AFGHANISTAN TO 2030: BACKGROUND PAPER

COMPUTABLE GENERAL-EQUILIBRIUM MODELING OF AFGHANISTAN GROWTH OPPORTUNITIES

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1. Introduction

This paper presents a general equilibrium analysis applied to evaluate different growth policy options for Afghanistan. The analysis is part of a larger analytical work program undertaken by the World Bank which aims at enhancing understanding of Afghanistan's growth and fragility challenges[1]. In this paper, we analyze the potential growth drivers from the increase in foreign aid as well as from the implementation of a series of reforms and pubic investment options, specifically in mining and agriculture.

The paper is structured as follows: We first present the structure of the CGE model and the data used to calibrate it. Then, we present the baseline scenario and the simulation scenarios. Finally, we present results from the simulation scenario and we draw some conclusions.

[1] World Bank (2018): Afghanistan to 2030. Forthcoming.

2. CGE model

We applied a dynamic, country-specific CGE model developed at the World Bank, named MAMS (Maquette for MDG Simulations). The model is well documented by Lofgren, Cicowiez and Díaz Bonilla (2013), and Lofgren (2013). It is suitable for the purpose of this study because it has a detailed modelling of the public sector. It has been applied in numerous studies for developing countries, among them for Afghanistan (Hogg et al. 2013).

It is a recursive dynamic model, divided into two modules, "within-period" and "between-period", integrated into a system of simultaneous equations. The "within-period" module is essentially a static Computable General Equilibrium model (CGE) that models production, consumption and investment decisions in the economy at any given moment. The "between-period" module provides the dynamic decisions of agents, by linking periods through the update of some parameters (factor supply, factor productivity) based on the path of some exogenous variables and the value of endogenous variables in the previous period. Growth is modeled by the accumulation of production factors (capital and labor) and by their productivity.

In each period, the model accounts for the decisions and payments regarding production, consumption, foreign trade, taxation, as well as transfers between institutions and links between factors and institutions.

Production is carried out by activities that produce commodities through the use of factors and intermediate inputs. We assume a nested production function. At the upper level, firms combine intermediate inputs and value added, through a Leontief function of fixed coefficients. Then, at a second level, firms combine aggregate labor and other factors of productions –land, capital, public capital. Finally, at the lower level, firms combine labor by qualifications. We assume CES functions for the second and lower levels of the nested production function, and we assume that labor categories by qualifications are substitutes, and aggregate labor and other factors are complementary.

Consumption and investment decisions are carried out by the institutions i.e. households, government and the rest of the world. Private demand functions are

obtained through the household's maximization problem of a CES-LES welfare function, subject to disposable income. Households own labor, land and part of private capital, and they obtain their income from factor income, and transfers from the government and from abroad. The rest of private capital is owned by the rest of the world, as well as specific capital for the mining sector.

Goods and services are sold in the domestic market or exported, according to a Constant Elasticity of Transformation (CET) function. Exported goods face an infinity elastic demand curve. Domestic agents demand final goods, investment goods and intermediate goods, and they combine domestic goods and imported goods through a CES function with a constant elasticity of substitution, known as the Armington elasticity.

The government finances public investment with public savings and by borrowing from domestic institutions and from the rest of the world. The model also considers the effects of public investment on total factor productivity as an externality factor resulting from public investment in infrastructure.

3. Social Accounting Matrix for Afghanistan

The main source of information for any CGE model is the Social Accounting Matrix (SAM). As the latest available SAM for Afghanistan was for year 2009-10, we built a new SAM for fiscal year 1392, which runs from December 21, 2012 to December 21, 2013.

Ten activities and eleven goods were defined. Each activity produces one specific goods, the eleven good is part of the intermediate and final consumption in the economy but is completely imported and not produced by any domestic activity. Agriculture, Mining, Industry, and Services activities were defined following the nationals accounts definition of Afghanistan. We also include a sector dedicated to the production of Opium that does not appear in official statistics. On the other hand, government and donations activities are included, in both cases are distinguished from civilian and military activities, and the former also distinguished the infrastructure activities.

Table 1. Activities and commodities included in Afghan SAM 2013

Activity – *Goods*
Agriculture
Opium
Mining
Industry
Government (Civilian)
Government (Military)
Government (Infrastructure)
Donation (Civilian)
Donation (Military)
Services
Goods exclusively imported

Production factors were classified into nine categories. In the case of labor factor we distinguished four categories according to year of schooling (illiterate, primary education, secondary education and higher education). Table 2 shows how labor is distributed among the different sectors.

For the capital factor, five categories were defined: one private capital factor common to all activity and four specific capitals factor associated with the

agricultural, opium, mining and the public sector. In the first three cases, this factor relates to natural resources (land, mines), whereas in the case of the public sector, the capital factor is obtained through public investment.

The economy has three institutional sectors, households, government and donations sector, and rest of the world. For each institutional sector, savings were defined individually (saving households, saving government, saving donations and saving the rest of the world). Three categories of investment, infrastructure investment, public investment and private investment were defined.

Table 2. Labor employment by sector

	Unskilled labor	Low-skilled labor	Medium-skilled labor	Skilled labor	Total labor
Agriculture	45.8	23.7	15.1	3.4	29.0
Opium	7.2	3.7	2.4	0.5	4.6
Mining	0.1	0.1	0.0	0.0	0.1
Industry	17.3	19.1	10.7	5.3	14.1
Goverment (Civilian)	1.9	3.0	6.8	23.5	6.4
Goverment (Military)	6.4	8.4	25.0	15.6	12.9
Donation (Civilian)	1.0	1.6	3.5	12.2	3.3
Donacion (Military)	0.3	0.3	1.0	0.6	0.5
Private services	20.0	40.2	35.5	38.8	29.2
	100.0	100.0	100.0	100.0	100.0

Source: SAM

Data update

i. Gross output (GO)

The *gross output* for each activity was determined from the structure of *Intermediate Consumption* and *Gross Domestic Product* (GDP) in SAM 2009-10 In the case of agriculture, industry, donations and services activities, information was taken from national accounts GDP data. In the case of Opium sector, the *gross output* estimation for 2013 is taken from the UN Report on the Annual Survey Opium in Afghanistan, and the *Intermediate Consumption* and GDP structure for the sector are from SAM 2009-10. For Government and donations activities *the gross output* structure was determined from the fiscal data provided by the Word Bank

staff (WB). The value of *intermediate consumption* was distributed among different goods following the structure of SAM 2009-10.

The tax component on goods of GDP was taken from the income tax data provided by the WB, and was distributed between Agriculture, Industry and Services activities under the structure in the SAM 2009-10.

ii. External sector

The aggregate import and export information for the reference year was taken from the Nationals Accounts. The distribution between different goods follows the structure resulting from the reports of the *Central Statistic Organization* (CSO)[2] and the value of imports and exports[3].

iii. Households

Sources of income

Households' income consists of the factor remuneration received by households, transfers from the government, and remittances. Transfers from the government are taken from fiscal data, and the net private flows transfers from the rest of the world are from the Annual Statistical Bulletin of the Central Bank of Afghanistan[4].

The aggregate value of the factor remuneration is determined from the GDP per activity data deducting taxes and the structure of factorial remuneration between capital and labor of the SAM09-10.

In turn, the labor factor remuneration is distributed according to year of schooling based on information from the survey of living conditions of households 2013-14 (ALCS 13-14)[5].

Consumption

The aggregate household consumption is made up of five components: on one hands the consumption of agriculture, industry and private services goods. A fourth component is the good produced by de Government civil activities, which

[2] http://cso.gov.af/en
[3] http://cso.gov.af/en/page/economy-statistics/6323/annual-trade
[4] Annual Economic and Statistical Bulletin FY 1392, Da Afghanistan Bank, January 2014.
[5] Central Statistics Organization (2016), Afghanistan Living Conditions Survey 2013-14. National Risk and Vulnerability Assessment. Kabul, CSO.

were provided in fiscal data by the Word Bank staff as sales of goods and services in the government revenues. The distribution of household consumption value from National Accounts between these four components is carried out according to the structure of household consumption SAM 2009-10. A fifth component of household consumption is domestic consumption of goods produced by the Opium activity, from Afghanistan Opium Survey 2013[6].

Direct taxes

Information on direct taxes paid to the government and other transfers to the government comes from fiscal data.

iv. Public Sector

The public sector is composed of two institutional sectors, the government and the donations. The government consumes three kinds of goods, civil, military and infrastructure services produced by the correspondent government activities. The donation sector consumes two kinds of goods, the civil and military service produced by the two donations activities. The consumption of these goods emulates the on- and off-budget civilian and military spending.

The government makes social transfers to households. The value of transfers is obtained from the tax information[7]. Data on foreign interest payments by the government is taken from the Central Bank of Afghanistan.

v. Savings-investment

Savings and investment are determined as the difference between income and expenditure for each agent.

Government savings are distributed according to the investment destination in infrastructure and public investment in general, based on CSO information. On the other hand, savings from households, the donations sector and the rest of the world goes to private investment.

[6] Afghanistan Opium Survey 2013 Summary findings, UNODC, November 2013.
[7] Word Bank Staff

Household Savings

$$cap_h = \left(\sum_f fac_{h,f} + tr_{h,g} + tr_{h,row} + int_h\right) - \left(\sum_c com_{h,c} + tr_{g,h} + Tax_h\right)$$

Government savings

$$cap_g = \left(\sum_t tax_t + \sum_h tr_{g,h} + tr_{g,row}\right) - \left(\sum_c com_{g,c} + tr_{h,g} + int_{dom} + int_{row}\right)$$

Donation saving

$$cap_d = \left(\sum_f fac_{d,f} + tr_{d,row}\right) - \left(\sum_c com_{d,c}\right)$$

Rest of de world saving

$$cap_{row} = \left(\sum_c mx_c + \sum_f fac_f + int_{row}\right) - \left(\sum_c ex_c + tr_{h,row} + tr_{g,row} + tr_{d,row}\right)$$

vi. Investment

Investment is split into private investment, and public investment, also disaggregated between public investment and infrastructure investment. The SAM and the model include foreign direct investment. The data to calibrate the base year FDI inflows is from World Bank.

The investment destination of each good is determined by the difference between the total supply and the intermediate and final consumption of each good. For industrial goods and private services the investment is distributed in public investment and infrastructure in a portion equivalent to government savings for each type of investment, based on CSO information. The rest of the assets are allocated entirely in private investment.

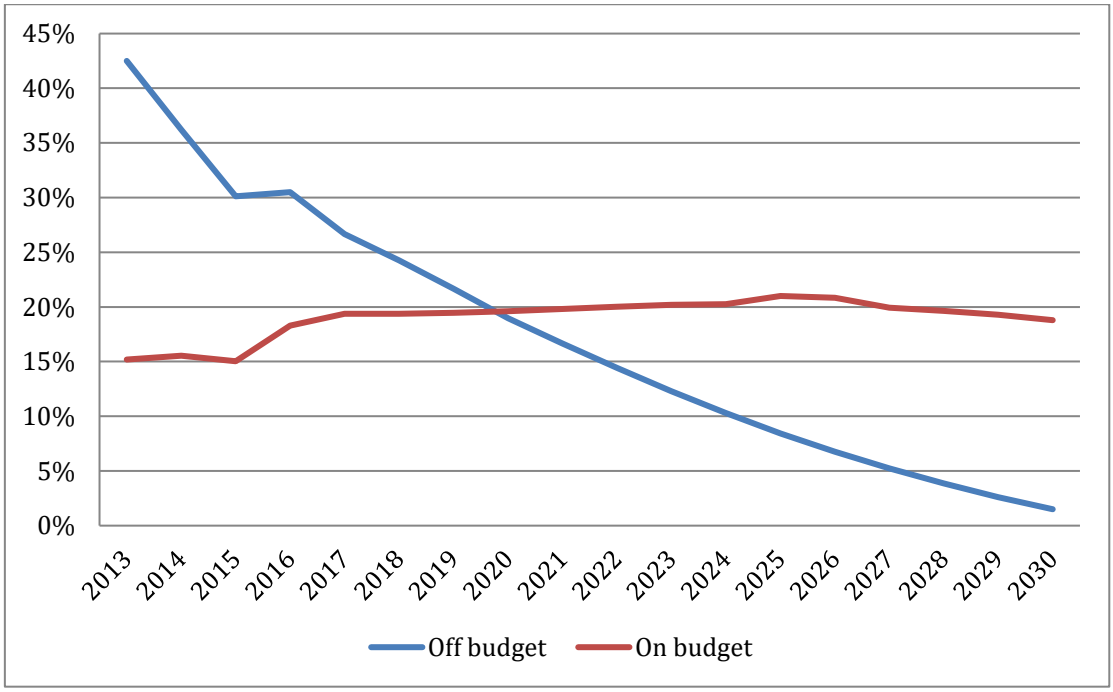
4. Baseline scenario and closure rules

The baseline scenario, which serves as a comparison point for the simulation scenarios, is supposed to represent the evolution of the economy in absence of any significant changes. To calibrate this scenario, we impose trends for some exogenous variables, such as population, aid and public debt; we establish closure rules for macroeconomic balances; and we calibrate total factor productivity (TFP) growth from GDP growth rate estimates for the long run. We run the baseline scenario until 2030.

We assume a 4.5% average GDP growth rate, increasing from 1.5% in 2016 to 5.3% by 2030. Population growth trends follow the medium variant from 2015 Revision of World Population Prospects (United Nations Population Division). We assume a scenario with unmanaged migration flows. Under this assumption, population grows at an average annual rate of 2.4%, and labor force at an average annual rate of 3.1%. The average net outflow of migrants is close to 200,000. As a result from migration outflows, remittances per capita increase between 2015 and 2030 at an average growth rate of 6.3% annually.

We assume that foreign aid decreases in terms of GDP. However, on-budget aid increases as percentage of GDP, from 15% in 2013 to 19% in 2030; while off-budget aid decreases, from 43% of GDP to 2% of GDP, as shown in Figure 1.

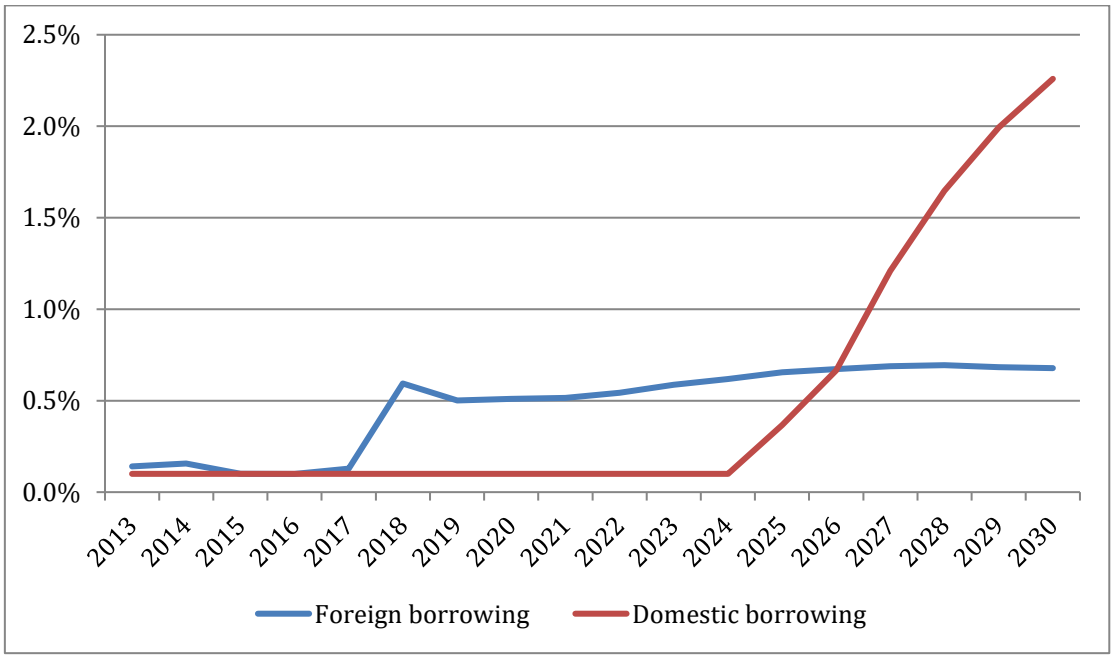
Figure 1. Aid trends as percentage of GDP. Baseline scenario



Source: World Bank projections

For the baseline, we assume that the Afghan government relies more on foreign borrowing, reaching 0.7% of GDP in 2030. We also assume that the government starts to borrow from domestic agents in year 2024, and that domestic borrowing reaches 2.3% of GDP in 2030, as depicted in Figure 2.

Figure 2. Public borrowing as percentage of GDP. Baseline scenario



Source: World Bank projections

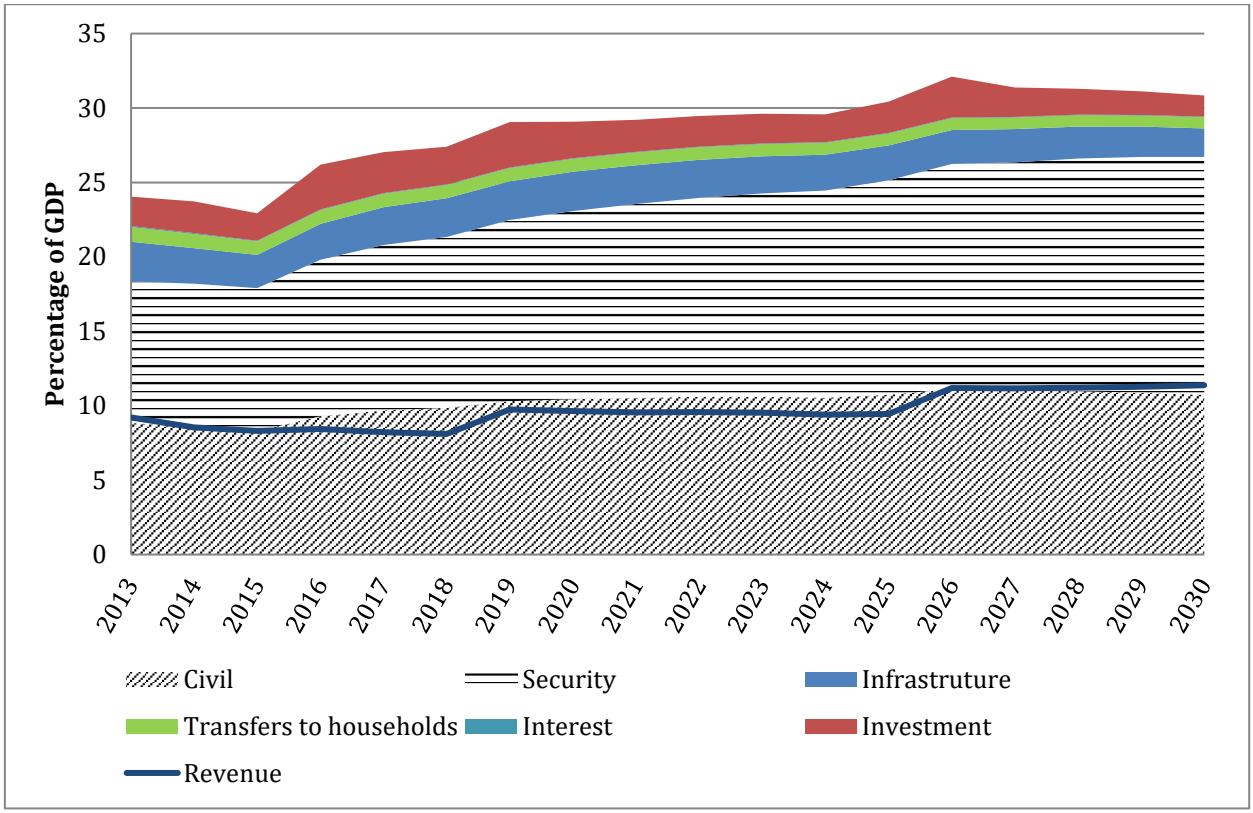
Tax rates are assumed fixed over time. Government revenue increases due to the introduction of a Value Added Tax (VAT) in 2019, which increases over time. By 2030, VAT revenue represents 3.9% of GDP.

We assume that some private investment projects in the mining sector are accomplished, specifically, the Amu Darya oil exploitation project, Turkmenistan–Afghanistan–Pakistan–India (TAPI) Pipeline, and the Central Asia South Asia Electricity Transmission and Trade Project (Casa-1000). As a consequence, foreign direct investment (FDI) and mining production increase. As a consequence, there is an increase in public revenue from mining activities, as there tax rates applied to the mining sector increase and the sector pays royalties to the government. We should keep in mind that in the model, we have only one generic mining sector; so we are not able to identify the impact of the various projects on Afghan economy.

We assume that the different public expenditures evolve as follows: transfers to households are constant in terms of total absorption; and transfers to the rest of the world are constant in terms of GDP. We assume that the public budget adjusts through current consumption of goods.

Figure 3 depicts the evolution of the government budget under the baseline scenario, as percentage of GDP.

Figure 3. Detailed government budget. Baseline scenario (% of GDP)



Source: World Bank projections

In the baseline, we also adjust the size of the informal sector of opium production, in order to reduce its GDP share, from 6% in 2013 to 0.20% in 2030.

We assume an investment-driven closure, that is, investment remains fixed as share of GDP, and in order to reach the investment levels, we adjust private savings rates.

5. Simulation scenarios

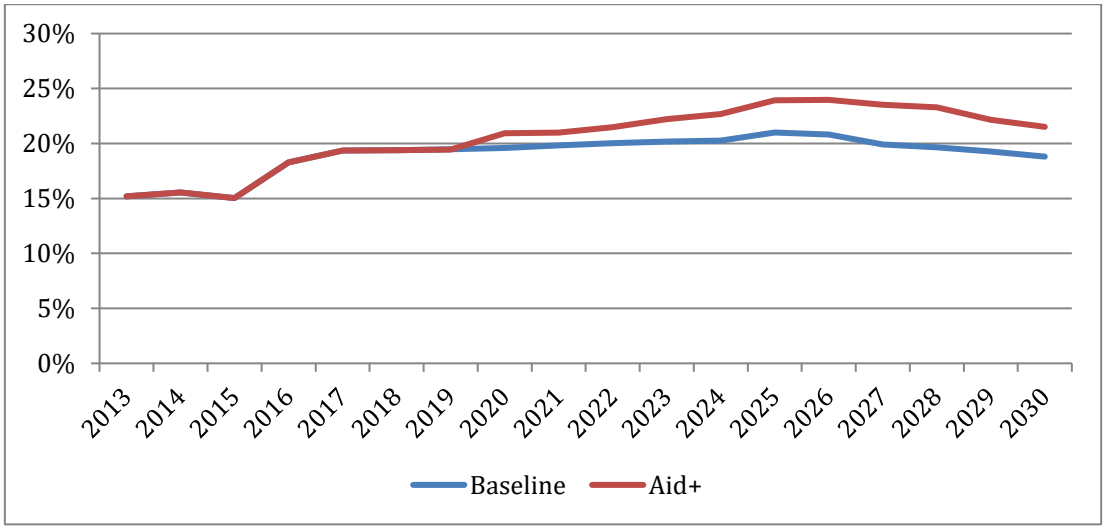
We simulate five simulation scenarios of growth opportunities for Afghanistan for the period 2018-2030, as presented in Table 1. We then combine these scenarios into one.

Table 3. Simulation scenarios

Scenario	Description	Variables
Aid+	Increase in foreign aid	On-budget foreign aid (in terms of GDP)
Min+	Development of mining projects	Mining factor growth; productivity growth in the mining sector; increase in FDI flows
Agr+	Expansion of the agriculture sector	Agriculture land expansion; productivity growth in the agriculture sector
FinSect	Development of financial sector	Increase in private savings rates
HCap	Human Capital Policies	Increase in civilian public expenditures; reduction of natality rates; improve in education
Comb	Combined scenario	All scenarios combined

The Aid+ scenario simulates an increase in foreign aid. Specifically, we assume that on-budget foreign aid is 2 percentage points higher in terms of GDP on average between 2020 and 2030, as Figure 4 depicts. Off-budget foreign aid remains as defined in the baseline scenario.

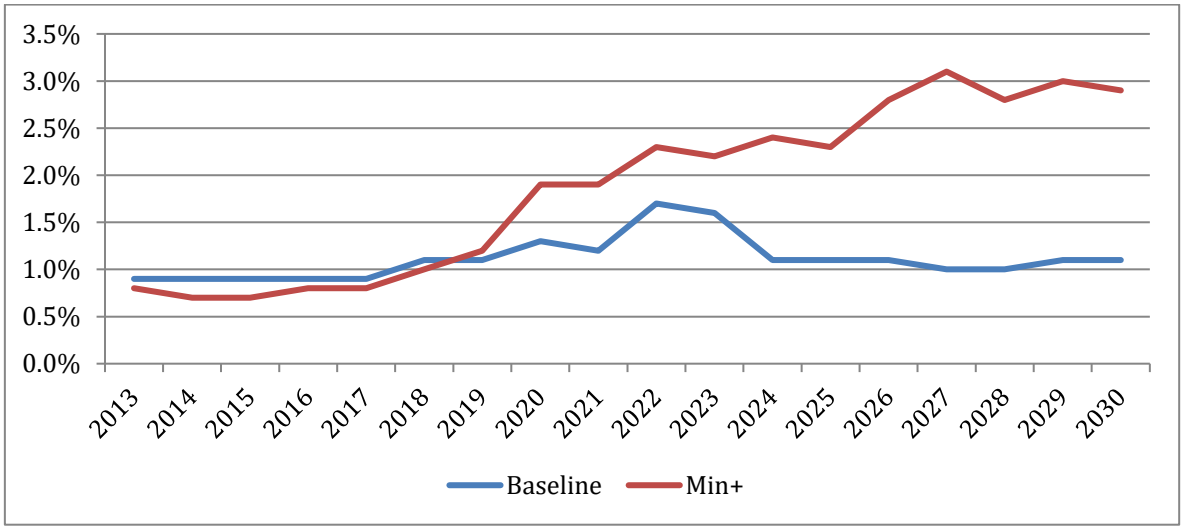
Figure 4. Aid trends as percentage of GDP. Baseline and Aid+ scenarios



Source: World Bank projections

Min+ scenario simulates an increase in mining production, assuming that besides from the mining projects achieved in the baseline, Afghan-Tajik oil and Aynak Copper also materialize. The increase in mining productions –gathered in one mining sector- is simulated through an exogenous increase in the specific natural resource factor of the sector, and an increase in productivity of the sector. Also, FDI investment and public revenue from taxes to the mining activity increase under this scenario. Figure 5 presents the evolution of FDI as percentage of GDP under Min+ and baseline scenarios.

Figure 5. FDI as percentage of GDP. Baseline and Min+ scenarios



Source: World Bank projections

Agr+ scenario simulates an increase in agriculture production. This is achieved through an expansion of land use (we assume no substitution with land used by other sectors) and an increase in total factor productivity in the sector.

FinSect scenario simulates an improvement in the financial sector of the Afghan economy, simulated through an increase in private savings rates. We assume that private savings rates increase with time, and depending on the year, savings rates are around 5 - 20% higher with respect to the baseline.

HCap scenario simulates human capital policies aimed to reduce fertility rates and improve education. As a consequence, population growth rates are lower than under the baseline scenario, and there is a change in labor composition by skills, as depicted in Table 4. In order to finance human capital policies, there is a 2.6 percentage points of GDP increase in civilian public expenditure, financed with foreign aid. We also run an alternative Hcap scenario (Hcap_alt) assuming that the increase in public expenditure is not financed with external aid, and instead a reduction of other public expenditures take place, mainly budget destined to security and public investment in infrastructure.

Table 4. Population and human capital, HCAP scenario

	Baseline	HCap
Population growth (%)	2.4%	1.9%
Labor force growth (%)	3.1%	3.2%
Literacy rate (%)	43.4%	52.2%

Finally, COMB combines all simulation scenarios presented above, with the exception of HCAP, because in this scenario the closure rule for government budget is modified.

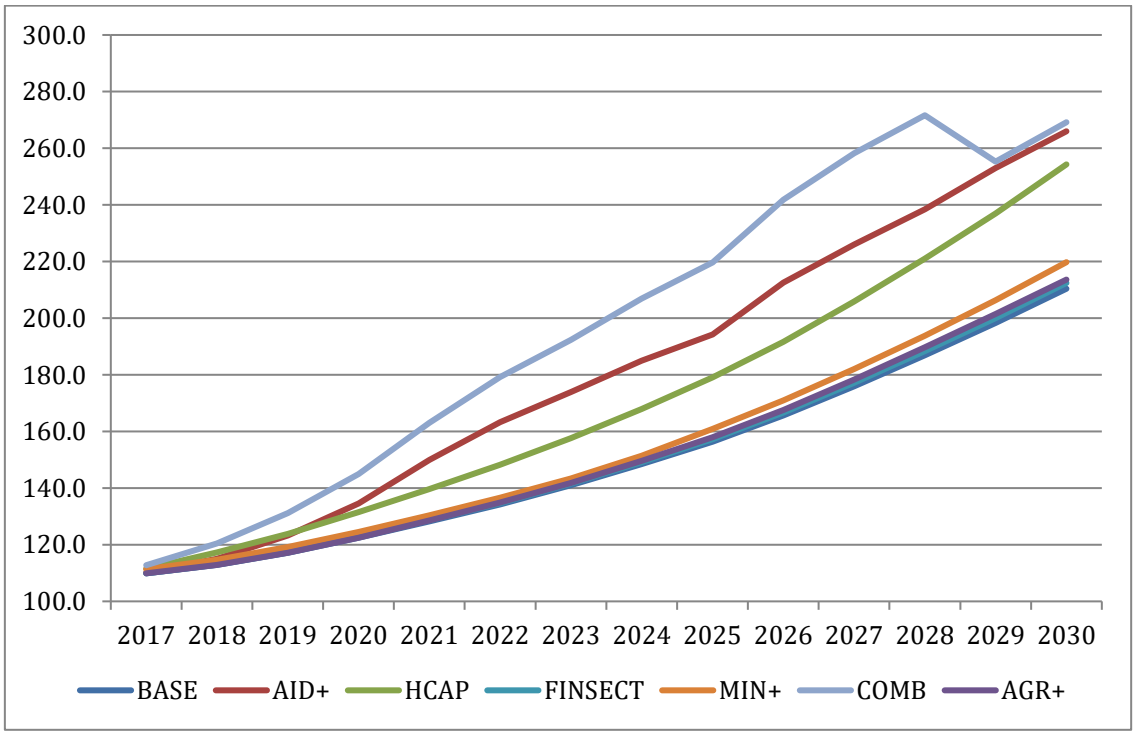
6. Results

6.1. Main scenarios

Figure 6 shows the growth path up to 2030 for the different scenarios. The scenario which boosts to a larger extent GDP growth is MIN+ scenario, followed by AGR+ scenario. An increase in mining production leads to a significant increase in real GDP, with an average annual growth rate of 5.9% in the period, compared to the 4.5% expected growth rate in the baseline. An increase in agriculture production also leads to a significant increase in GDP growth rate, with an average annual rate of 5.7% in the period.

In the rest of the scenarios, GDP growth is also above growth rates in the baseline, but to a lower extent. In Hcap scenario, real GDP growth is 0.3 percentage points higher than under the baseline, and in AID+ and FINSECT, real GDP growth rates are similar to the baseline

Figure 6. Real GDP index at factor cost, by simulation and year. Index 2013= 100



Source: Results from MAMS model for Afghanistan

Min+ simulates a strong expansion of the mining sector. In physical terms, on average in the period production increases 34% annually. Output from the mining sector is almost entirely destined to exports, and thus total exports increase 8% annually. The boost in exports, linked to an increase in FDI inflows, leads to a significant GDP growth, 1.5 percentage points higher than under the baseline by year on average.

Under this scenario, real exchange rate depreciates with respect to the baseline (in fact, under all scenarios there is a real exchange rate appreciation in the whole period). Even though we might expect an appreciation of the real exchange rate as a consequence of the expansion of the mining sector, the depreciation occurs because factor income to the rest of the world increases significantly –from 1.2% of GDP in 2030 under the baseline to 2.9% of GDP.

The real exchange rate depreciation has a positive impact on competitiveness of the manufacturing sector, which increases exports with respect to the baseline. Agriculture exports fall, but less than under the baseline. The rise in imports is less pronounced compared to the baseline scenario. Mining exports increase 31.2% annually on average.

Non-tradable sectors, mainly off-budget services, are negatively hit under this scenario. This is related to a decrease of off-budget flows in terms of GDP –which also takes place in the baseline scenario- and also due to the depreciation of the real exchange rate with respect to the baseline. The contraction of donor activities has a negative impact on the labor market, which is not entirely offset by the increase in mining activity, as the mining sector is not labor intensive. This sector only represents 0.1% of labor in the economy (see Table 2).

For this reason, under this scenario total employment and wages fall. Even when this scenario has a positive impact on GDP growth, the impact on households' income and welfare is negative (see Table 11).

Agr+ simulates an improvement in productivity in the agriculture sector, as well as an increase in land use. As a result, agricultural production, measured in physical terms, increases 30% annually. Value added in the sector increases 5% annually (see Table 6) and agricultural exports, which show a declining trend in the

baseline, increase 1.7% annually. The rise in agricultural exports has an impact on the real exchange rate, which appreciates significantly with respect to the baseline. This, in turn, has a positive impact on imports, mainly of manufactures and foreign services, and to an expansion of private services. The mining sector is negatively hit by the real exchange rate appreciation and exports increase less than under the baseline.

Other sectors benefit from the expansion of the agriculture sector. Output and export of manufactures rise; and donor activities, financed through off-budget aid, also increase.

Under this scenario, there is a positive impact on the labor market. Employment rises among workers with all types of qualification levels, although the increase is higher among qualified workers. Wages also increase more for qualified workers. This is related to the growth in non-tradable services, which are more intensive in skilled labor. On the other hand, the growth in the agriculture sector improves employment and wages among lower skilled workers. For this reason, there is an overall improvement in households' income and welfare. Under this scenario, welfare and real consumption per capita increase the most (See Table 11).

The scenario that simulates an average increase in foreign aid of two percentage points of GDP (Aid+), leads to an increase in the fiscal space. As we are assuming that the public budget balances through an increase in current expenditure (both in civilian expenditure and investment), public expenditure increases. This has a positive, though small, effect on the economy.

Under this scenario, some sectors of the economy expand, mainly mining and public services, but overall employment does not increase, and wages fall. This is mainly related to a negative impact on donors' activities. Although positive, the impact of this scenario on long-term growth is not significant: it increases 0.1 percentage points annually compared to the baseline scenario, and there is a negative impact on welfare.

The human capital scenario (Hcap) simulates an increase in civilian public expenditure and public investment. The increase in public expenditure is intended to improve education, which is simulated through an improvement of

qualifications of the working populations, and health, which is simulated through a reduction of fertility rates. As Table 5 shows, current public expenditure increases more than under the baseline, and so does public investment.

The impact on the long-term growth rate is slight, but significant: 0.3 percentage points per year. The impact is more pronounced in the last years of the simulation period, which suggests that the full impact of this type of policy is expected in the longer run, and we are not fully capturing it. Besides, we are not modelling directly the education and health systems, and thus we are not capturing the full impact of this policy.[8] Despite the moderate impact on GDP growth, this policy scenario has a significant positive impact on households' consumption and welfare, as Figure 11 presents.

We are assuming that the increase in public expenditure is financed through an increase in foreign aid. The increase in foreign aid has an impact on the real exchange rate and affects the rest of the sectors in the economy. In order to analyze to what extent this assumption explains the results of the scenario, we run the same scenario but assuming that the increase in civilian public expenditure is done at the expense of the spending in other components of public expenditure, i.e. in military spending and in investment in infrastructure (Hcap_alt scenario). These results are presented in Table 12. Under Hcap_alt scenario, the impact on the real exchange rate is not significant and exports expand, but at the same time, total public expenditure remains at similar levels than under the baseline scenario. As a consequence, the impact on GDP is the same than under Hcap scenario. Even when the impact on GDP growth is the same under both assumptions regarding the source of financing of public expenditure, this does not imply that results are not sensitive to other financing sources.

The FinSect scenario simulates an improvement in the financial sector of the country, which is simulated through an increase in private saving rates. As a result,

[8] In a recent paper, Asea (2016) estimates the multiplier effect of different government spending components in low-income countries. The author finds a higher multiplier effect of public spending that our findings. Several factors may be behind these differences. First, we are taking into account a medium-term impact, and education and health policies might have an impact in a longer period of time. Second, we are not modelling other aspects of public spending, such as fall in mortality rates and increase in transfers to households. Third, we are capturing general equilibrium effects of the public policies. Finally, we are not modelling the education or health sectors directly.

private consumption falls, but private investment increases 0.4 percentage points more annually compared to the baseline scenario. Public investment also increases, and this has a positive effect on production and exports in the economy, which in turn also affects positively growth. This scenario has a small positive impact on wages among the least qualified workers, but this has no effect on welfare, which falls slightly compared to the baseline. As it happens in Hcap scenario, FinSect scenario may not be fully capturing the potential benefits of an improvement in the financial sector, as we are not modelling explicitly the financial sector and its linkages with other sectors of the economy.

Lastly, Comb scenario combines all scenarios except Hcap. It has a significant positive impact on GDP growth: 1.4 percentage points higher than under the baseline per year. Under this scenario, all sectors expand, with the exception of donor services, which contract, but less than under the baseline scenario. As expected, the sectors that expand the most are agriculture and mining. Employment and wages increase, unemployment rates fall and welfare improves.

Table 5. Real Macro Indicators, by simulation. Percentage annual growth from 2013 to 2030

Indicator	Base	Min+	Agr+	Aid+	FinSect	Hcap	Comb
GDP at factor cost	4,5	5,9	5,6	4,6	4,5	4,7	6,0
Private consumption	3,5	2,4	5,8	3,1	3,4	3,6	5,3
Public consumption	8,6	8,4	8,5	9,1	8,6	9,1	9,1
Private investment	7,0	7,4	8,6	6,9	7,4	7,1	9,7
Public investment	7,8	7,4	7,5	7,9	7,9	8,8	8,4
Exports	-0,9	8,0	0,0	-0,4	-0,8	-0,5	1,6
Imports	5,4	4,6	7,9	5,0	5,4	5,5	7,3
Real exchange rate (Index)	-6,4	-4,3	-7,4	-5,3	-6,3	-5,7	-6,0

Source: Results from MAMS model for Afghanistan

Table 6. Average Annual Growth in Value Added, by Activity and Simulation. Real GDP at factor cost -- annual growth from first to final report year (%)

	2013	Base	Min+	Agr+	Aid+	FinSect	Hcap	Comb
Agriculture	2,505	2,5	2,5	5,0	2,5	2,6	2,4	2,5
Opium	612	-4,4	-4,4	-4,4	-4,3	-4,4	-4,3	-1,3
Mining	151	12,7	29,7	11,7	13,7	12,9	13,4	12,6
Industry	2,261	3,5	3,6	5,1	3,5	3,6	3,9	3,9
Gov Non Security	486	8,4	8,1	8,4	8,8	8,4	9,6	9,6
Gov Security	970	8,6	8,4	8,5	9,1	8,7	8,6	7,9
Gov Infrastructure	3	8,4	8,2	8,3	8,9	8,5	8,4	7,8
Donor Non Security	290	-0,8	-3,2	3,0	-1,6	-1,0	-0,8	-0,2
Donor Security	51	-0,4	-3,0	3,6	-1,3	-0,7	-0,5	0,1
Services	4,867	4,7	4,4	5,9	4,7	4,8	5,0	5,1
Total	12,196	4,5	5,9	5,6	4,6	4,5	4,7	4,7

Source: Results from MAMS model for Afghanistan

Table 7. Real exports -- annual growth from first to final report year (%)

	2013	Base	Min+	Agr+	Aid+	FinSect	Hcap	Comb
Agriculture	331.65	-2,9	-1,8	1,7	-2,3	-2,8	-2,6	2,4
Opium	722.15	-4,6	-4,5	-4,8	-4,5	-4,6	-4,5	-4,6
Mining	39.45	13,7	31,2	12,5	14,8	13,9	14,5	17,3
Industry	209.27	0,8	1,8	1,2	1,3	0,9	1,4	2,2
Total	**1,510.83**	**-0,9**	**8,0**	**0,0**	**-0,4**	**-0,8**	**-0,5**	1,6

Source: Results from MAMS model for Afghanistan

Table 8. Real imports -- annual growth from first to final report year (%)

	2013	Base	Min+	Agr+	Aid+	FinSect	Hcap	Comb
Agriculture	946.25	5,5	4,8	6,8	5,1	5,5	5,2	6,5
Opium	37.78	6,0	4,4	8,9	5,3	5,9	5,9	7,9
Mining	109.77	4,3	3,0	6,6	3,9	4,7	4,2	6,7
Industry	4,798.53	6,7	5,5	9,4	6,1	6,7	6,7	8,9
Donors	2,724.50	2,4	2,5	4,6	2,3	2,3	2,7	3,8
Total	**9,994.88**	**5,4**	**4,6**	**7,9**	**4,9**	**5,4**	**5,5**	7,3

Source: Results from MAMS model for Afghanistan

Table 9. Employment by factor annual growth by simulation from first to final report year (%)

	2013	Base	Min+	Agr+	Aid+	FinSect	Hcap	Comb
Total Labor	6,662	4,16	4,07	4,5	4,1	4,2	4,2	4,5
Labor No Skill	3,849	1,98	1,92	2,2	1,9	2,0	1,9	2,0
Labor Low Skill	725	4,72	4,61	5,2	4,7	4,7	4,8	5,4
Labor Med Skill	1,515	6,41	6,31	6,8	6,4	6,4	6,5	6,9
Labor High Skill	574	7,60	7,49	8,0	7,6	7,6	7,8	8,3

Source: Results from MAMS model for Afghanistan

Table 10. Real wages by factor -- annual growth by simulation from first to final report year (%)

	Base	Min+	Agr+	Aid+	FinSect	Hcap	Comb
Labor No Skill	3,6	3,1	4,6	3,4	3,6	3,6	4,8
Labor Low Skill	1,5	1,0	3,7	1,3	1,5	1,4	3,4
Labor Med Skill	1,5	1,0	3,5	1,4	1,6	1,5	3,6
Labor High Skill	0,6	0,1	3,0	0,6	0,7	0,8	2,9
Private Capital	-4,1	-5,3	-0,7	-4,4	-4,3	-4,0	-1,4
Mining Capital	-25,3	-22,5	-26,5	-22,3	-24,7	-23,4	-47,2
Land	11,5	11,0	-42,5	11,1	11,6	10,9	-42,5

Source: Results from MAMS model for Afghanistan

Table 11. Households' welfare. Equivalent Variation per capita for final year (% of consumption spending per capita in base year) and annual growth in consumption per capita, by simulation

	Base	Min+	Agr+	Aid+	FinSect	Hcap	Comb
Equivalent variation	33,6	17,2	86,0	28,3	33,3	47,1	79,1
Consumption per capita	2,0	1,1	4,0	1,7	1,9	2,6	3,7

Source: Results from MAMS model for Afghanistan

Table 12. Sensitivity analysis of alternative financing for public expenditure. Hcap scenario. Impact of simulation scenarios on selected variables -- annual growth from first to final report year (%)

	Base	Hcap	Hcap_alt
Consumption - private	3,4	3,6	3,9
Consumption - government	8,6	9,1	8,8
Fixed investment - private	7,0	7,1	7,2
Fixed investment - government	7,8	8,8	8,3
Exports	-0,9	-0,5	0,3
Imports	5,4	5,5	5,9
GDP at factor cost	4,5	4,7	4,7
Total factor employment (index)	5,3	5,3	5,5
Total factor productivity (index)	-0,8	-0,6	-0,7
Real exchange rate (index)	-6,4	-5,7	-6,6

Source: Results from MAMS model for Afghanistan

6.2. Sensitivity analysis

Some of the results presented in the previous section are sensitive to the closure assumed for external aid. In our main scenarios, we are imposing the evolution of aid flows –both on-budget and off-budget- in terms of nominal GDP. Thus, nominal external transfers will depend on GDP variations, and this, in turn, will have an effect on the real exchange rate of the economy, affecting macroeconomic results. For this reason, we simulated the same scenarios but changing the assumption about external aid flows. We now assume that aid flows increase at a fixed rate. This implies that, in all scenarios except Aid+, nominal external transfers are the same across scenarios. Table 13 presents the impact of the change in this assumption for some relevant variables.

Under this new assumption, macroeconomic results change, but the main findings from the previous section remain. GDP growth is higher under Agr+ scenario, but

Min+ scenario still has a significant positive effect on real GDP. Under these two scenarios, the real exchange rate behaves differently than under the main scenarios. In Min+, there is now a real exchange rate appreciation, which is related to the expansion of the mining sector and the increase in mining exports. For this reason, export increase less than under the main scenario, and real GDP growth is less pronounced, although still significantly higher than under the baseline scenario. Contrarily to our main results, now under Min+ scenario we find a positive impact on employment and households' welfare.

In Agr+ scenario, there is a real exchange rate depreciation, which has a higher impact on exports. In any case, the impact on GDP growth is the same than under the main scenario, and welfare also improves significantly under this scenario.

In the rest of the scenarios, the impact on GDP is not significantly different from the main results, and so the main conclusions hold.

Table 13. Sensitivity analysis. Impact of simulation scenarios on selected variables – percentage point deviation from annual growth rates in the baseline

Indicator	Min+	Agr+	Aid+	FinSect	Hcap	Comb
Real GDP at factor cost	0,1	1,3	0,0	0,1	0,2	2,2
Exports	0,3	2,9	0,5	0,1	0,5	7,6
Real exchange rate (Index)	-0,4	3,5	1,3	0,1	0,7	2,7
Equivalent variation	3,4	23,2	-5,8	-0,2	16,8	38,2
Employment	0,0	0,2	-0,1	0,0	0,0	0,3

Source: Results from MAMS model for Afghanistan

7. Concluding remarks

Applying a general equilibrium model, we evaluated growth opportunities for Afghanistan. To do so, we use MAMS model and we calibrated it with an updated version of the Social Accounting Matrix (SAM) for fiscal year 1392. We incorporated some features into the CGE model and the SAM relevant for Afghanistan, such as a nested production function, a segmented labor market by qualifications, and a sectoral aggregation that includes public and donor activities.

We simulated five growth opportunity policies: an expansion of the mining sector; an increase in agriculture production and productivity; an increase in external aid inflows; a human capital policy aimed at improving education and controlling fertility rates; and an improvement of the financial sector. A combination of this policies aimed at improving growth, excluding the human capital policy, would increase real GDP growth rate by 1.5 percentage points per year in the period 2013-2030, with respect to a business-as-usual scenario. The scenario that contributes the most to this growth is the expansion of the mining activity, followed by the expansion of the agriculture production. The rest of the scenarios do not contribute significantly to growth in the long term, although the policy aimed at improving education and health in the country has a significant positive impact on welfare. Both this policy and the policy aimed at improving the financial sector have a more significant and positive impact on the last years of the period of analysis, which suggest that these policies might have a more significant long term impact.

Some of the results should be taken with caution. Even when the main conclusions still hold when we assume a different closure rule for external aid flows, we find changes in the impact of the external sector in Agr+ and Min+ scenarios. In the case of Min+ scenario, the change in the underlying assumption leads to a significant different impact on GDP growth (-0.6 percentage points per year). Results are also conditioned by the data used in the analysis, which lacks a more detailed sectoral aggregation.

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