth for the government is similar to *infhd+tx* but, for non-government sectors, it is faster than any previous scenario (Figure 3.4).

An alternative scenario was formulated to see the consequences of relying on foreign borrowing instead of foreign grants to finance the same increase in real government demands. The only significant difference is that, for this case, Liberia's foreign debt in 2030 would be at 106 percent of GDP as opposed to 28 percent under *infhd+fg* -- the change in foreign debt is equal to the cumulated value of the additional foreign grants plus additional interest payments.

Expansion in infrastructure and HD financed from a combination of taxes, efficiency gains, and foreign grants (*infhd+mix*). This scenario may be more realistic than the preceding scenarios as it may be easier to create more limited increases in fiscal space from multiple sources. Given that it represents a mixture of the preceding *infhd* scenarios, the results represent an intermediate case also in terms of outcomes, in terms of macro and MDG indicators, not very different from *infhd+eff*. (Figures 3.2-3.4).

Expansion in infrastructure financed from a combination of taxes, efficiency gains, and foreign grants (*inf+mix*). Instead of expanding both infrastructure and HD spending, the spending expansion is here limited to infrastructure; apart from that, this scenario is identical to *infhd+mix*, including the fact that it relies on a mixture of three sources of fiscal space (taxes, efficiency and grants). Compared to the preceding simulation with mixed financing (*infhd+mix*), the outcomes are quite similar. *inf+mix* generates small improvements in terms of macro growth (including absorption, GDP and household consumption) and poverty reduction, while doing marginally less well in terms of HD (Figures 3.2 and 3.3). As expected, among production sectors, this scenario features a strong growth acceleration for government infrastructure services (Figure 3.4).

Expansion in HD financed from a combination of taxes, efficiency gains, and foreign grants (*hd+mix*). On the other extreme, the government may allocate all of its fiscal space gain to HD instead of infrastructure, the option that is captured by *hd+mix*; among the government sectors, growth accelerates rapidly for HD instead of infrastructure (Figure 3.4). Compared to *inf+mix*, this leads to a growth slowdown for most macro aggregates, including absorption, GDP, and household consumption (Figure 3.2), slower non-government GDP growth, less poverty reduction, but better performance for non-poverty MDGs (Figures 3.3-3.4). On the other hand, compared to *infhd+mix*, *hd+mix* does worse or no better according to all indicators that have been considered.[10]

THE MINING SECTOR AND FISCAL SPACE

Efforts to increase fiscal space take place against the backdrop of considerable uncertainty about the future of Liberia's mining sector. This is a major concern since it adds to uncertainty regarding a wide range of variables, including government revenues. In order to get some sense of possible magnitudes, the scenario *pwemin-sd* was constructed: it is identical to *base* except for that, starting from 2014, real mining export prices are 29.6 percent lower – this represents a price cut of one standard deviation (computed on the basis of real world prices 2007-2012).

A permanently lower mining export price has a significant negative impact on most key indicators. GDP growth slows down by 0.4 percentage points due to slower capital accumulation and slower productivity growth (ultimately also due to slower capital accumulation since the endogenous productivity component largely depends on growth in government capital stocks, especially in the infrastructure area) (Figure 3.2). The decline in domestic absorption growth stronger (a loss of 0.6 percentage points) since, due to this loss in terms-of-trade, Liberia is forced to reduce its trade deficit via some combination of larger real exports and smaller real imports, an outcome that is induced by additional depreciation of the

[10] In additional simulations, we tested the impact of using financing from a single source (taxes, foreign grants or efficiency) for expanding spending on either only HD or only infra. The findings were similar to what emerged from the comparison when financing came from a mix of sources (*infhd+mix*, *inf+mix*, and *hd+mix*). – infrastructure does better in terms of growth and poverty reduction but less well in terms of other MDG indicators; the scenarios that spread the spending increase over both HD and infrastructure generate intermediate results.

real exchange rate. Household consumption growth declines by around 0.5 percentage points. The loss in final demand growth is particularly strong for the government (declines of around 1 percentage point both for consumption and investment due to slower revenue growth, especially for revenue from the mining sector. This is echoed in sectoral GDP growth rates, which slow down more strongly for the different parts of government services (by 0.9-1.1 percentage points) than for other sectors (which lose 0.3-0.5 percentage points) (Figure 3.4). The 2030 poverty rate is almost 3 percentage points higher than under *base* (Figure 3.3). As a result of worse performance for their different determinants, progress for non-poverty MDGs also slows down substantially.

From the much more narrow perspective of the preceding fiscal-space analysis, however, the level of mining export prices has virtually no influence: a rerun of all the fiscal space scenarios with the same decline in mining export prices as for *pwemin-sd* led to near identical changes in macro aggregates and MDG indicators; to exemplify, both with unchanged and low mining export prices, an increase in priority spending financed by improved government efficiency (*infhd+eff*) leads to an increase in household consumption growth of around 0.15 percentage points, albeit from a lower level if export prices are lower.[11] The implication is that it is possible to explore measures to increase fiscal space in isolation from questions related to the mining sector – measures that have a strong payoff if prices are high would also be expected to have a strong payoff if prices are low.

4. CONCLUDING OBSERVATIONS

The main findings are that, among the sources of fiscal space that are considered, foreign grants generate the best development outcomes followed by improvements in government allocative efficiency. Taxes (on domestic households and firms) are likely to involve trade-offs since they make less resources available for consumption and investment, both of which contribute to stronger macro and MDG performance. However, the strengths of these trade-offs would depend on the details of tax design and the strength of the payoffs from increased spending.[12] Foreign borrowing is a less attractive source of fiscal space: in order to make a substantial difference, the amounts borrowed could quickly add to the foreign debt, making the macro economy more prone to future crisis and reducing its flexibility.

Striking the right balance between different uses of fiscal space is difficult as it depends on the marginal payoffs of different government functions; typically, they are not known and they may

[11] When checking the results, the changes from the base for in each report indicators in Table A3.1 was ranked for the two cases of unchanged and low mining export prices; roughly 90 percent of the rankings were identical and, for the minority of cases where the rankings differed, this reflected that the changes were very close in magnitude (like an annual growth rate difference of 0.02 percent or less)

[12] If taxes can be designed to be relatively non-distortionary (if possible mitigating negative externalities), how low administrative costs, and if the uses to which additional resources are put have high payoffs, then these trade-offs may be avoidable, i.e. also tax-financed increases in priority spending could lead to improvements without any major trade-offs.

only appear with a considerable lag. Nevertheless, under the parameters used in the model simulations, determined in light of fragmentary evidence, the outcomes under a balanced approach dominated singular emphasis on the HD without being dominated by the case with singular emphasis on infrastructure. Other factors that speak in favor of a balanced approach include political economy considerations (politically it may be easier not to discriminate strongly between the rates of resource growth in different priority functions) and the fact that it may be easier to maintain acceptable efficiency if expansion is not concentrated in one area. However, these decisions have to be made in light of the specifics of the alternative uses that are available.

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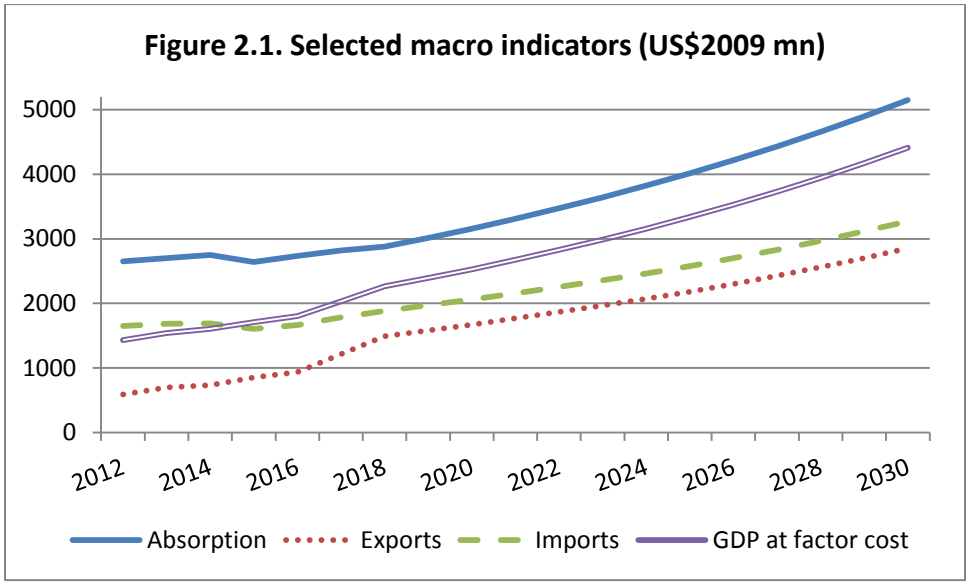
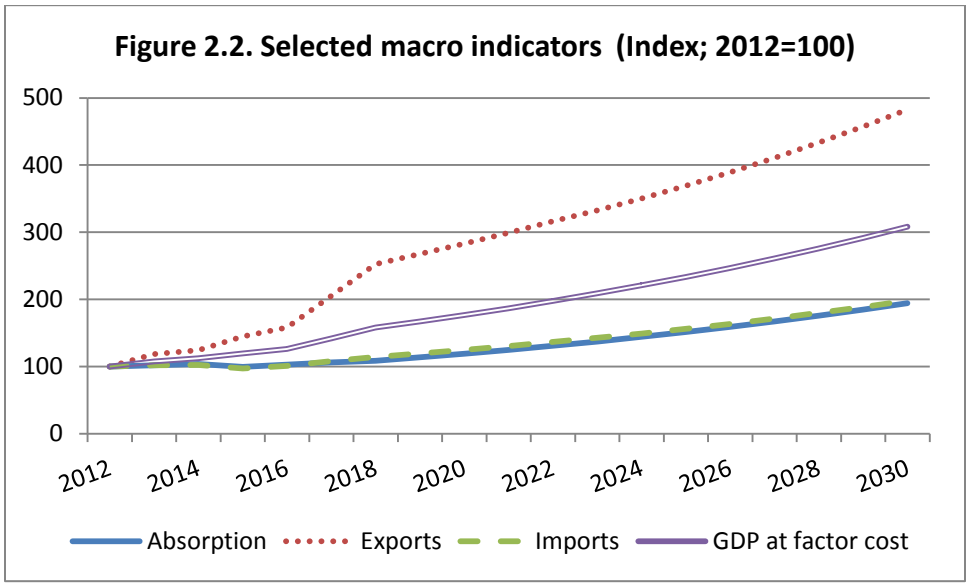
FIGURES AND TABLES





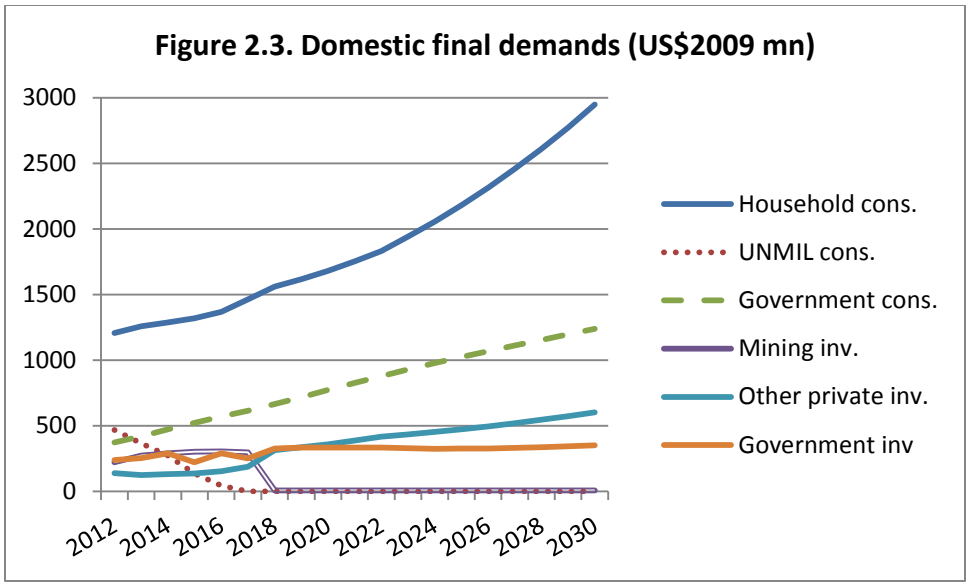


Figure 2.3. Domestic final demands (US$2009 mn)
3000
2500
2000
1500
1000
500
0
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
Household cons.
UNMIL cons.
Government cons.
Mining inv.
Other private inv.
Government inv

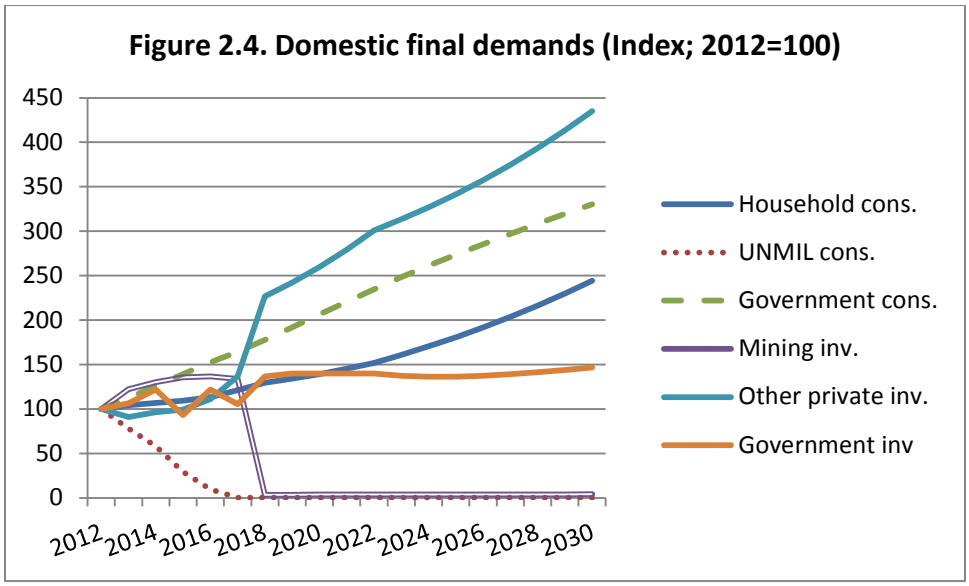


Figure 2.4. Domestic final demands (Index; 2012=100)
450
400
350
300
250
200
150
100
50
0
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
Household cons.
UNMIL cons.
Government cons.
Mining inv.
Other private inv.
Government inv

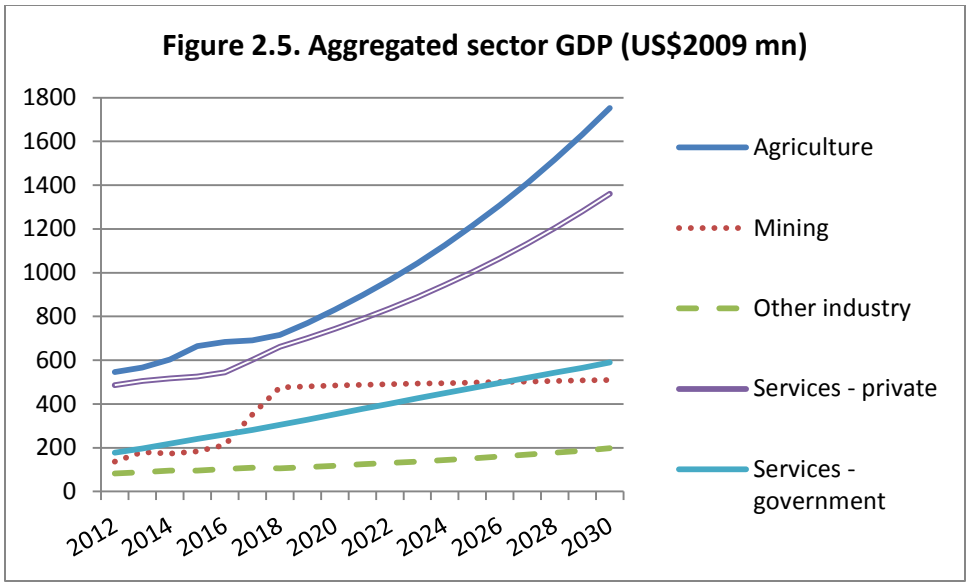


Figure 2.5. Aggregated sector GDP (US$2009 mn)
1800
1600
1400
1200
1000
800
600
400
200
0
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
Agriculture
Mining
Other industry
Services - private
Services - government

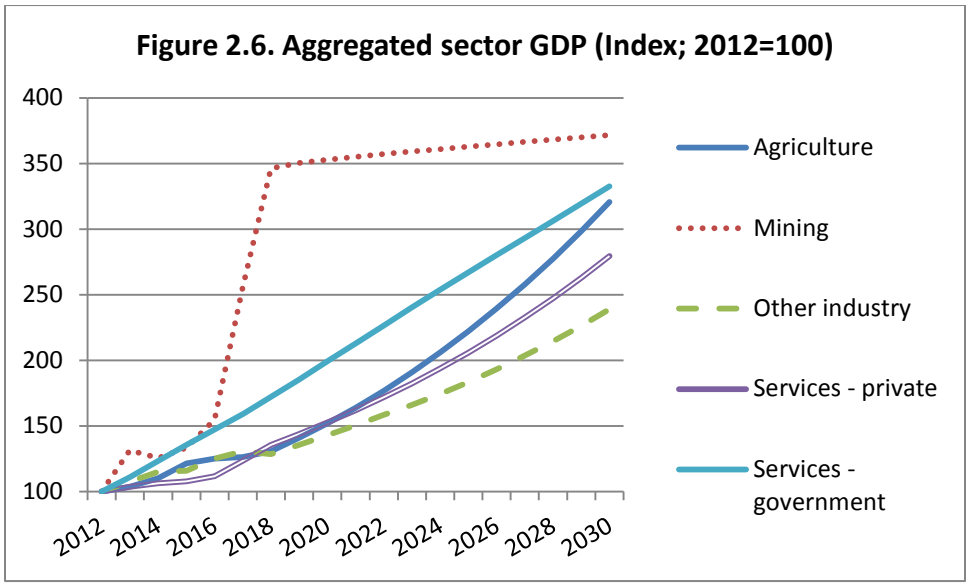


Figure 2.6. Aggregated sector GDP (Index; 2012=100)
400
350
300
250
200
150
100
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
Agriculture
Mining
Other industry
Services - private
Services - government

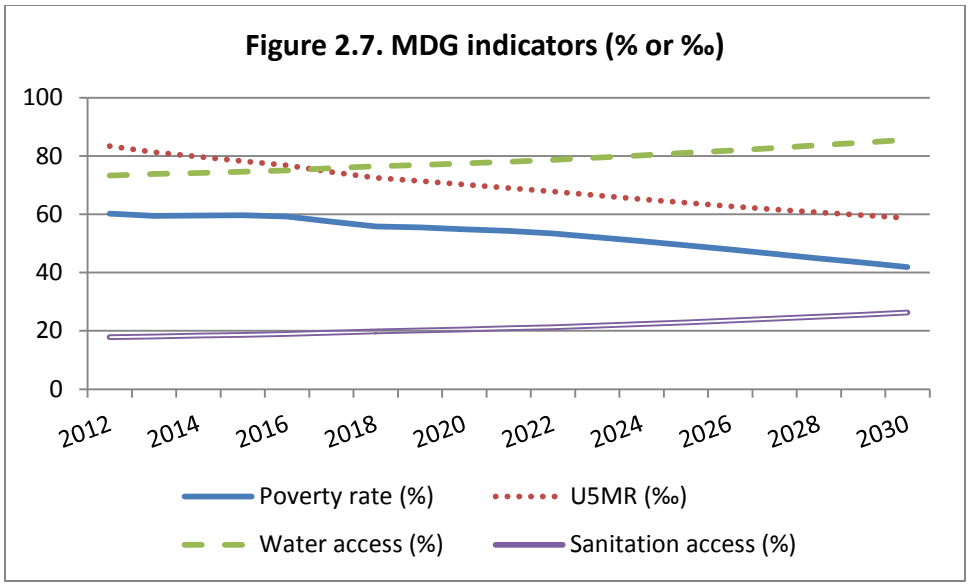


Figure 2.7. MDG indicators (% or ‰)
100
80
60
40
20
0
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
Poverty rate (%)
U5MR (‰)
Water access (%)
Sanitation access (%)

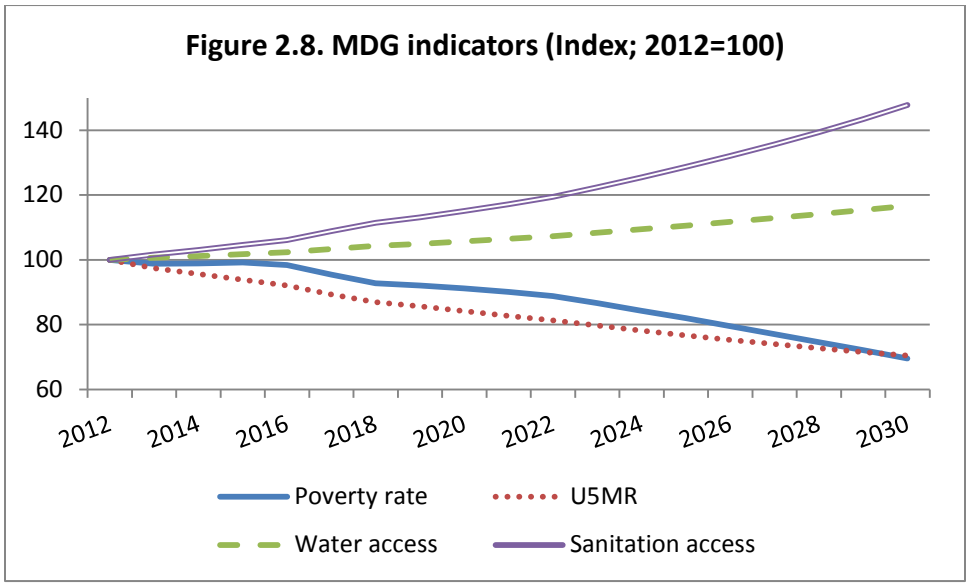


Figure 2.8. MDG indicators (Index; 2012=100)
140
120
100
80
60
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
Poverty rate
U5MR
Water access
Sanitation access

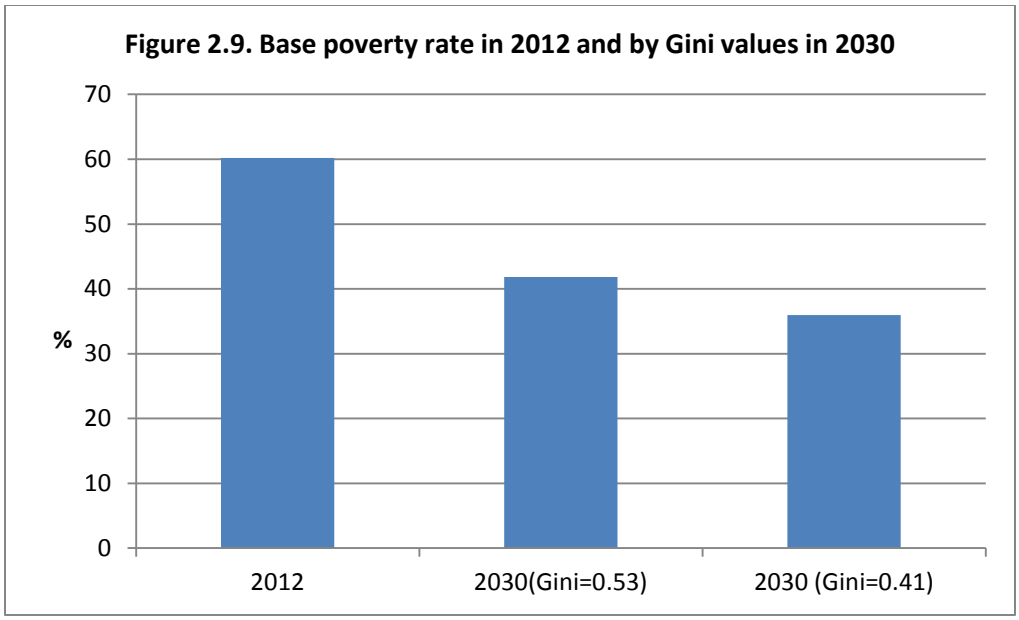


Figure 2.9. Base poverty rate in 2012 and by Gini values in 2030
70
60
50
40
%
30
20
10
0
2012
2030(Gini=0.53)
2030 (Gini=0.41)

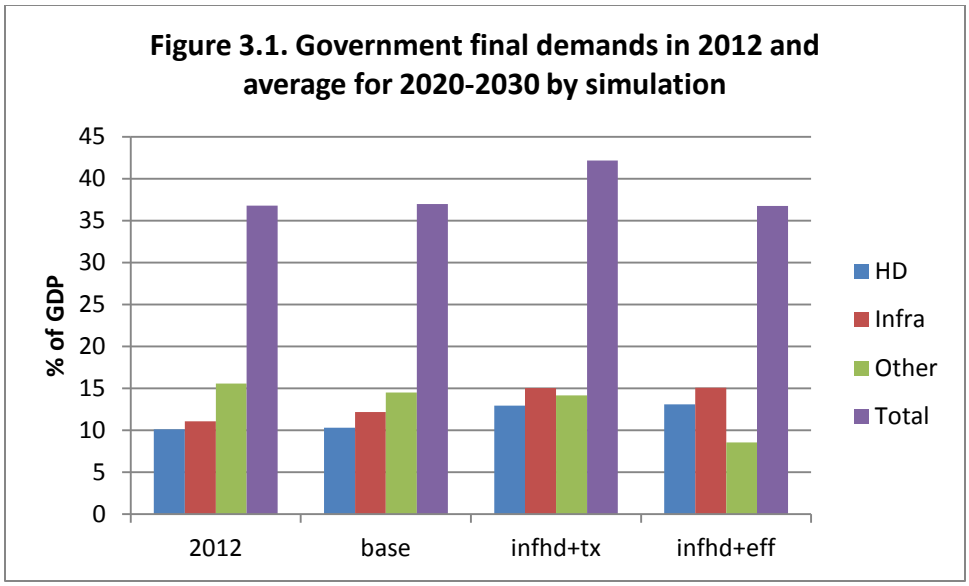


Figure 3.1. Government final demands in 2012 and average for 2020-2030 by simulation
% of GDP
45
40
35
30
25
20
15
10
5
0
2012
base
infhd+tx
infhd+eff
HD
Infra
Other
Total

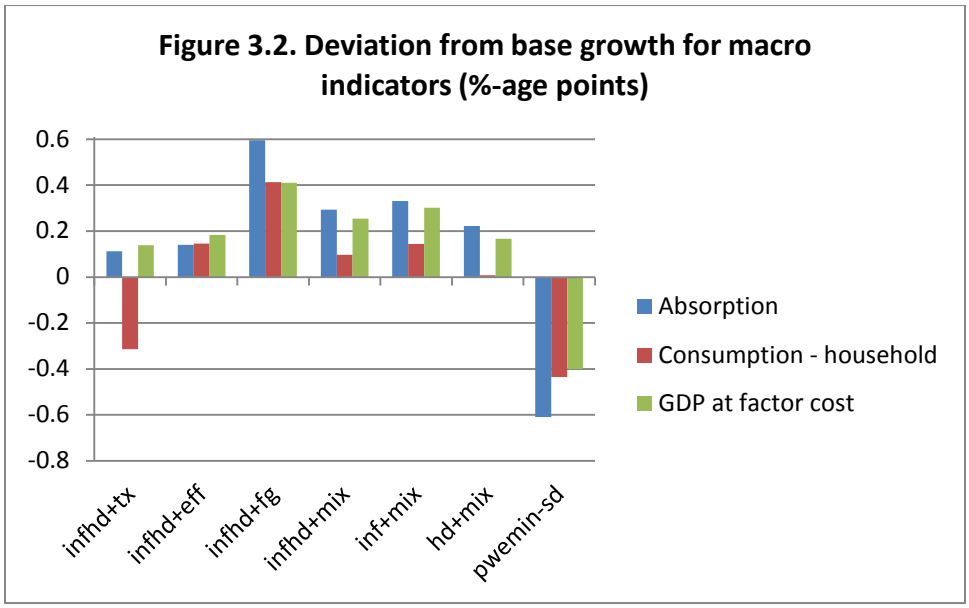


Figure 3.2. Deviation from base growth for macro indicators (%-age points)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
infhd+tx
infhd+eff
infhd+fg
infhd+mix
inf+mix
hd+mix
pwemin-sd
Absorption
Consumption - household
GDP at factor cost

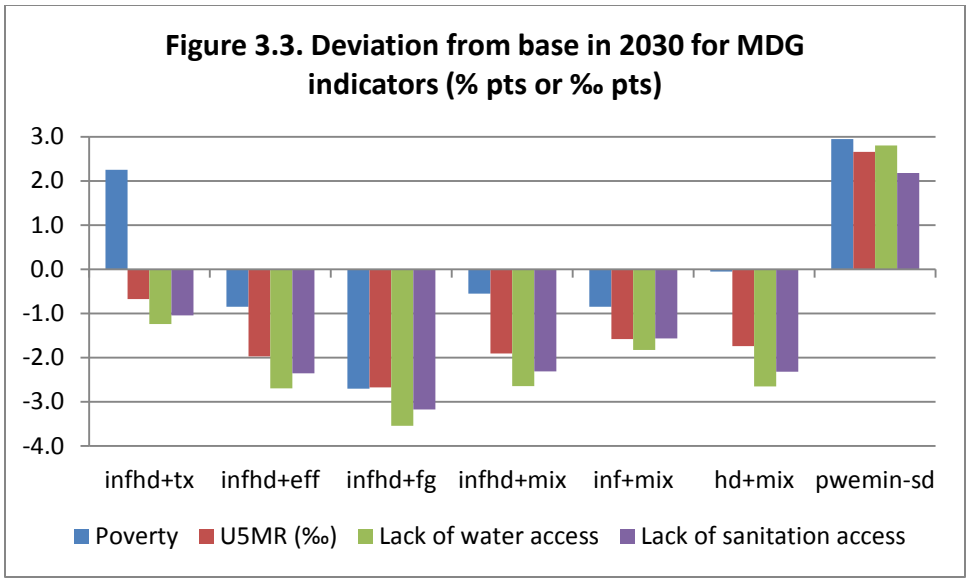


Figure 3.3. Deviation from base in 2030 for MDG indicators (% pts or ‰ pts)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
infhd+tx
infhd+eff
infhd+fg
infhd+mix
inf+mix
hd+mix
pwemin-sd
Poverty
U5MR (‰)
Lack of water access
Lack of sanitation access

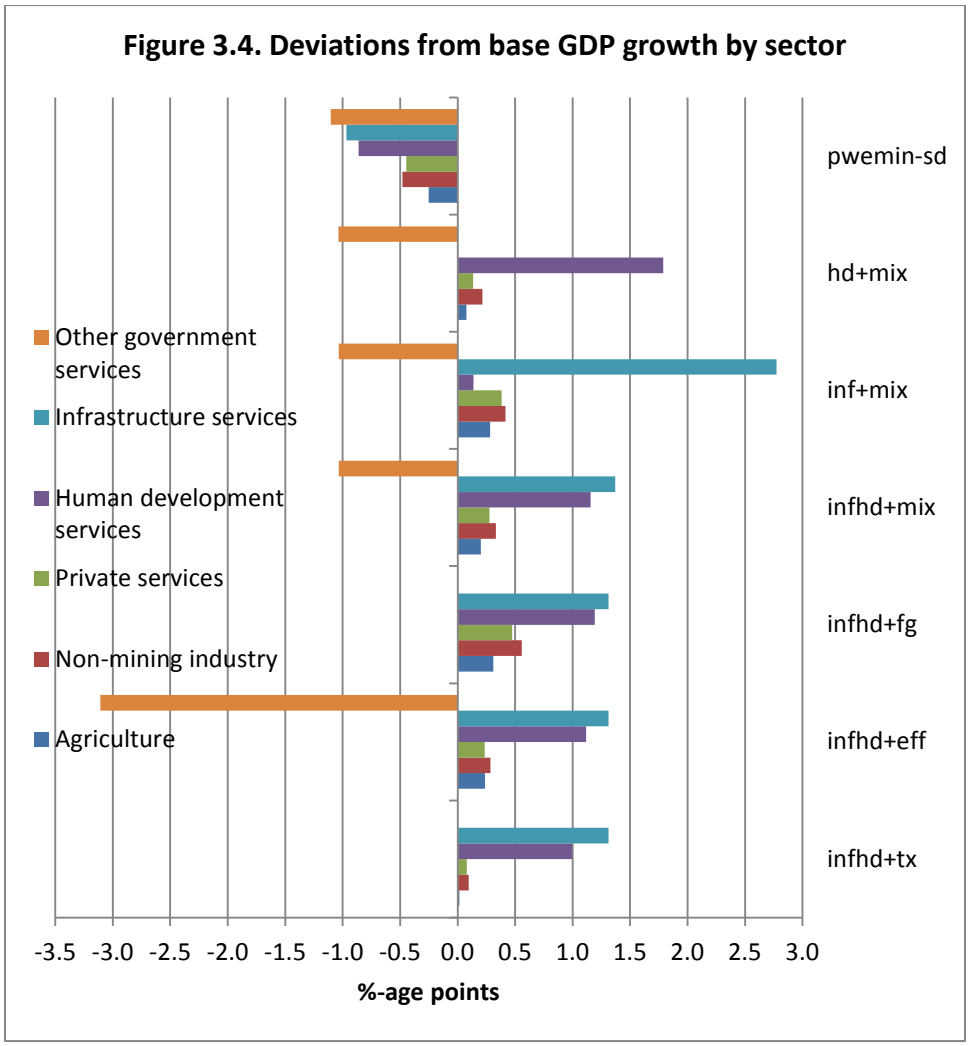


Figure 3.4. Deviations from base GDP growth by sector
Other government services
Infrastructure services
Human development services
Private services
Non-mining industry
Agriculture
pwemin-sd
hd+mix
inf+mix
infhd+mix
infhd+fg
infhd+eff
infhd+tx
-3.5
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
%-age points

APPENDIX 1: STRUCTURE OF MAMS

Figure A1.1 summarizes the payment flows that are captured by MAMS in any year. 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 core institutions: households, government, and the rest of the world.

- Households (an aggregate domestic private institution) 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.[13] 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 (which also includes donors) 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.

- The rest of the world (which appears in the balance of payments) sends US dollars to Liberia in the form of transfers to Liberia's government and households (net of interest payments on their foreign debts), FDI, loans, and export payments.[14] Liberia 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.[15]

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[13] 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.

[14] Liberia's economy is treated as fully dollarized.

[15] 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). The resulting increase in domestic demands (be it from the government or other agents) would not change international (export and import prices) but would raise domestic prices (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.

- In addition to the three institutions in Figure 2.1, the Liberian version of MAMS also includes UNMIL due to its significant economic role. All of its incomes stem from foreign transfers and are used for consumption with a large import share.

Private investment financing is provided from domestic private savings (net of lending to the government) and foreign direct investment (FDI). It is assumed that private investment spending will adjust 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 – Liberia 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.[16]

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 market, unemployment is endogenous – 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 A1.2; 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) without any change in the labor-force participation rate; typically, this seems realistic. Over time, the labor force grows due to demography. For non-labor factors, the supply curves are vertical in any single year (the supply is fixed) but switch over time as supplies change (see next point).

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 demography), and other factors (following exogenous growth trends), as well as because of improvements in total factor productivity (TFP). Apart from an exogenous component, TFP depends on the levels of government capital stocks.[17]

[16] Many individual production activities do not respond to changes in relative prices for exports and domestic sales as their output only has one destination, either exported in full or sold domestically in full. By the same token, domestic demanders do not have a choice between imports and domestic output for commodities that only have one source. Such structural features reduce the flexibility of Liberia's economy.

[17] In Appendix 2 (on the MAMS database), we discuss our treatment of the links between productivity and government capital stocks.

The disaggregation of MAMS varies widely across different applications depending on data availability and the kinds of questions the model is called upon to analyze. For the Liberian application, the database is disaggregated into some 60 accounts (see Table A2.1), indicative of the aspects of Liberia's economy that the model is able to consider. Most importantly, the database includes 22 production sectors as well as two commodities without domestic production (refined petroleum and non-competitive imports). Among the sectors, government production is represented by 7 services, covering HD, infrastructure and other areas. The factors of production are split into labor, different types of capital (mining, other private, and one capital type for each government service), and land factors specific to agricultural sectors.

Figure A1.1. Aggregate payment flows in MAMS

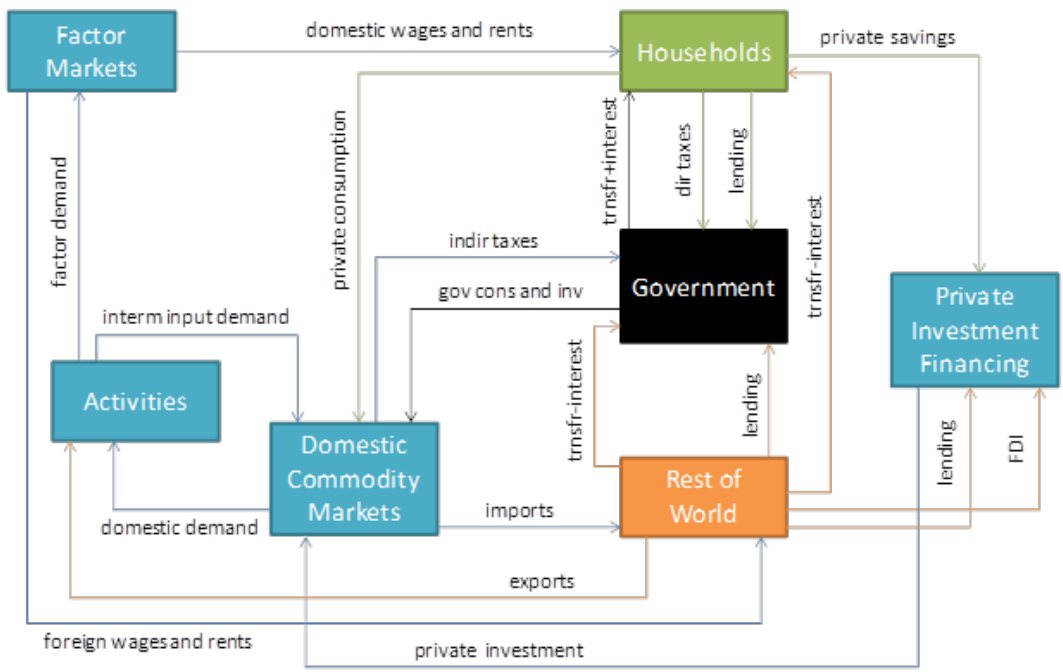
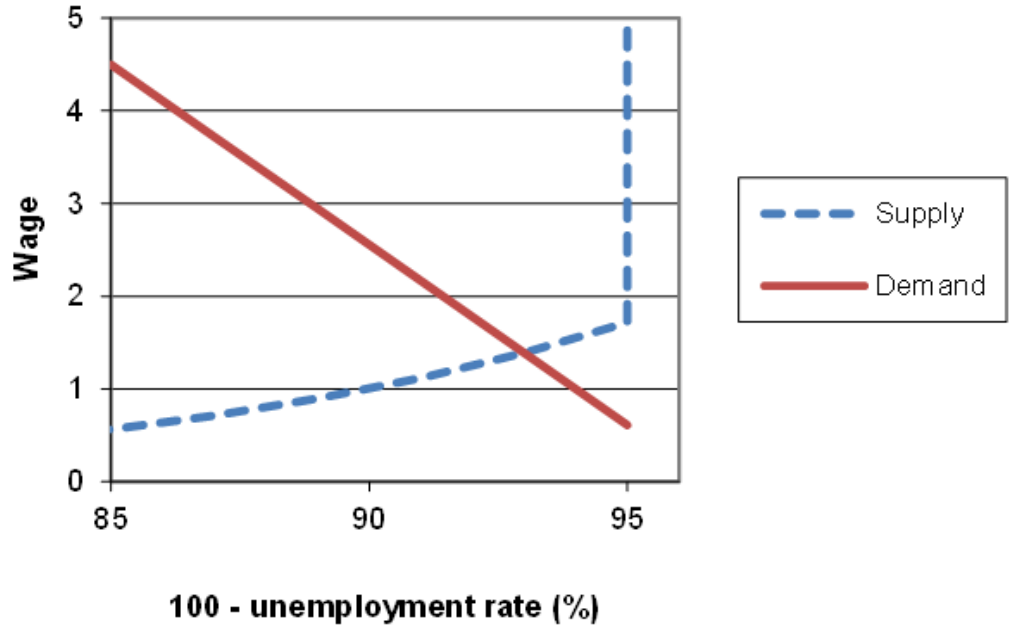


Figure A1.2. The labor market in MAMS.



APPENDIX 2: THE MAMS DATABASE

The database with this disaggregation consists of a Social Accounting Matrix (SAM), data on stocks (of factors of production and debts), elasticities (in production, consumption, trade, and MDG functions), and miscellaneous other data.[18] Table A2.1 shows the disaggregation of the database. The SAM, which was specifically built for this analysis is mainly based on the 2008 Supply and Use Tables (SUTs; which also include employment data), IMF fiscal and balance of payments data, as well as disaggregated fiscal and foreign aid data from the Ministry of Finance on the allocation of foreign aid across different areas (LISGIS 2011; Ministry of Finance, 2009, pp. 27-30; Ministry of Finance, 2010, p. 8). World Bank (2012) provided additional indicators, both on Liberia and across countries. Relative to earlier national accounts data (which mostly relied on extrapolations of pre-war surveys), the SUTs offer improved coverage of non-tradable domestic economic activities (including subsistence farming and informal service sectors). At the same time, the SUTs are by construction incomplete when it comes to fiscal and foreign transactions, requiring reliance on data from other sources; we here turned to IMF data. Inconsistencies between IMF and SUT data were resolved using statistical procedures. According to the resulting SAM, FY2009 GDP was US$1,421 million, in contrast with an earlier IMF figure of US$832 million for CY (calendar year) 2008 and an SUT figure of US$2,025 million for calendar year 2008; after a recent round of revisions, the IMF GDP figure for CY2008 and CY2009 are now US$1101 million and US$1155 million, respectively (IMF 2011, p. 21; LISGIS 2011, p. I; IMF 2012, p. 51).[19] With regard to the findings of the fiscal space analysis of this paper, the exact level of GDP makes little difference; the structure of the economy (the relative sizes of different payment flows is more important.

The analysis addresses the effects of alternative government spending patterns. In MAMS, these effects are covered via two mechanisms: (1) total factor productivity in selected production sectors is a function of the level of government service-specific capital stocks (cf. the disaggregation of government service sectors in Table 1), which are driven by government investments and depreciation rates; and (2) spending on health and water-sanitation has a direct impact on the MDGs for under-five mortality, water access, and sanitation.[20] The

[18] A SAM is a square matrix that that provides a comprehensive, consistent economy-wide summary of the payments in an economy during one year. It links institutions, factors, and production sectors. The latter are split into activities (which carry out production) and commodities (representing activity outputs or imports without domestic production). Given the consistency requirement, each account must be balanced – its receipts must equal its outlays. The accounts of the Liberia SAM closely match the disaggregation of MAMS (cf. Table 1). The elasticities used in MAMS draws on the international literature; given the consistency features of an economy-wide model like MAMS, as long as they stay within ranges that are widely accepted, most elasticities play a very minor role. In the analysis of the simulation results, we will highlight the features of the model and the database (including elasticities) that have a significant bearing on our qualitative conclusions.

[19] The higher the GDP (and GNI), the lower the average growth rate required to reach middle-income status by 2030. However, it is also worth noticing that economic activities that register the largest increases compared to earlier statistics (the informal sector and subsistence farming in particular) are less likely to grow rapidly.

[20] In other MAMS applications, the impact of education has typically been captured by linking a detailed treatment of this sector to a labor market that is disaggregated by educational attainment, with higher wages (and marginal value products) for workers with more education. By permitting education spending to bring about an expansion in

parameter values selected for these links reflect our assessment of the relevant empirical literature and the situation in Liberia. With regard to (1), the internal rates of return (IRRs; the interest rates at which the net present value of the investment is zero) are as follows: 38% for energy, 34% for roads and other infrastructure, 18% for education, 15% for water and sanitation, and 9% for health.

More specifically, government spending in these areas influence growth raising TFP in selected activities. When calibrating these links, we calculate IRRs (internal rates of return) for different areas of government spending on the basis of the following variables: the initial investment cost; O&M costs linked to the resulting capital stock; gestation lags (the lag between the investment and the time when the capital stock is available for use; longer for infrastructure); productivity lags (the lag between the time when the capital stock is available and when it starts to yield positive productivity effects; longer for education); the depreciation rate (once the gestation lag is completed); the marginal productivity of the capital stock (once the productivity lag is over); and expected growth for the sectors in which productivity increases due to the investment. Among these, the marginal productivity figures are adjusted to generate targeted IRRs. For empirical data on typical IRRs (approximately matched in our parameterization, see Foster and Briceño-Garmendia (2010) for infrastructure; and Psacharopoulos and Patrinos (2004, pp. 112 and 114) for education (for the latter using social rates since they have a more complete cost coverage). With regard to the impact of health outcomes (among other things influenced by government spending on health) on growth, Jack and Lewis (2009, p. 2) conclude that they are difficult to measure and likely to be small; given this, we impose a more moderate IRR for health. Given that water and sanitation are likely to have its major effects by impacting health, we impose a similar IRR for this sector. (It should be noted that better health and better access to water and sanitation also are objectives in their own right, quite apart from the growth effects that they may have.) Our combined gestation and productivity lags follow those used for Uganda by Estache and Muñoz (2007, p. 18).

With regard to (2), a set of functions covering MDGs other than poverty, were, in a first step, calibrated to replicate projected responses given simulated growth in GNI per capita. In a second step, the sources of the gains were assigned to the following determinants: real government services in the relevant functional area (education, health, and water-sanitation). The data draw on cross-country regressions and a review of the relevant literature. However, it should be stressed that the results merely should be viewed as illustrations of plausible responses to changes under different scenarios.

For MDG 1, here covered by headcount poverty, the results are generated by a module that draws on the simulated evolution of household per-capita consumption, a Gini coefficient (which is exogenous), and an initial poverty rate, assuming that consumption is log-normally distributed. Drawing on World Bank data and the 2007 CWIQ Survey, we use a Gini coefficient

---

real education services and, over time, in the educational attainments of the labor force, such a treatment endogenizes gains from education spending. However, due to a lack of data, this was not possible in this analysis of Liberia.

of 52.6 and an initial headcount poverty rate of 63.8% (World Bank 2012; Backiny-Yetna *et al*. no date, p. 8). By 2012, the poverty rate is simulated to have declined to 60.2%). We report on the sensitivity of poverty outcomes to a decline in the Gini coefficient to a gradual decline such that, by 2030, it has fallen to the current world-wide average of 40.9.[21]

[21] It is widely accepted that a log-normal distribution provides a good approximation for within-country income and consumption distributions (Bourguignon 2003; Easterly 2009). Inter alia, as noted by Easterly (2009, pp. 28-29), (i) empirical cross-country analysis indicates that the higher the initial poverty rate, the lower the poverty elasticity of growth, and (ii) the absolute value of the simulated poverty-elasticity of growth with a log-normal distribution is inversely related to the initial poverty rate and positively related to per-capita income. The average of the most recent Gini coefficient for all 124 countries with data for the period 2000-2008 was 40.9 (World Bank 2012).

Table A2.1. Disaggregation of Liberia MAMS

Item category	Description
Sectors	
agriculture	annual crops (rice, other crops)
	tree crops (incl. rubber, palm oil, cocoa)
	animal-based (incl. fishing, livestock, poultry)
	forestry (incl. logs, firewood, charcoal, bushmeat)
industry	mining (incl. iron ore, gold, diamond, quarrying products)
	food (processed food incl. beverages)
	other manufacturing (incl. furniture, machinery, etc.)
	electricity and water supply (utilities)
	construction
	refined petroleum products (no domestic production)
	other non-competitive imports (no domestic production)
services -- private	retail and wholesale trade
	domestic transportation
	traded transportation
	telecommunications
	extraterritorial organizations and bodies
	other private services
services -- government	education
	health
	water and sanitation
	energy infrastructure
	roads infrastructure (O&M and other)
	other infrastructure (O&M and other)
	other government
Transactions costs	
	transactions margins -- domestic trade
	transactions margins -- exports
	transactions margins -- imports

cont. Table A2.1. Disaggregation of Liberia MAMS

Factors	
	labor
	mining capital and natural resources
	private capital
	one capital stock for each government service
	crop land
	tree land
	forestry land
Institutions	
current accounts	household (domestic institution excluding government, donors, and unmil)
	government (including donors)
	UNMIL (United Nations Mission in Liberia)
	rest of world
auxiliary accounts	taxes -- direct
	taxes -- imports
	taxes -- activities
	taxes -- commodities
	interest on domestic government debt
	interest on foreign government debt
capital accounts	household -- capital account
	government -- capital account
	rest of world -- capital account
Investment	
	mining
	one investment account for each government service
	stock change

APPENDIX 3: SUPPLEMENTARY SIMULATION RESULTS

Table A3.1. Real macro indicators: level in 2012 (constant US$mn) and base growth by period (% per year

	2012	2013-17	2018-30	2013-30
Absorption	2,652.4	1.2	4.7	3.8
Consumption - household	1,206.6	3.9	5.5	5.1
Consumption - UNMIL	469.8	-71.6	-0.4	-29.7
Consumption - government	374.6	10.4	5.5	6.9
Fixed investment - private	362.2	6.2	1.8	3.0
Fixed investment - government	239.2	1.0	2.6	2.2
Exports	590.7	15.5	6.8	9.1
Imports	1,649.9	1.6	4.8	3.9
GDP at market prices	1,593.3	7.1	5.9	6.2
GDP at factor cost	1,430.2	7.3	6.1	6.5
Total factor employment (index)	100.0	4.4	3.7	3.9
Total factor productivity (index)	100.0	2.9	2.5	2.6
GNI	1,410.0	6.6	6.4	6.5
GNDI	2,355.5	0.9	5.7	4.3
GNI per capita (2009 US$)	0.4	4.1	4.2	4.2
GNDI per capita (2009 US$)	0.6	-1.5	3.4	2.0
Real exchange rate (index)	100.0	1.1	2.4	2.0
Unemployment rate (%)	14.7	13.6		11.0
MDG 1 -- poverty rate (%)	60.2	57.5		41.8
MDG 4 -- U5MR (per 1000)	83.4	74.4		58.7
MDG 7 -- Water access (%)	73.3	75.8		85.5
MDG 7 -- Sanitation access (%)	17.8	19.4		26.3

Note:
Unless otherwise noted, the unit for the 2012 column is millions of US$ (at 2009 prices).
Rows for unemployment and MDG indicators show levels in 2012 and at end of each period;
the "2018-2030" column is blank since 2030 data is provided in the column 2013-2030.
Other rows and columns show average annual real growth during the indicated period.

Table A3.2. Macro indicators in 2012 and for base simulation by period (% of nominal GDP)

	2012	2017	2030	2013-17	2018-30	2013-30
Absorption	166.5	126.8	111.9	145.1	114.1	122.7
Consumption - household	75.7	65.7	60.8	70.4	60.3	63.1
Consumption - UNMIL	29.5	0.0	0.0	9.5	0.0	2.7
Consumption - government	23.5	27.1	26.6	26.9	27.8	27.5
Fixed investment - private	22.7	22.4	15.6	24.0	15.0	17.5
Fixed investment - government	15.0	11.5	8.8	14.3	11.0	11.9
Exports	37.1	56.6	80.9	48.7	73.1	66.3
Imports	-103.5	-83.4	-92.8	-93.7	-87.1	-89.0
GDP at market prices	100.0	100.0	100.0	100.0	100.0	100.0
Net indirect taxes	10.2	9.8	9.9	10.4	9.5	9.8
GDP at factor cost	89.8	90.2	90.1	89.6	90.5	90.2
GNI	88.5	85.6	87.2	86.2	87.2	86.9
GNDI	147.8	109.8	106.5	123.5	108.2	112.5
Foreign savings	18.6	17.0	5.4	21.5	5.8	10.2
Gross national savings	19.1	17.0	19.1	16.8	20.1	19.2
Foreign government debt	12.1	27.0	30.0	23.5	28.5	27.1
Domestic government debt	17.6	17.4	21.2	18.5	19.5	19.2

Note:

Columns show values for single years or averages for multiple years (as indicated).

Table A3.3. Government budget in 2012 and for base simulation by period (% of nominal GDP)

		2012	2017	2030	2013-17	2018-30	2013-30
Receipts	**Domestic transfers**	1.5	1.5	1.5	1.5	1.5	1.5
	Foreign transfers	24.3	18.9	12.8	22.1	15.2	17.1
	Direct taxes	3.9	8.5	12.8	5.4	13.9	11.6
	Import tariffs	6.4	6.3	7.0	6.7	6.5	6.6
	Other indirect taxes	3.8	3.5	2.8	3.7	3.0	3.2
	Domestic borrowing	-0.2	1.0	1.0	1.0	1.0	1.0
	Foreign borrowing	2.2	2.5	1.2	4.3	1.3	2.1
	Total	42.0	42.2	39.2	44.8	42.5	43.1
Spending	**Education**	5.3	5.7	4.8	5.9	5.4	5.5
	Health	4.8	5.0	4.5	5.4	5.0	5.1
	Water-sanitation	1.7	1.7	1.3	1.9	1.6	1.7
	Energy	3.9	4.0	4.3	4.4	4.4	4.4
	Roads	5.1	5.1	5.3	5.8	5.6	5.6
	Other infrastructure	2.1	2.1	2.1	2.4	2.2	2.3
	Other	15.6	15.1	13.2	15.3	14.6	14.8
	Domestic transfers	2.9	2.9	2.9	2.9	2.9	2.9
	Domestic interest	0.4	0.4	0.5	0.5	0.5	0.5
	Foreign interest	0.1	0.3	0.4	0.3	0.3	0.3
	Total	42.0	42.2	39.2	44.8	42.5	43.1

Note:

Columns show values for single years or averages for multiple years (as indicated).

Table A3.4. Balance of payments in 2012 and for base simulation by period (% of nominal GDP)

		2012	2017	2030	2013-17	2018-30	2013-30
Outflows	Agriculture imports	0.5	0.4	0.4	0.5	0.4	0.4
	Food imports	9.5	8.8	9.8	9.4	9.2	9.2
	Petroleum imports	15.5	15.8	19.4	16.5	17.5	17.2
	Other industry imports	38.4	38.0	41.3	40.8	38.4	39.1
	Non-competive imports	24.6	5.2	4.6	10.8	5.5	7.0
	Service imports	15.1	15.1	17.3	15.8	16.1	16.0
	Factor income mining	7.0	9.9	6.4	9.1	7.2	7.8
	Other factor incomes	4.3	4.2	6.0	4.4	5.3	5.0
	Interest	0.1	0.3	0.4	0.3	0.3	0.3
	Total	115.1	97.8	105.6	107.5	100.0	102.1
Inflows	Agriculture exports	12.0	13.2	33.3	14.9	23.0	20.7
	Mining exports	18.8	35.8	31.6	26.1	38.2	34.9
	Other industry exports	1.1	1.3	2.6	1.4	1.9	1.8
	Service exports	5.1	6.3	13.4	6.3	9.9	8.9
	Private transfers (net)	5.6	5.3	6.4	5.7	5.9	5.8
	Government transfers	24.3	18.9	12.8	22.1	15.2	17.1
	UNMIL transfers	29.5	0.0	0.0	9.5	0.0	2.7
	Government borrowing	2.2	2.5	1.2	4.3	1.3	2.1
	FDI -- mining	14.0	13.7	0.2	16.0	0.3	4.7
	FDI -- other sectors	2.4	0.8	4.0	1.2	4.3	3.4
	Total	115.1	97.8	105.6	107.5	100.0	102.1

Note:

Columns show values for single years or averages for multiple years (as indicated).

Table A3.5. Sectoral GDP shares in 2012 and for base simulation by period (% of nominal GDP at factor cost)

	2012	2017	2030	2013-17	2018-30	2013-30
Mining	9.6	19.1	19.9	14.1	22.4	20.1
Non-mining	90.4	80.9	80.1	85.9	77.6	79.9
Agriculture	38.2	34.8	44.1	37.7	37.7	37.7
Non-mining industry	5.8	5.0	2.8	5.4	3.4	4.0
Private services	34.0	27.8	21.9	29.7	24.0	25.6
Government services	12.4	13.2	11.4	13.1	12.4	12.6
Human development services	5.8	5.9	4.8	5.9	5.3	5.4
Infrastructure services	1.9	2.1	2.0	2.0	2.1	2.1
Other government services	4.7	5.2	4.6	5.2	5.1	5.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table A3.6. Real GDP at factor cost by sector: level in 2012 (constant US$mn) and base growth by period (% per year)

	2012	2013-17	2018-30	2013-30
Mining	137.2	20.7	2.9	7.6
Non-mining	1,292.9	5.4	6.7	6.3
Agriculture	546.5	4.8	7.4	6.7
Non-mining industry	82.6	5.5	4.7	5.0
Private services	486.8	4.3	6.5	5.9
Government services	177.1	9.7	5.8	6.9
Human development services	83.3	9.1	6.1	6.9
Infrastructure services	27.1	11.6	7.0	8.3
Other government services	66.7	9.8	4.9	6.3
Total	1,430.2	7.3	6.1	6.5

Note:

Constant US$ are at 2009 prices.

Table A3.7. Sectoral structure for base scenario in 2012 and 2030 (%)

		Shares(%) in national ….					Shares (%) for …	
Year	**Sector**	**VA**	**Output**	**Employment**	**Exports**	**Imports**	**exports in sector output**	**imports in sector demand**
2012	**Agriculture**	38.2	25.1	49.6	32.5	0.5	22.3	1.4
	Industry	15.4	26.4	7.5	53.7	85.0	34.1	73.6
	Mining	9.6	8.8	1.6	50.6		99.5	
	Manufacturing	2.0	5.4	1.3	3.0	46.2	5.0	82.3
	Other	3.8	12.2	4.6		38.8		63.3
	Services	46.4	48.5	42.9	13.8	14.5	5.0	13.3
	Private	34.0	35.9	33.3	13.8	12.6	6.7	15.4
	Government	12.4	12.6	9.6		1.9		7.0
	Total	100.0	100.0	100.0	100.0	100.0	17.0	41.3
2030	**Agriculture**	44.1	30.8	53.8	41.2	0.5	46.4	1.3
	Industry	22.6	26.7	7.2	42.3	80.9	53.4	75.2
	Mining	19.9	13.6	3.6	39.0		99.6	
	Manufacturing	1.2	4.9	1.1	3.3	55.0	14.9	84.0
	Other	1.6	8.2	2.4		25.8		60.0
	Services	33.3	42.4	39.0	16.5	18.7	13.6	16.9
	Private	21.9	29.7	28.6	16.5	16.1	19.4	21.3
	Government	11.4	12.8	10.4		2.5		7.4
	Total	100.0	100.0	100.0	100.0	100.0	34.4	42.2

Table A3.8. Real macro indicators in 2012 (constant US$mn) and growth 2013-2030 by simulation (% per year)

	2012	base	infhd+tx	infhd+eff	infhd+fg	infhd+mix	inf+mix	hd+mix	pwemin-sd
Absorption	2,652.4	3.8	3.9	3.9	4.4	4.0	4.1	4.0	3.1
Consumption - household	1,206.6	5.1	4.8	5.2	5.5	5.2	5.2	5.1	4.7
Consumption - UNMIL	469.8	-29.7	-29.6	-29.7	-29.7	-29.7	-29.7	-29.7	-29.6
Consumption - government	374.6	6.9	7.8	6.8	7.8	7.5	7.3	7.6	5.8
Fixed investment - private	362.2	3.0	2.5	3.0	3.4	3.0	3.0	2.9	2.5
Fixed investment - government	239.2	2.2	3.5	3.0	3.5	3.4	3.9	2.9	1.2
Exports	590.7	9.1	9.3	9.4	9.3	9.4	9.4	9.2	9.0
Imports	1,649.9	3.9	4.0	4.1	4.4	4.2	4.2	4.1	3.4
GDP at market prices	1,593.3	6.2	6.4	6.4	6.6	6.5	6.5	6.4	5.8
GDP at factor cost	1,430.2	6.5	6.6	6.6	6.9	6.7	6.8	6.6	6.1
Total factor employment (index)	100.0	3.9	4.0	4.0	4.1	4.0	4.1	4.0	3.6
Total factor productivity (index)	100.0	2.6	2.6	2.7	2.7	2.7	2.7	2.7	2.5
GNI	1,410.0	6.5	6.6	6.7	6.9	6.8	6.8	6.7	6.2
GNDI	2,355.5	4.3	4.4	4.5	4.9	4.6	4.7	4.6	4.1
GNI per capita (2009 US$)	0.4	4.2	4.3	4.3	4.6	4.4	4.5	4.3	3.9
GNDI per capita (2009 US$)	0.6	2.0	2.2	2.2	2.6	2.4	2.4	2.3	1.8
Real exchange rate (index)	100.0	2.0	2.1	2.1	2.0	2.1	2.1	2.0	2.1
Unemployment rate (%)	14.7	11.0	11.5	10.9	10.3	10.8	10.9	10.9	12.0
MDG 1 -- poverty rate (%)	60.2	41.8	44.1	41.0	39.1	41.3	41.0	41.8	44.8
MDG 4 -- U5MR (per 1000)	83.4	58.7	58.1	56.8	56.1	56.8	57.2	57.0	61.4
MDG 7 -- Water access (%)	73.3	85.5	86.8	88.2	89.1	88.2	87.4	88.2	82.7
MDG 7 -- Sanitation access (%)	17.8	26.3	27.4	28.7	29.5	28.7	27.9	28.7	24.2

Table A3.9. Macro indicators in 2012 and by simulation in 2030 or averages for 2013-2030 (% of nominal GDP)

	2012	base	infhd+tx	infhd+eff	infhd+fg	infhd+mix	inf+mix	hd+mix	pwemin-sd
Absorption	166.5	122.7	122.6	122.6	127.0	124.1	124.2	124.1	131.5
Consumption - household	75.7	63.1	59.1	62.8	63.5	61.8	61.6	62.0	69.4
Consumption - UNMIL	29.5	2.7	2.7	2.7	2.6	2.7	2.7	2.7	2.8
Consumption - government	23.5	27.5	29.3	26.5	29.2	28.3	27.5	29.0	28.5
Fixed investment - private	22.7	17.5	16.6	17.4	17.4	17.2	17.1	17.2	19.5
Fixed investment - government	15.0	11.9	14.9	13.3	14.2	14.2	15.3	13.3	11.3
Exports	37.1	66.3	67.2	68.1	63.3	66.3	67.1	65.4	67.5
Imports	-103.5	-89.0	-89.8	-90.7	-90.3	-90.4	-91.3	-89.5	-99.0
GDP at market prices	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Net indirect taxes	10.2	9.8	12.8	9.9	10.0	10.8	11.0	10.7	10.8
GDP at factor cost	89.8	90.2	87.2	90.1	90.0	89.2	89.0	89.3	89.2
GNI	88.5	86.9	87.0	86.7	87.5	87.1	87.0	87.1	89.8
GNDI	147.8	112.5	112.4	112.4	117.1	114.0	114.0	114.1	119.8
Foreign savings	18.6	10.2	10.2	10.2	9.8	10.1	10.1	10.1	11.7
Gross national savings	19.1	19.2	21.3	20.5	21.8	21.3	22.3	20.4	19.1
Foreign government debt	12.1	30.0	29.2	29.6	28.1	29.0	28.9	29.2	35.7
Domestic government debt	17.6	21.2	20.8	21.0	20.6	20.8	20.7	20.9	22.7

Table A3.9. Macro indicators in 2012 and by simulation in 2030 or averages for 2013-2030 (% of nominal GDP)

	2012	base	infhd+tx	infhd+eff	infhd+fg	infhd+mix	inf+mix	hd+mix	pwemin-sd
Absorption	166.5	122.7	122.6	122.6	127.0	124.1	124.2	124.1	131.5
Consumption - household	75.7	63.1	59.1	62.8	63.5	61.8	61.6	62.0	69.4
Consumption - UNMIL	29.5	2.7	2.7	2.7	2.6	2.7	2.7	2.7	2.8
Consumption - government	23.5	27.5	29.3	26.5	29.2	28.3	27.5	29.0	28.5
Fixed investment - private	22.7	17.5	16.6	17.4	17.4	17.2	17.1	17.2	19.5
Fixed investment - government	15.0	11.9	14.9	13.3	14.2	14.2	15.3	13.3	11.3
Exports	37.1	66.3	67.2	68.1	63.3	66.3	67.1	65.4	67.5
Imports	-103.5	-89.0	-89.8	-90.7	-90.3	-90.4	-91.3	-89.5	-99.0
GDP at market prices	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Net indirect taxes	10.2	9.8	12.8	9.9	10.0	10.8	11.0	10.7	10.8
GDP at factor cost	89.8	90.2	87.2	90.1	90.0	89.2	89.0	89.3	89.2
GNI	88.5	86.9	87.0	86.7	87.5	87.1	87.0	87.1	89.8
GNDI	147.8	112.5	112.4	112.4	117.1	114.0	114.0	114.1	119.8
Foreign savings	18.6	10.2	10.2	10.2	9.8	10.1	10.1	10.1	11.7
Gross national savings	19.1	19.2	21.3	20.5	21.8	21.3	22.3	20.4	19.1
Foreign government debt	12.1	30.0	29.2	29.6	28.1	29.0	28.9	29.2	35.7
Domestic government debt	17.6	21.2	20.8	21.0	20.6	20.8	20.7	20.9	22.7

Table A3.10. Government budget in 2012 and by simulation in 2030 (% of nominal GDP)

		2012	base	infhd+tx	infhd+eff	infhd+fg	infhd+mix	inf+mix	hd+mix	pwemin-sd
Receipts	**Domestic transfers**	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Foreign transfers	24.3	17.1	17.0	17.2	21.5	18.6	18.7	18.6	20.2
	Direct taxes	3.9	11.6	13.4	11.7	11.0	12.1	12.1	12.0	7.6
	Import tariffs	6.4	6.6	6.7	6.7	6.7	6.7	6.8	6.6	7.3
	Other indirect taxes	3.8	3.2	6.1	3.2	3.3	4.1	4.1	4.1	3.5
	Domestic borrowing	-0.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Foreign borrowing	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.5
	Total	42.0	43.1	47.9	43.4	47.0	46.2	46.4	46.0	43.6
Spending	**Education**	5.3	5.5	6.6	6.7	6.5	6.6	5.4	7.7	5.6
	Health	4.8	5.1	6.2	6.2	6.0	6.2	5.0	7.2	5.2
	Water-sanitation	1.7	1.7	2.1	2.1	2.0	2.1	1.6	2.5	1.7
	Energy	3.9	4.4	5.2	5.2	5.1	5.2	6.3	4.3	4.5
	Roads	5.1	5.6	6.8	6.8	6.6	6.8	8.3	5.5	5.7
	Other infrastructure	2.1	2.3	2.8	2.8	2.7	2.8	3.4	2.2	2.3
	Other	15.6	14.8	14.6	10.0	14.5	12.8	12.8	12.9	14.8
	Domestic transfers	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
	Domestic interest	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Foreign interest	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4
	Total	42.0	43.1	47.9	43.4	47.0	46.2	46.4	46.0	43.6

Table A3.11. Balance of payments in 2012 and by simulation for 2013-2030 (% of nominal GDP)

		2012	base	infhd+tx	infhd+eff	infhd+fg	infhd+mix	inf+mix	hd+mix	pwemin-sd
Outflows	Crop imports	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
	Food imports	9.5	9.2	8.9	9.3	9.1	9.1	9.1	9.1	10.5
	Petroleum imports	15.5	17.2	17.1	17.3	17.3	17.3	17.4	17.1	19.2
	Other industry imports	38.4	39.1	40.3	40.2	40.3	40.4	41.1	39.6	43.1
	Non-competive imports	24.6	7.0	7.0	7.0	6.7	6.9	6.9	6.9	8.0
	Service imports	15.1	16.0	16.1	16.5	16.3	16.3	16.2	16.4	17.8
	Factor income mining	7.0	7.8	7.8	7.9	7.3	7.6	7.7	7.6	4.0
	Other factor incomes	4.3	5.0	4.9	5.1	4.9	5.0	5.0	5.0	5.8
	Interest	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4
	Total	115.1	102.1	102.8	104.0	102.8	103.4	104.3	102.4	109.2
Inflows	Trees exports	12.0	20.7	21.8	21.9	19.7	21.2	21.6	20.6	25.8
	Mining exports	18.8	34.9	34.6	35.0	33.0	34.2	34.3	34.2	29.1
	Other industry exports	1.1	1.8	1.6	1.9	1.8	1.8	1.9	1.7	2.1
	Service exports	5.1	8.9	9.2	9.4	8.8	9.1	9.3	8.9	10.6
	Private transfers (net)	5.6	5.8	5.8	5.8	5.5	5.7	5.7	5.7	6.9
	Government transfers	24.3	17.1	17.0	17.2	21.5	18.6	18.7	18.6	20.2
	UNMIL transfers	29.5	2.7	2.7	2.7	2.6	2.7	2.7	2.7	2.8
	Government borrowing	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.5
	FDI -- mining	14.0	4.7	4.7	4.7	4.6	4.6	4.6	4.6	5.1
	FDI -- other sectors	2.4	3.4	3.4	3.4	3.2	3.3	3.3	3.3	4.1
	Total	115.1	102.1	102.8	104.0	102.8	103.4	104.3	102.4	109.2

Table A3.12. Sectoral GDP shares in 2012 and by simulation for 2013-2030 (% of nominal GDP at factor cost)

	2012	base	infhd+tx	infhd+eff	infhd+fg	infhd+mix	inf+mix	hd+mix	pwemin-sd
Mining	9.6	20.1	20.7	20.4	18.9	20.0	20.2	19.8	11.1
Non-mining	90.4	79.9	79.3	79.6	81.1	80.0	79.8	80.2	88.9
Agriculture	38.2	37.7	37.4	38.4	37.4	37.8	38.0	37.4	43.8
Non-mining industry	5.8	4.0	3.9	4.0	4.1	4.0	4.0	4.1	4.3
Private services	34.0	25.6	24.9	25.3	26.1	25.4	25.4	25.5	27.9
Government services	12.4	12.6	13.1	11.9	13.6	12.8	12.4	13.2	12.9
Human development services	5.8	5.4	5.8	5.9	6.1	5.9	5.3	6.5	5.7
Infrastructure services	1.9	2.1	2.2	2.3	2.3	2.3	2.6	2.0	2.1
Other government services	4.7	5.1	5.0	3.7	5.2	4.6	4.6	4.6	5.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table A3.13. Real GDP at factor cost by sector: level in 2012 (constant US$mn) and growth 2013-2030 by simulation (% per year)

	2012	base	infhd+tx	infhd+eff	infhd+fg	infhd+mix	inf+mix	hd+mix	pwemin-sd
Mining	137.2	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.4
Non-mining	1,292.9	6.3	6.5	6.5	6.8	6.6	6.7	6.5	5.9
Agriculture	546.5	6.7	6.7	6.9	7.0	6.9	7.0	6.8	6.4
Non-mining industry	82.6	5.0	5.1	5.2	5.5	5.3	5.4	5.2	4.5
Private services	486.8	5.9	6.0	6.1	6.4	6.2	6.3	6.0	5.4
Government services	177.1	6.9	7.6	6.9	7.7	7.4	7.3	7.5	5.9
Human development services	83.3	6.9	7.9	8.0	8.1	8.1	7.0	8.7	6.0
Infrastructure services	27.1	8.3	9.6	9.6	9.6	9.6	11.0	8.3	7.3
Other government services	66.7	6.3	6.3	3.2	6.3	5.2	5.2	5.2	5.2
Total	1,430.2	6.5	6.6	6.6	6.9	6.7	6.8	6.6	6.1