Inter-American Development Bank

Government and Institutional Capacity

Simulations in a CGE model for Haiti

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Country Department
Central America, Haiti, Mexico, Panama and Dominican Republic

TECHNICAL NOTE Nº
IDB-TN-01568

January 2019

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IDB
Inter-American
Development Bank

Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library
Cicowiez, Martín.
Government and institutional capacity: simulations in a CGE model for Haiti / Martín Cicowiez and Agustín Filippo.
p. cm. — (IDB Technical Note ; 1568)
Includes bibliographic references.
1. Economic development-Haiti-Econometric models. 2. Haiti-Economic policy-Econometric models. 3. Haiti-Economic conditions-Econometric models. I. Filippo, Agustín. II. Inter-American Development Bank. Country Department Central America, Haiti, Mexico, Panama and the Dominican Republic. III. Title. IV. Series.
IDB-TN-1568

JEL Codes: C68, D58, E23, O47, O54.

Keywords: Haiti, structural change, structural transformation, computable general equilibrium, economic development, institutions, institutional capacity.

http://www.iadb.org

Government and Institutional Capacity.

Simulations in a CGE model for Haiti.

Martín Cicowiez[1] and Agustín Filippo[2]

Simulations

This document presents the group of simulations related to "Government and Institutional Capacity", and analyzes the results for both the CGE model and the microsimulation model. In a companion document (Cicowiez and Filippo, 2018a), we provide an introduction and describe the method and data used in this study.

1. Scenarios

The simulations consist of a base simulation and a set of non-base simulations that explore the impact of changes in policies and exogenous conditions. The Haiti CGE simulations cover the period FY 2013-2030. The initial year, FY 2013, was selected in light of data availability (see companion document on method and data). The base run is designed to replicate trends since 2013 at the macro and sectoral levels. From 2015 on, this first simulation assumes that past trends will continue into the period from 2015 to 2030. In what follows, all shocks are introduced during the period 2016-2030; i.e., the non-base simulations deviate from the base

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for the period 2016-2030; thus, base and non-base scenarios are the same for the period 2013-2015.

The following non-base scenarios have been developed to assess various vulnerabilities and opportunities:

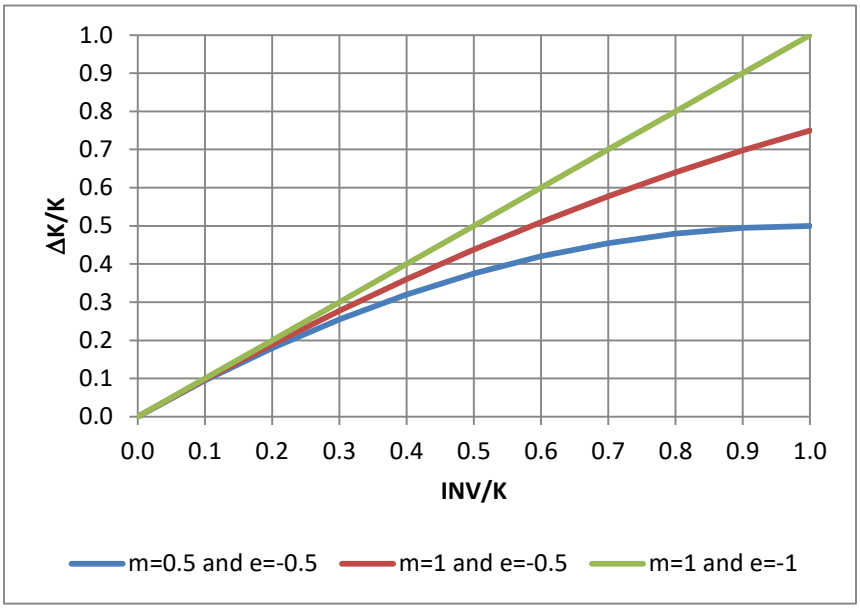
- abscap-g = increase in (general) government absorptive capacity
- abscap-ng = increase in private sector absorptive capacity
- aid-tdir = 50 percent reduction in foreign transfers combined with increase in direct taxation
- aid-dbor = 50 percent reduction in foreign transfers combined with domestic borrowing
- aid-gcon = 50 percent reduction in foreign transfers combined with decrease in government consumption/provision of goods and services

In general, it is not feasible to increase the capital stock in large proportions within a given period of time. Following the discussion in Katz (2018), this is especially true in Haiti, both for the government and the private sectors. Thus, from a modeling perspective, we need to constrain the amount of investment that can be transformed into effective additions to the capital stock within a single time period. To that end, we implemented the same absorptive capacity function that is described in Cicowiez and Filippo (2018b) and based on Mercado and Cicowiez (2016). Then, in the first two simulations in this set we ask what the impact of improving the absorptive capacity of the Haitian economy would be, both for the government and the private sectors.

Figure 1 depicts our absorptive capacity function; the forty-five degree line represents the case of perfect absorption, while the other two lines show functions with different asymptotic value

parameters (m=1 and m=0.5). For example, the last case shows that while an increase in the capital stock of about 20% is likely to be achieved with no serious problems of absorption -say, within one year-, increases beyond 50% within a year will likely be impossible no matter how much investment is made since the absorptive capacity of the economy would be saturated.

Figure 1: Absorptive Capacity Function



In addition, in this set of simulations we consider three scenarios in which foreign aid is decreased to a level that is consistent with recent projections from the IMF.[3] In each of the three scenarios, the impacts of alternative compensating mechanisms for the adjustment of government budget are considered. Specifically, an increase in the direct tax rate, an increase in domestic borrowing, and a decrease in government consumption are considered.

[3] As an alternative, we also considered a scenario with transfers per capita reduced to the average received by LDCs. As expected, the qualitative results do not change relative to the ones presented here.

2. Baseline Scenario

For the base scenario, which serves as a benchmark for comparisons, we impose the observed growth rates in real GDP at factor cost for the period 2013-2014, and an average growth of 3.5 percent starting from 2015, based on projections from the October 2015 IMF World Economic Outlook Database.[4] In addition, the following assumptions are imposed: demand for government services is kept fixed as a share of GDP at the base year value, transfers from government to households and from rest of the world to government are also kept fixed as a share of GDP at base year value, tax rates are fixed over time, and government borrowing (i.e., government savings) adjust in order to clear the government budget. For all simulations, annual labor supply is assumed to grow at an average rate of 2.6 percent per year. In turn, based on recent trends, agricultural land area is set to grow only slightly, at 0.1 percent per annum (WDI, 2015). These assumptions generate results that are consistent with recent trends.

At the macro level, our Haiti CGE model – like any other CGE model – requires the specification of the equilibrating mechanism ("closures") for three macroeconomic balances: government, savings-investment, and the balance of payments. For the base scenario, the following closures are used: (a) government: the government accounts are balanced via adjustments in (domestic) borrowing; (b) savings-investment: household savings adjust to financed exogenous GDP shares for private investment; among other investment categories, FDI is determined by exogenous inflows, while government investment is financed within the government budget; and (c) balance of payments: the real exchange rate equilibrates the balance by influencing export and

[4] The exogenous part of TFP growth is adjusted to generate such a growth path. GDP growth is endogenous for all non-base scenarios.

import quantities and values (in foreign currency); the non-trade-related payments of the balance of payments (transfers and foreign investment) are non-clearing, kept fixed as shares of GDP.[5] In the non-base scenarios, the treatment of the government balance varies as part of the design of the simulations; private investment becomes the clearing variable in the savings-investment balance, adjusting to make use of available financing; and the balance of payments rule remains the same as for the base.

For each simulation, the Haiti CGE-Microsimulation (Macro-Micro) model provides the evolution over time for a wide range of indicators, including: (a) macro indicators such as GDP (split into private and government consumption and investment, exports, imports, etc.), the composition of the government budget, the balance of payments, the savings-investment balance, and total factor productivity; (b) sectoral structure of production, incomes, exports, and imports; (c) labor market indicators such as wages, unemployment, and sectoral employment; and (d) poverty. The presented information is relevant for policymakers as they consider the attractiveness, potential pitfalls, and likely tradeoffs for alternative policies and/or exogenous conditions, all of which take the current structure of Haiti's economy as their starting point.

Figure 2 and Table 1 show key macroeconomic results for the base and the non-base scenarios for the year 2016 (i.e., the year when all scenarios start deviating from the base) and 2030, the last simulation year. In the base scenario, the economy evolves according to recent trends, with most macro aggregates growing at 3-4 percent per year (see also Appendix), at the upper end of this range for investment and exports. Per-capita household consumption grows at a rate of

[5] In fact, there is an implicit functional relationship between the real exchange rate and the trade balance.

2.2 percent per year. The real exchange rate appreciates slightly over time. GDP growth is accompanied by an expansion of employment. The unemployment rate is reduced from 31.7 percent in 2013 to 25.6 percent in 2030. Real wage grows somewhat less than one percent per year on average. In the base scenario, the extreme poverty rate falls to about 16.6 percent in 2030, down from 23.7 percent measured by the ECVMAS in 2012. Thus, poverty reduction would still fall significantly short of reaching the goal of extreme poverty of 3 percent or less by 2030 (see World Bank (2015)).

In terms of sectoral structure, growth for agriculture is constrained by the land supply, which is assumed to grow only 0.1 percent annually. Thus, the sectoral structure of value added and exports changes in favor of manufactures and services. To some extent, growth in the services sector is driven by the investment projects of the government, especially for the construction sector.

Figure 2.a: change in real private consumption 2013-2030
(percent deviation from base)

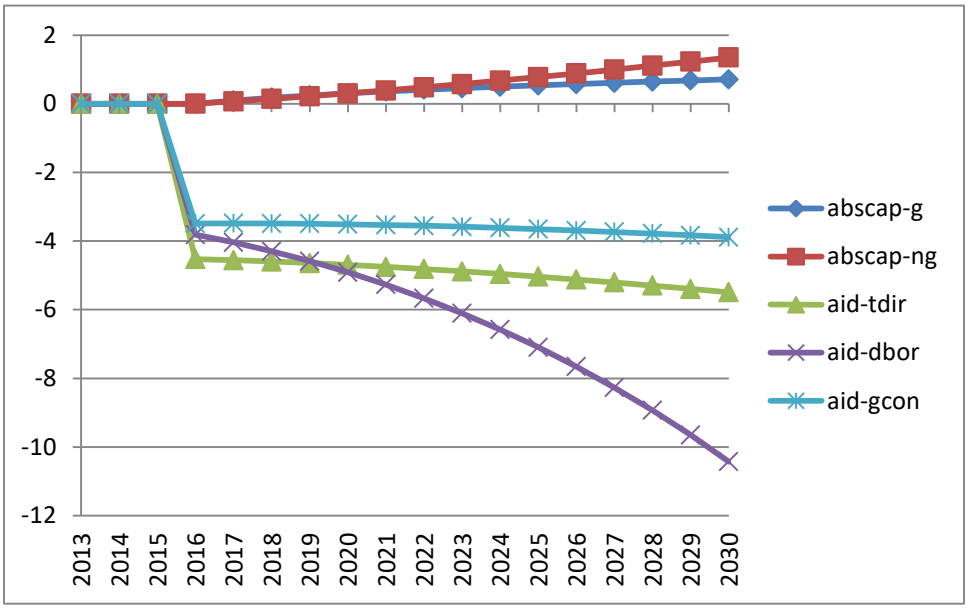
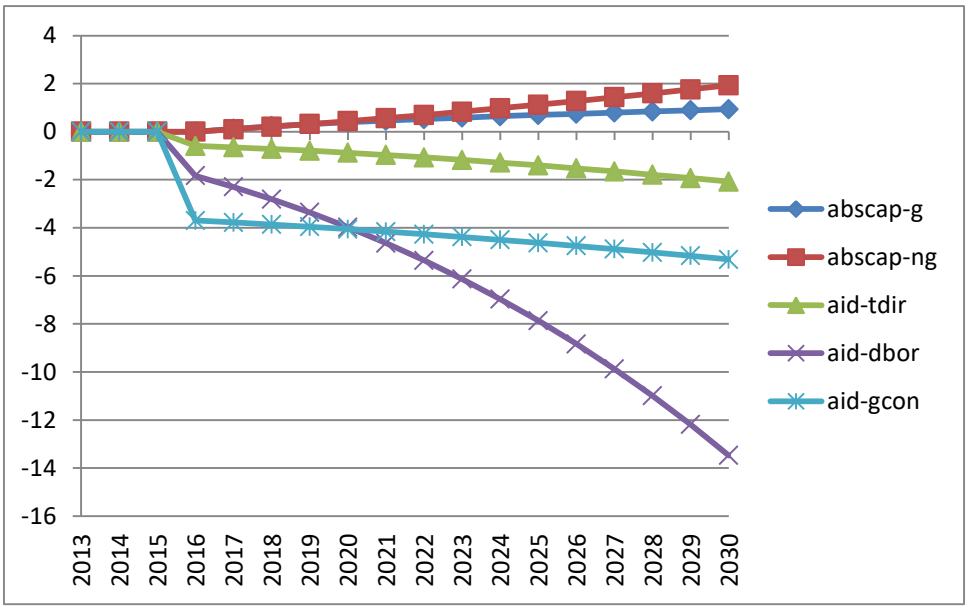


Figure 2.b: change in real GDP at factor cost 2013-2030
(percent deviation from base)



Source: Author's elaboration.

Table 1: change in real macro indicators
(percent deviation from base)

	base	abscap-g		abscap-ng		aid-tdir		aid-dbor		aid-gcon	
Item	2013	2016	2030	2016	2030	2016	2030	2016	2030	2016	2030
Absorption	493,643	0.00	0.68	0.00	1.41	-3.65	-4.79	-4.54	-13.05	-5.88	-7.12
Private consumption	352,731	0.00	0.71	0.00	1.35	-4.53	-5.49	-3.81	-10.43	-3.49	-3.89
Fixed investment	109,528	0.00	0.81	0.00	2.06	-1.91	-4.16	-8.23	-25.72	-1.25	-2.62
Private fixed investment	50,796	0.00	1.74	0.00	4.44	-4.12	-8.97	-17.76	-55.46	-2.69	-5.66
Government fixed investment	58,732	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Government fixed inv, infra	56,624	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Change in stocks	57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Government consumption	31,327	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-47.45	-51.47
Exports	44,879	0.00	3.10	0.00	5.75	20.04	16.70	21.42	-8.54	20.01	18.31
Imports	171,307	0.00	0.84	0.00	1.56	-3.73	-4.20	-3.40	-11.09	-3.84	-3.89
GDP at market prices	367,215	0.00	0.94	0.00	1.94	-0.64	-2.09	-1.81	-13.37	-3.58	-5.15
Net indirect taxes	19,907	0.00	1.09	0.00	2.16	-0.95	-2.11	-0.91	-12.15	-1.04	-1.58
GDP at factor cost	347,308	0.00	0.93	0.00	1.93	-0.59	-2.08	-1.83	-13.48	-3.70	-5.31
Real exchange rate	1.00	0.00	0.32	0.00	0.98	4.59	2.17	6.50	0.01	4.10	1.92
Wage, average	1.00	0.00	0.20	0.00	0.26	0.71	0.51	-0.98	-3.52	-3.15	-3.82
Capital return, average	1.00	0.00	-0.05	0.00	-3.10	-3.93	0.40	-9.85	7.23	-3.63	-0.95
Unemployment rate	31.72	0.00	-1.54	0.00	-2.66	4.98	6.75	6.22	23.63	10.04	13.24
2013 = million gourdes											

Source: Author's elaboration.

3. Aggregate Results

Certainly, the mostly positive results from the absorptive capacity scenarios are straightforward to explain (see Figure 2 and Table 1). Figures 3a and 3b summarize the main transmission channels in the absorptive capacity scenarios abscap-g and abscap-ng, respectively. In a nutshell, for the same volume of investment the country now obtains a larger increase in the capital stock, which – as expected – has an economy-wide positive impact.[6] For example, given the larger capital stock, labor productivity and thus wages increase, at the same time that unemployment decreases. Consequently, household income, consumption, and savings also increase. In turn, larger savings translate into larger investment, with a (second-round) positive impact on GDP growth. It should be noted that household consumption raises more with increased non-government absorptive capacity, given that non-government investment is larger than government investment. Overall, the results show that changes in efficiency have direct and potentially strong impacts on growth. In other words "investing in investing" through structural reforms that increase efficiency can have very high rates of return (Berg et al., 2015). For the government, we see an increase in income driven by an expanded tax base, both for direct and indirect taxes.

[6] Of course, the impacts of the shock are observed in 2017 and afterwards, once the improved absorptive capacity is reflected in a larger capital stock.

Figure 3a: main transmission channels government absorptive capacity scenario

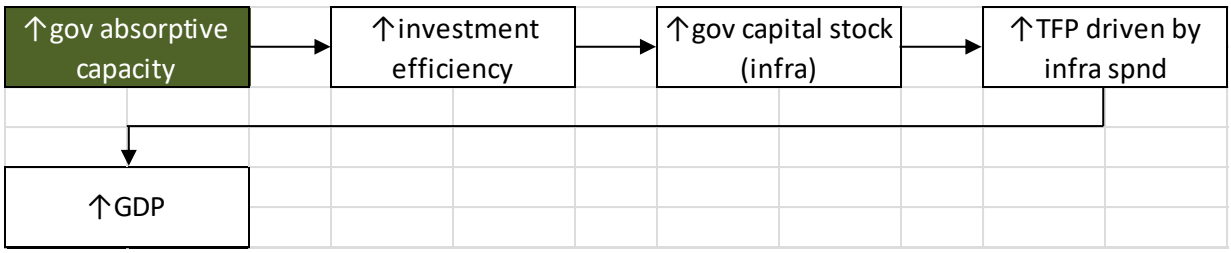
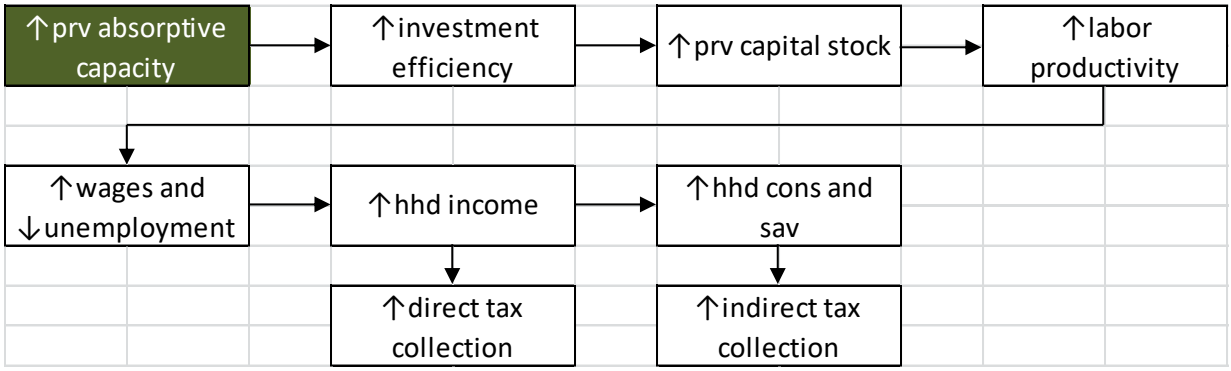


Figure 3b: main transmission channels non-government absorptive capacity scenario

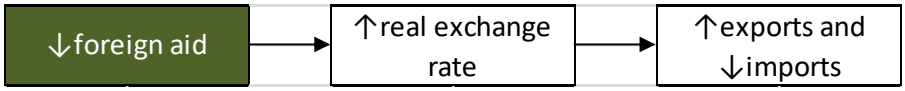


Source: Author's elaboration.

Figure 4 and Figure 5 summarize, for the three foreign aid scenarios, the main transmission channels through the foreign and government sectors, respectively. In this groups of counterfactual simulations, GDP growth loses between 0.1 (aid-tdir) and 1 (aid-dbor) percentage points and is accompanied by a contraction in private consumption and private investment. In all cases, the decrease in foreign aid results in a real exchange rate depreciation. It represents a response to the fact that, due to the decrease aid, Haiti is now required to have a more positive trade balance, importing less and/or exporting more, and reducing its total domestic final demand at any given level of GDP. It is interesting to note that the decrease in wages is larger when the government balances its budget through decreases in current

consumption. As shown in Table 2.4 in Cicowiez and Filippo (2018a), government services are relatively intensive in the use of (skilled) labor. Consequently, a shrinking government sector has a markedly negative impact on skilled labor wages and employment.

Figure 4: main transmission channels aid scenarios; through foreign sector



Source: Author's elaboration.

Figure 5a: main transmission channels aid-tdir scenario; through government sector

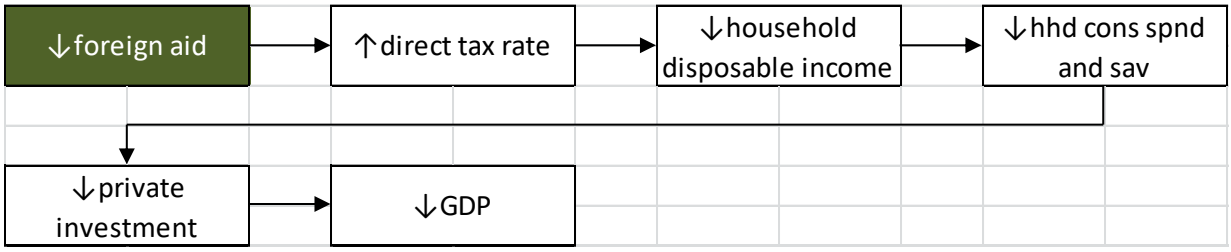


Figure 5b: main transmission channels aid-dbor scenario; through government sector

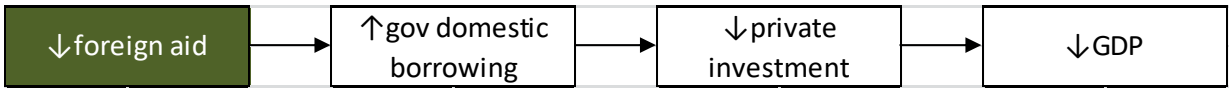
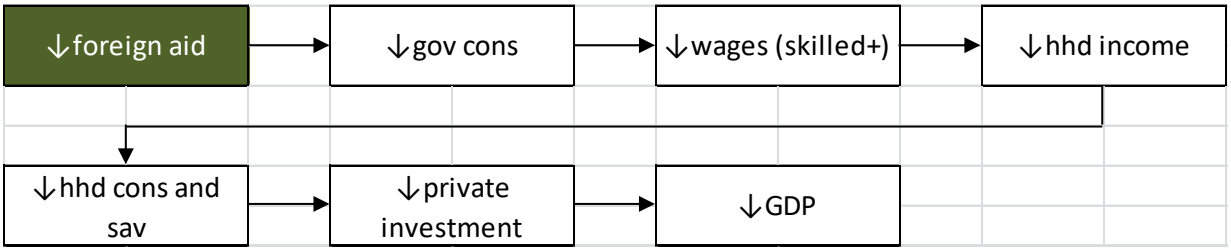


Figure 5c: main transmission channels aid-fbor scenario; through government sector



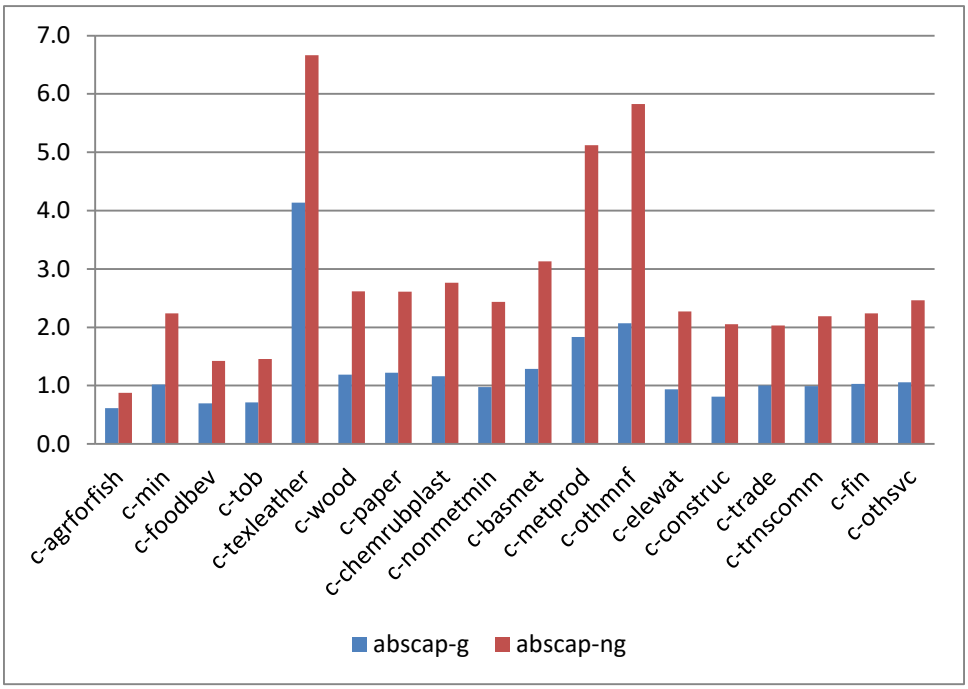
Source: Author's elaboration.

4. Sectoral Results

Figure 6 and Table 2 show sectoral results in terms of (real) value added, exports and imports, for the years 2016 and 2030. At the sectoral level, we found that improvements in absorptive capacity favor all sectors. At the same time, the most favored sectors are those with a higher ratio between exports and output -- i.e., the most export-orientated sectors. Specifically, Textiles, wearing apparel and leather and Other manufactures show the largest increases in sectoral value added (VA). For all other sectors, the ratio between exports and output is relatively small (see Table 2.3 in Cicowiez and Filippo (2018a). As explained, Haiti is assumed to be a price taker in world markets. Therefore, the said sectors are the ones that can expand production and increase sales with a relatively minor decrease in domestic prices. In other words, the (widespread) increase in investment efficiency favors the current pattern of sectoral specialization.

In the aid scenarios, with the exception of Textiles, wearing apparel and leather and Other manufactures, all other sectors show a decrease in output. (In fact, the Fabricated metal prod; Mach and equip sector also shows an increase in output in two of the three aid scenarios, but its base-year VA share is relatively small.) Again, the driver of this sectoral result is the relatively large export orientation of both sectors. Specifically, these are the two sectors most favored by the real exchange rate depreciation (see above; Table 1). For the other sectors, exports also increase initially. However, in the long run, the slower GDP growth dominates and all but the two said sectors show decreases in exports and output.

Figure 6: change in sectoral real value added in 2030 scenarios abscap-g and abscap-ng (percent deviation from base)



Source: Author's elaboration.

Table 2: change in sectoral real value added, exports, and imports
(percent deviation from base)

	base	abscap-g		abscap-ng		aid-tdir		aid-dbor		aid-gcon	
Commodity	2013	2016	2030	2016	2030	2016	2030	2016	2030	2016	2030
Value added											
Agr, hunting and forestry; Fishing	67,345	0.00	0.62	0.00	0.88	-0.35	-1.00	-0.23	-5.25	-0.51	-1.13
Mining and quarrying	560	0.00	1.02	0.00	2.24	-4.31	-5.91	-4.75	-16.72	-2.91	-3.71
Food prod and beverages	6,639	0.00	0.69	0.00	1.42	-0.55	-2.52	-0.17	-8.40	-0.05	-1.45
Tobacco prod	118	0.00	0.71	0.00	1.46	-0.95	-3.07	-0.36	-8.67	-0.21	-1.75
Textiles, wearing apparel and leather	9,609	0.00	4.14	0.00	6.67	30.74	26.74	33.06	-3.73	30.50	27.98
Wood and of prod of wood and cork	1,227	0.00	1.19	0.00	2.62	-1.27	-4.34	-0.38	-14.30	-2.22	-4.82
Paper and paper prod; Publishing	1,856	0.00	1.22	0.00	2.61	-3.22	-5.19	-2.34	-15.31	-2.38	-3.44
Chemicals; Rubber and plastics	839	0.00	1.16	0.00	2.77	-2.00	-4.80	-1.32	-15.54	-2.91	-5.17
Other non-metallic mineral prod	1,426	0.00	0.97	0.00	2.44	-2.23	-4.76	-4.75	-20.45	-2.20	-3.94
Basic metals	204	0.00	1.29	0.00	3.13	-2.08	-4.94	-3.02	-20.26	-0.69	-2.27
Fabricated metal prod; Mach and equip	208	0.00	1.83	0.00	5.12	4.46	-0.48	4.89	-20.28	4.08	0.50
Other manufactures	2,449	0.00	2.07	0.00	5.83	6.85	1.85	6.44	-22.72	8.17	5.89
Electricity and water supply	6,366	0.00	0.93	0.00	2.27	-2.04	-4.06	-1.44	-13.08	-2.22	-3.67
Construction	83,021	0.00	0.81	0.00	2.05	-1.88	-4.11	-7.91	-25.10	-1.28	-2.66
Wholesale and retail trade	90,090	0.00	1.00	0.00	2.03	-2.46	-3.87	-2.31	-12.95	-2.74	-3.59
Hotels and restaurants, foreign tourism	1,134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transport, storage and comm	34,190	0.00	0.99	0.00	2.19	-1.91	-3.91	-1.53	-13.00	-1.76	-3.06
Financial intermediation	6,990	0.00	1.03	0.00	2.24	-0.88	-2.80	-0.89	-12.81	-7.59	-9.85
Other market services	11,490	0.00	1.06	0.00	2.46	-2.66	-4.73	-2.26	-14.90	-2.40	-3.71
Education, government	770	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-47.45	-51.47
Health, government	2,227	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-47.45	-51.47
Other government services	18,552	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-47.45	-51.47
2013 = million gourdes											

Table 3 (cont.): change in sectoral real value added, exports, and imports (percent deviation from base)

	base	abscap-g		abscap-ng		aid-tdir		aid-dbor		aid-gcon	
Commodity	2013	2016	2030	2016	2030	2016	2030	2016	2030	2016	2030
Exports											
Agr, hunting and forestry; Fishing	3,263	0.00	0.68	0.00	0.59	4.62	2.74	4.89	0.19	2.40	-0.04
Food prod and beverages	892	0.00	1.39	0.00	3.26	7.70	1.44	8.28	-12.32	7.86	2.63
Textiles, wearing apparel and leather	21,600	0.00	4.42	0.00	7.12	34.18	29.26	36.67	-3.39	34.04	30.72
Wood and of prod of wood and cork	906	0.00	2.24	0.00	5.70	13.53	2.50	14.57	-19.56	12.73	2.75
Chemicals; Rubber and plastics	599	0.00	1.66	0.00	4.51	4.37	-2.16	5.03	-19.48	4.03	-1.63
Other non-metallic mineral prod	6	0.00	1.80	0.00	5.42	8.08	-0.95	8.09	-24.79	8.41	1.15
Fabricated metal prod; Mach and equip	501	0.00	2.51	0.00	7.47	12.45	3.99	13.20	-24.01	13.07	6.64
Other manufactures	8,161	0.00	2.47	0.00	7.16	11.19	4.60	11.44	-23.94	12.53	9.30
Transport, storage and comm	3,801	0.00	1.26	0.00	3.05	0.90	-2.71	1.28	-15.25	1.22	-1.36
Financial intermediation	566	0.00	1.30	0.00	2.81	1.52	-1.61	1.66	-13.75	-4.02	-7.47
Imports											
Agr, hunting and forestry; Fishing	26,478	0.00	0.61	0.00	1.25	-4.08	-3.94	-4.07	-10.03	-2.21	-1.29
Mining and quarrying	136	0.00	0.99	0.00	1.99	-6.23	-7.12	-6.82	-17.55	-4.66	-4.84
Food prod and beverages	24,386	0.00	0.37	0.00	0.59	-4.16	-4.41	-3.85	-6.59	-3.40	-3.22
Tobacco prod	546	0.00	0.39	0.00	0.63	-4.88	-5.07	-4.45	-7.22	-4.05	-3.77
Textiles, wearing apparel and leather	29,163	0.00	1.36	0.00	2.26	2.19	2.11	3.05	-7.65	2.64	3.22
Wood and of prod of wood and cork	2,595	0.00	0.84	0.00	1.57	-6.47	-6.93	-5.55	-12.77	-7.46	-7.54
Paper and paper prod; Publishing	2,185	0.00	0.99	0.00	1.80	-6.12	-6.42	-5.25	-13.56	-5.31	-5.06
Chemicals; Rubber and plastics	25,695	0.00	0.90	0.00	1.75	-5.42	-6.23	-4.69	-13.12	-6.72	-7.15
Other non-metallic mineral prod	2,098	0.00	0.78	0.00	1.61	-4.55	-5.58	-7.98	-19.40	-4.59	-5.11
Basic metals	3,799	0.00	1.12	0.00	2.54	-4.02	-5.71	-5.11	-19.01	-2.75	-3.37
Fabricated metal prod; Mach and equip	19,595	0.00	0.94	0.00	1.91	-5.50	-6.67	-5.48	-15.47	-7.38	-8.20
Other manufactures	1,204	0.00	0.59	0.00	0.94	-7.91	-8.29	-10.74	-18.64	-6.61	-6.65
Hotels and restaurants	2,047	0.00	0.99	0.00	1.72	-13.12	-10.29	-11.59	-16.61	-19.45	-15.31
Transport, storage and comm	27,048	0.00	0.71	0.00	1.28	-4.80	-5.15	-4.43	-10.56	-4.81	-4.81
Financial intermediation	2,853	0.00	0.75	0.00	1.66	-3.25	-4.01	-3.41	-11.87	-11.01	-12.15
Other market services	1,476	0.00	0.79	0.00	1.12	-6.44	-5.77	-5.99	-10.63	-6.15	-5.24
2013 = million gourdes											

Source: Author's elaboration.

In terms of sectoral employment, results are shown in Appendix Table A.2. As expected, changes in sectoral employment follow those of sectoral value added.

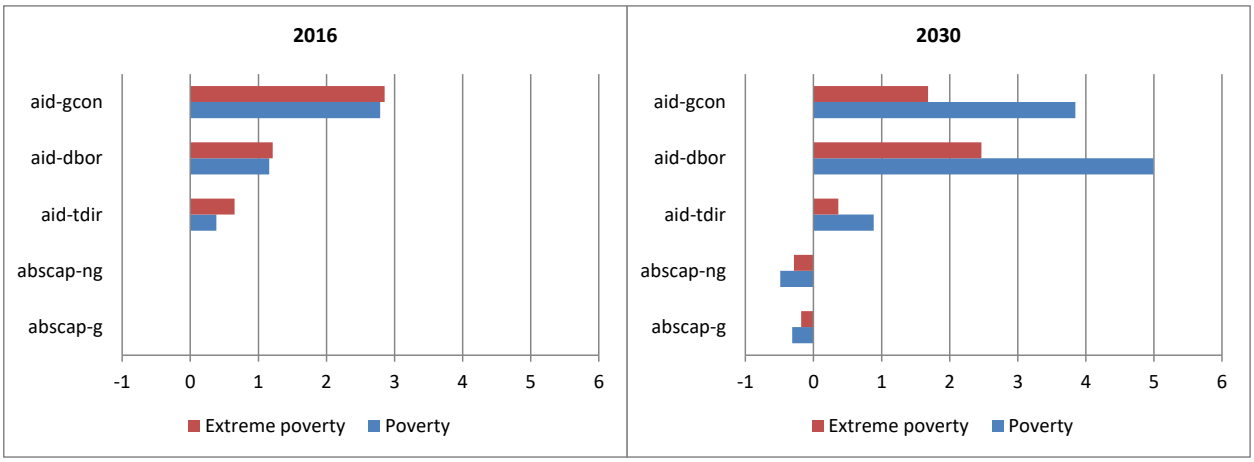
5. Distributive Results

As explained in Cicowiez and Filippo (2018a), the microsimulation model can decompose the poverty impact of a given non-base scenario into the following effects related to labor market parameters: unemployment, sectoral structure, relative wages, and average wage. In terms of

poverty, our results show, for example, that the poverty headcount ratio falls by half percentage point in the last year of the simulation period in the abscap-ng scenario (Figure 7). The main drivers of this result are a decrease in unemployment, a higher average wage, and an increase in non-labor income. For example, in the abscap-ng scenario, unemployment decreases 0.7 percentage points and, as a consequence, poverty decreases 0.5 percentage points. In terms of growth, our results show that the growth elasticity of poverty is 0.25 percent.

In turn, the aid scenarios show increases in the poverty headcount ratio that range between 0.8 (scenario aid-tdir) and 4.9 (scenario aid-dbor) percentage point. The growth-incidence curves in Figure 8 present a more detailed picture of the income change patterns in two of the aid scenarios. Each curve shows the proportional income change of each percentile in a given time period. Ideally, we would like these curves to be (i) well above the horizontal axis, implying income growth, and (ii) decreasing, implying pro-poor growth. In both cases, the curves are below the horizontal axis and have a slightly positive slope. In both aid scenarios, real incomes decrease for the whole distribution, and in an unequalizing way.

Figure 7: change in poverty
(percentage points from base)



Source: Author's elaboration.

Figure 8a: growth-incidence curves scenario aid-dbor; 2030
household per capita income
proportional changes by percentile

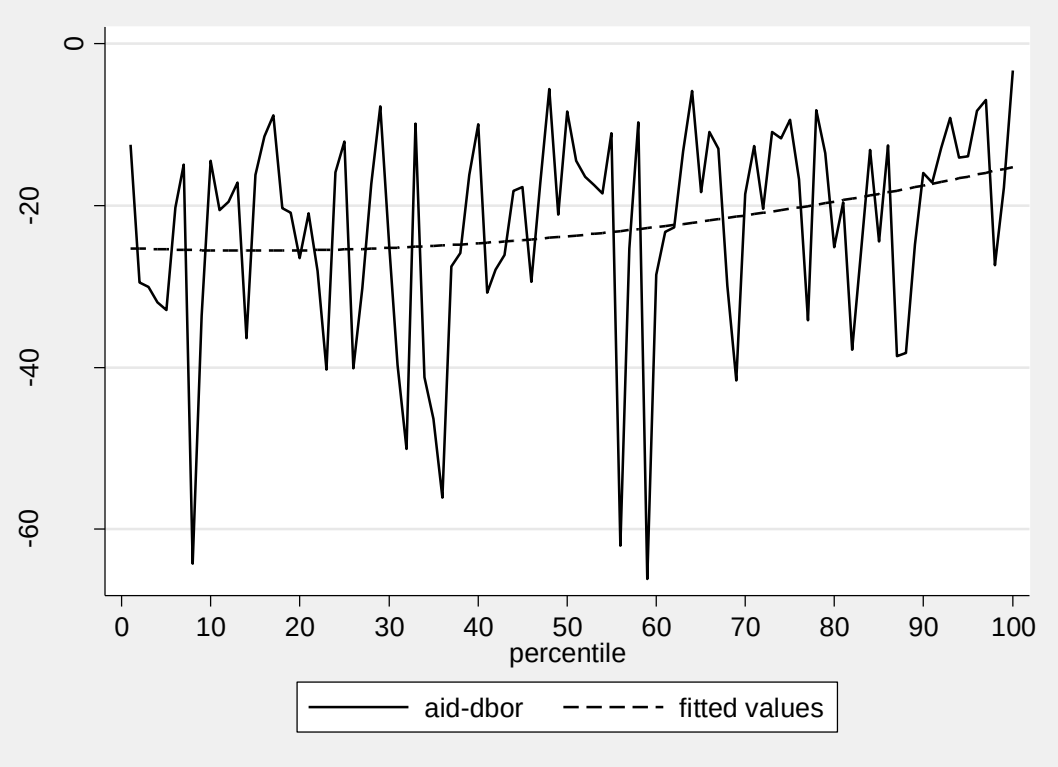
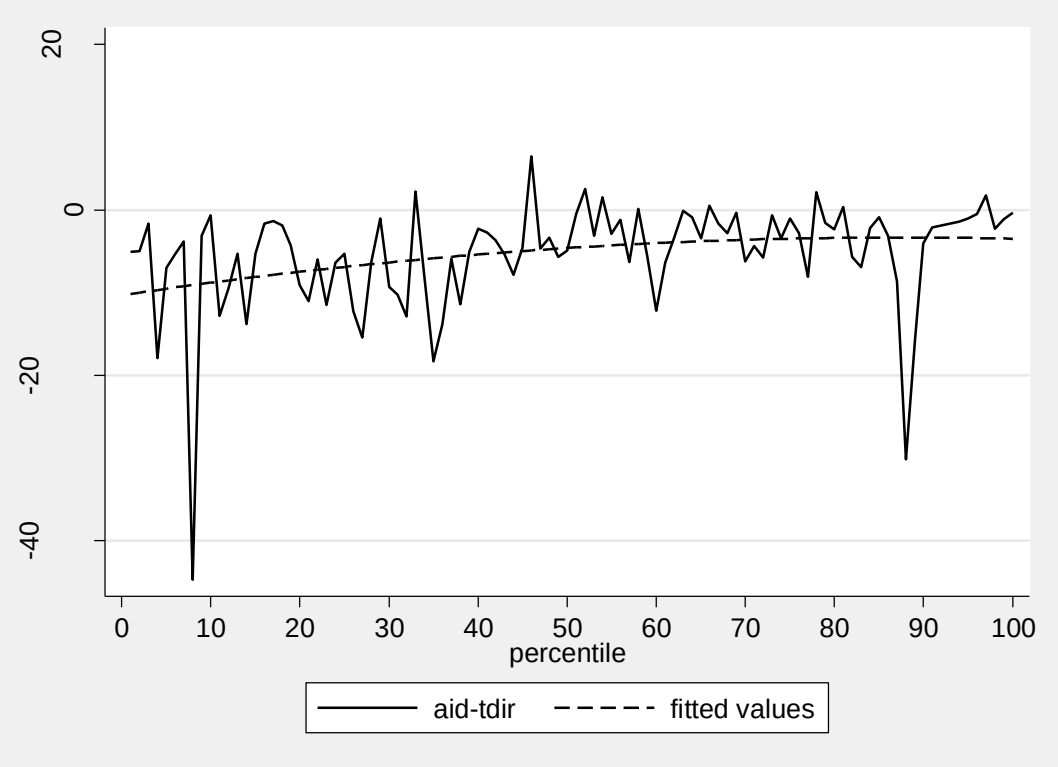


Figure 8b: growth-incidence curves scenario aid-tdir; 2030
household per capita income
proportional changes by percentile



Source: Author's elaboration.

6. Sensitivity Analysis

Certainly, the results from our Haiti CGE model are a function of (i) the model structure (e.g., functional forms used to model production and consumption decisions, macroeconomic closure rule, among other elements), (ii) the base year data used for model calibration (i.e., the SAM), and (iii) the values assigned to the model elasticities or, more generally, to the model's free parameters. In other words, the elasticities used in this study implicitly carry an estimation

error, as in any similar model. Consequently, we have performed a systematic sensitivity analysis of the results with respect to the value assigned to the model elasticities. Hence, if the conclusions of the analysis are robust to changes in the set of elasticities used for model calibration, we will have greater confidence in the results presented above.

In order to perform the systematic sensitivity analysis, it is assumed that each of the model elasticities is uniformly distributed around the central value used to obtain the results. The range of variation allowed for each elasticity is +/- 75%; that is, a wide range of variation for each model elasticity is considered. Then, a variant of the method originally proposed by Harrison and Vinod (1992) is implemented, which allows for performing a systematic sensitivity analysis. In short, the aim is to solve the model iteratively with different sets of elasticities. Thus, a distribution of results is obtained to build confidence intervals for each of the model results. The steps for implementing the systematic sensitivity analysis are as follows.

Step 1. In the first step, the distribution (i.e., lower and upper bound) for each of the model parameter that will be modified as part of the systematic sensitivity analysis is computed: elasticities of substitution between primary factor of production, trade-related elasticities, expenditure elasticities, and unemployment elasticities for the wage curves.

Step 2. In the second step, the model is solved repeatedly, each time employing a different set of elasticities; it is, therefore, a Monte Carlo type of simulation. First, the value for all model elasticities is randomly selected. Second, the model is calibrated using the selected elasticities. Third, the same counterfactual scenarios as previously described are conducted. Then, the preceding steps are repeated several times, 500 in this case, with sampling with replacement for the value assigned to the elasticities.

Table 4 shows the percentage change in private consumption estimated (i) under the central elasticities, and (ii) as the average of the 500 observations generated by the sensitivity analysis. For the second case, the upper and lower bounds under the normality assumption were also computed; notice that all runs from the Monte Carlo experiment receive the same weight. As can be seen, the results reported above are significant, while estimates presented in Table 1 are within the confidence intervals reported in Table 4. For example, there is virtual certainty that the **abscap-ng** scenario has a positive effect on private consumption.

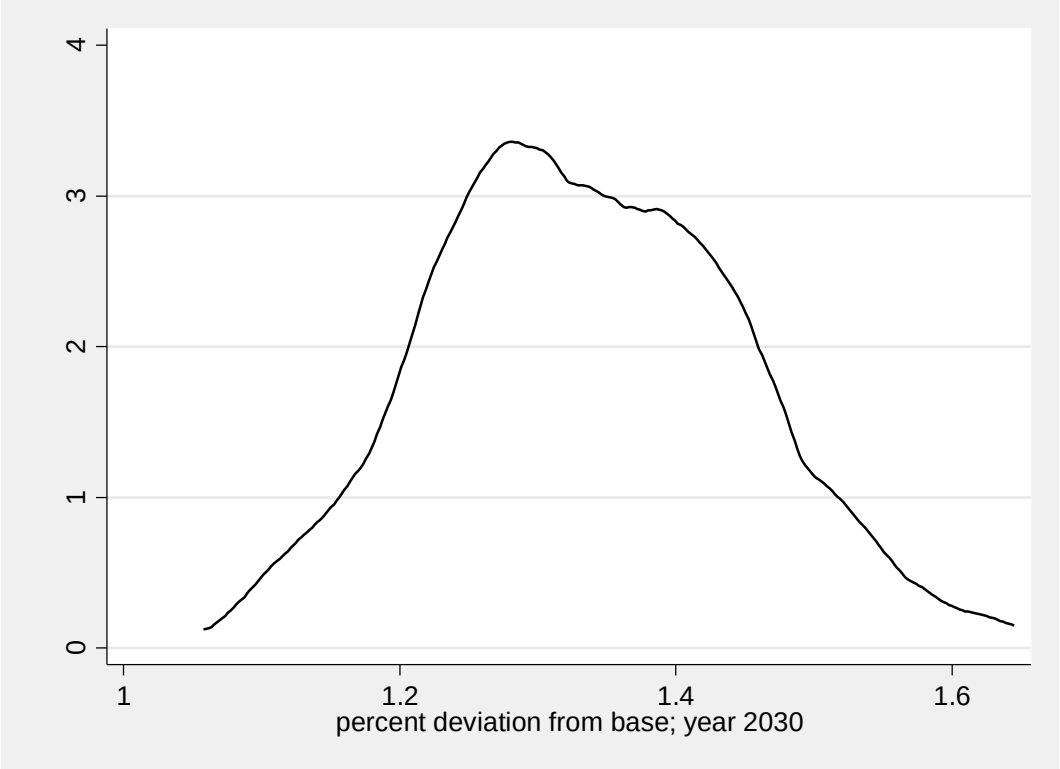
Table 3: sensitivity analysis; real private consumption in 2030
percent deviation from base
95% confidence interval under normality assumption

Scenario	Central elast	Mean	Standard dev	Lower bound	Upper bound
abscap-g	0.713	0.705	0.024	0.657	0.753
abscap-ng	1.349	1.335	0.111	1.119	1.552
aid-tdir	-5.494	-5.478	0.223	-5.915	-5.041
aid-dbor	-10.427	-10.253	1.094	-12.397	-8.108
aid-gcon	-3.890	-4.000	0.250	-4.490	-3.510

Source: Author's elaboration.

Figure 8 shows non-parametric estimates of the density function for the percentage change in 2030 in private consumption in the **abscap-ng** scenario. Again, the sign of the results (i.e., positive) is not changed when model elasticities are allowed to differ in +/- 75 percent of their "central" value.

Figure 8: sensitivity analysis, real private consumption in 2030 scenario abscap-ng percent deviation from base



Source: Author's elaboration.

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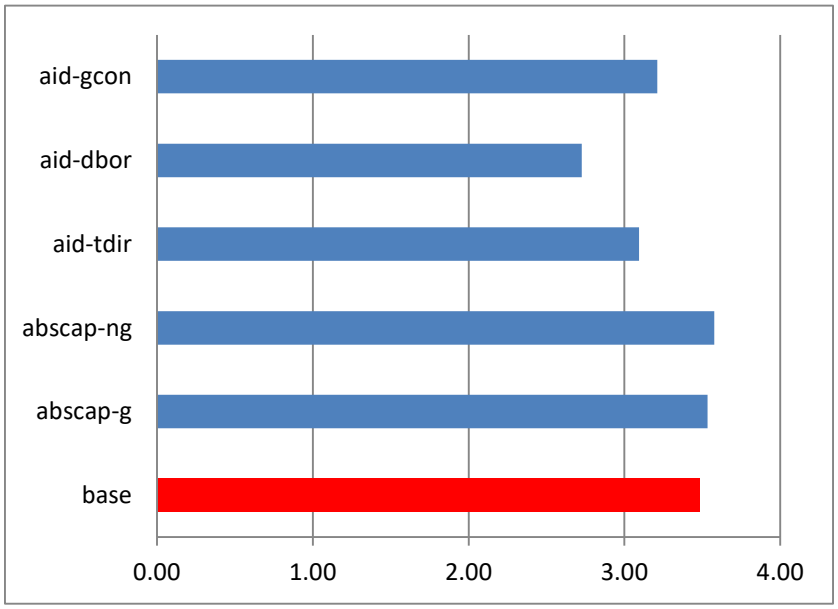
Appendix: Additional Simulation Results

Figure A.1: real private consumption
average annual growth rate 2014-2030; percent



Source: Author's elaboration.

Table A.1: real macroeconomic aggregates
average annual growth rate 2014-2030; percent

	base						
Item	2013	base	abscap-g	abscap-ng	aid-tdir	aid-dbor	aid-gcon
Absorption	493,643	3.58	3.63	3.68	3.24	2.62	3.07
Private consumption	352,731	3.48	3.53	3.58	3.09	2.73	3.21
Fixed investment	109,528	3.60	3.66	3.74	3.31	1.57	3.42
Private fixed investment	50,796	3.60	3.72	3.90	2.95	-1.84	3.20
Government fixed investment	58,732	3.60	3.60	3.60	3.60	3.60	3.60
Government fixed inv, infra	56,624	3.60	3.60	3.60	3.60	3.60	3.60
Change in stocks	57	3.57	3.57	3.57	3.57	3.57	3.57
Government consumption	31,327	4.49	4.49	4.49	4.49	4.49	-0.43
Exports	44,879	4.36	4.57	4.75	5.44	3.74	5.53
Imports	171,307	3.81	3.87	3.92	3.52	3.00	3.54
GDP at market prices	367,215	3.57	3.63	3.70	3.42	2.58	3.21
Net indirect taxes	19,907	3.80	3.87	3.95	3.65	2.91	3.69
GDP at factor cost	347,308	3.57	3.63	3.70	3.42	2.57	3.19
Real exchange rate	1.00	-0.32	-0.30	-0.25	-0.17	-0.32	-0.19
Wage, average	1.00	0.23	0.24	0.24	0.26	-0.01	-0.03
Unemployment rate	31.72	25.49	25.10	24.81	27.21	31.51	28.86
2013 = million gourdes							

Source: Author's elaboration.

Table A.2: change in sectoral employment
(percent deviation from base)

	base	abscap-g		abscap-ng		aid-tdir		aid-dbor		aid-gcon	
Sector	2013	2016	2030	2016	2030	2016	2030	2016	2030	2016	2030
Agr, hunting and forestry; Fishing	1,239,272	0.00	0.54	0.00	1.42	-0.87	-1.84	-0.58	-8.46	1.70	1.81
Mining and quarrying	1,034	0.00	0.90	0.00	1.59	-9.96	-8.58	-10.96	-19.04	-7.02	-5.59
Food prod and beverages	16,555	0.00	0.12	0.00	-0.16	-0.89	-1.80	-0.24	0.45	-0.34	-1.38
Tobacco prod	353	0.00	0.21	0.00	0.43	-1.33	-2.74	-0.48	-3.13	-0.59	-1.95
Textiles, wearing apparel and leather	35,704	0.00	4.11	0.00	6.86	36.59	30.14	39.38	-1.72	36.31	31.17
Wood and of prod of wood and cork	2,832	0.00	0.82	0.00	1.15	-2.31	-4.33	-0.65	-7.96	-4.40	-6.16
Paper and paper prod; Publishing	4,604	0.00	0.87	0.00	1.27	-5.50	-5.30	-3.99	-10.10	-4.38	-3.97
Chemicals; Rubber and plastics	1,479	0.00	0.77	0.00	0.52	-4.83	-4.75	-3.20	-6.15	-7.33	-6.75
Other non-metallic mineral prod	2,212	0.00	0.42	0.00	-0.33	-6.03	-4.53	-12.65	-14.93	-6.27	-4.77
Basic metals	609	0.00	0.97	0.00	2.50	-3.01	-5.12	-4.40	-19.07	-1.30	-2.57
Fabricated metal prod; Mach and equip	377	0.00	2.00	0.00	5.05	10.97	0.70	12.07	-19.38	9.65	1.00
Other manufactures	5,022	0.00	2.33	0.00	6.34	15.04	3.96	14.10	-24.41	17.62	9.06
Electricity and water supply	8,194	0.00	0.32	0.00	-1.05	-6.70	-2.99	-4.74	4.84	-7.52	-4.15
Construction	180,819	0.00	0.13	0.00	-0.92	-5.21	-3.49	-20.88	-25.20	-3.54	-2.48
Wholesale and retail trade	894,791	0.00	0.60	0.00	1.09	-3.60	-3.70	-3.38	-8.94	-4.05	-3.94
Hotels and restaurants	10,344	0.00	-0.84	0.00	-2.08	0.03	1.78	0.02	13.34	-0.12	0.82
Transport, storage and comm	113,723	0.00	0.57	0.00	0.78	-3.39	-3.72	-2.71	-6.60	-2.99	-3.09
Financial intermediation	64,411	0.00	0.65	0.00	1.66	-1.12	-2.54	-1.14	-10.27	-9.49	-10.87
Other market services	343,811	0.00	0.58	0.00	-0.28	-7.20	-4.28	-6.15	-2.70	-6.75	-4.22
Education, government	6,726	0.00	-0.37	0.00	-0.01	0.01	0.02	0.01	0.07	-47.48	-51.50
Health, government	19,448	0.00	-0.37	0.00	-0.01	0.01	0.02	0.01	0.07	-47.48	-51.50
Other government services	179,973	0.00	-0.37	0.00	-0.01	0.01	0.02	0.01	0.07	-47.48	-51.50
2010 = individuals											

Source: Author's elaboration.