

# Evaluation of the Socioeconomic Impact of Income Inequality in Morocco Using a CGE Model

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## Abstract

The main objective of this paper is to assess the impact of a change in household income inequality on macroeconomic variables of a developing country, in this case Morocco. To this end, we run a static CGE model calibrated to the 2016 Moroccan SAM. Among the main results, we find that a 1% increase in household income inequality leads to a decrease of (−1.60%) in GDP at market prices, which implies a loss of (−1.93%) in primary sector value added (agriculture and fishing) which remains a key sector in this economy. Furthermore, we find that a fiscal and budgetary policy that targets reducing inequality can also improve social and economic outcomes.<sup>3</sup>

## Keywords

*Income inequality, socioeconomic impact, public policy, North Africa, computable general equilibrium model*

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## JEL code

C68, D63, E62, H31

## INTRODUCTION

Across all human societies and ideologies, there has long been a significant debate about the nature of the relationship between economic development and social inequality (Piketty, 2021). Various exploratory studies on economic inequality, particularly in terms of income, assert a worldwide and extremely rapid increase since the 1980s. Henceforth, this phenomenon is perceived as global and unavoidable (Alvaredo, 2018; Lakner and Milanovic, 2015). Many authors, including Nobel Prize laureates in economics, express their concerns about the extent of this phenomenon (Deaton, 2015; Stiglitz, 2012, 2015; Krugman, 2008; Banerjee and Duflo, 2003; Sen, 1992). Therefore, if economic inequality is not effectively addressed, it is likely to lead to all sorts of political and social catastrophes. In fact, the Sustainable Development Goals

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<sup>3</sup> This study was presented during the 25<sup>th</sup> Annual Conference on Global Economic Analysis organized by Global Trade Analysis Project (GTAP) in collaboration with the Economic Commission for Africa (UNECA), Raouf and Chtouki (2022), Retrieved from: <[https://www.gtap.agecon.purdue.edu/resources/res\\_display.asp?RecordID=6518](https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=6518)>.

(SDGs), which outline the optimal way to address the challenges facing the world, consider the reduction of inequality as a central feature to achieve the expected progress.

Although the phenomenon is global, its socio-economic impact and the strategies used to deal with it cannot be generalized to all countries. The primary objective of this study, at least in part, is to assess the potential impact of an increase in income inequality on a national economy, particularly a developing economy such as Morocco. Using a static computable general equilibrium (CGE) model calibrated for the Moroccan economy, this study aims to simulate the shock of the variation of the level of inequality between income households on socioeconomic variables. This shock is applied by differentiating the direct taxation of the income of each category of representative household (namely, rural poor households, urban poor households, rural rich households, and urban rich households).

Additionally, our approach is to use the headcount data for each of the representative household agents to calculate the level of income inequality that emerges via the Gini method. Based on the level of income redistribution that results from the simulated shock, the variation in the level of income inequality is accompanied by a variation in multiple economic (production, consumption demand, firm performance, return on capital, trade openness, etc.) and social (living standards of poor and rural households, social transfers, access to education and health, etc.) variables that illustrate the impact of this inequality.

## 1 THEORETICAL BACKGROUND OF INCOME INEQUALITY IMPACT

Social and economic inequality is a global, complex, and highly varied phenomenon. Given its significance and complexity, we restrict our attention to dealing with income inequality. This refers to the flow of resources available to feed one's consumption and savings (Hicks, 1948). The growth of income inequality generates a form of division that reinforces the gap between certain social classes, some refer to it as the great divide (Deaton, 2015). This social structure puts low-income individuals or young people who are unable to access the labour market far behind the highest social classes (Serfati, 2015; Alvaredo, 2018). Some epidemiologists consider that the less equal a society is, the better it has the capacity to produce in terms of citizenship and strengthening social factors (Wilkinson and Pickett, 2009).

The socioeconomic impact of income inequality is supported by many theoretical studies (Mdingi and Ho, 2021; Hombres et al., 2012). Therefore, to enhance the relevance of our approach, we will limit it to the inputs related to the modelling approach. Thus, this theoretical review discusses two components: (i) Conceptualization of the impact channels of income inequality on the macroeconomic equilibrium with reference to Walras' general equilibrium theory; (ii) Presentation of the key variables of the model that illustrate the extent of this socioeconomic impact.

### 1.1 Inclusion of income inequality concept into general equilibrium analysis

According to Walras' general equilibrium theory (1874) of the late 19th century, the economy in its global perception is represented by a circulation of monetary flows that results from the interactions of the market between at least three actors:<sup>4</sup> Household, firm, and government. Under this illustration, the supply of factors of production (mainly labour and capital) by households generates a regular flow of income to finance their consumption expenditures. At the same time, the final consumption of households translates into sales, which in turn generate income for the general economic structure (sales for firms).

In a system that is as intertwined as it is interactive, we imagine that an increase in household income inequalities could affect final consumption demand and thus threaten the maintenance of the fluidity of this monetary circulation. As a result, our approach to analyzing the impact of income inequality consists of following the propagation of the impact of an additional income gap between households

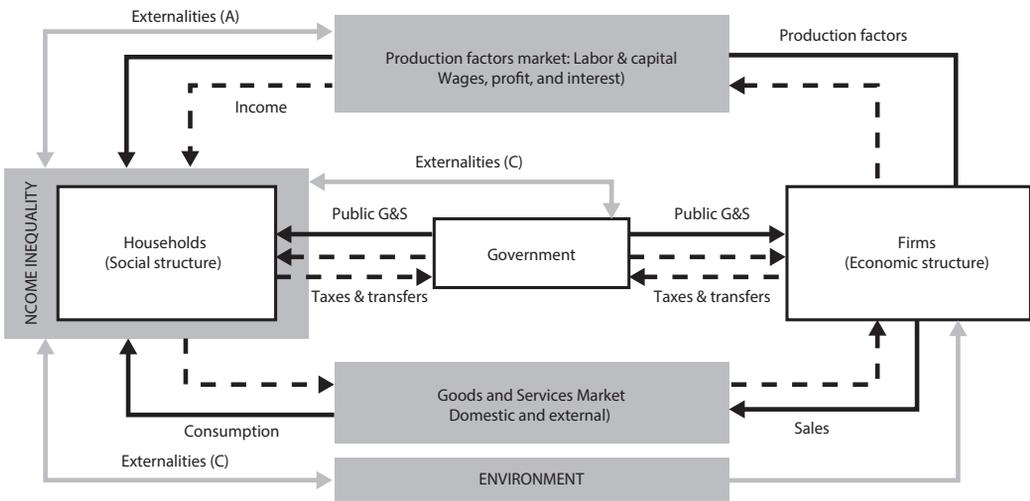
<sup>4</sup> On one side, households, which are supposed to own the production factors. Second, firms, which rent factors from households for use in the production of goods subsequently purchased by households and other firms (intermediate consumption). The third actor is the government, which provides public goods that are consumed by households and firms.

on its economic environment as shown in Figure 1. We distinguish three types of externalities that affects this equilibrium:

**Externalities (A):** These refer to the mutuality of effects between the level of income inequalities, the labour markets, and the capital market. The first connection to be highlighted concerns the returns to factors of production in proportion to households. On that note, Piketty (2013) confirms through his thesis on the forces of income divergence that capital incomes rise much more than labour incomes. This is reminiscent of Kalecki's (1954) thinking on the inevitable gap between workers and capitalists.

The second connection relates to the impact of inequality on employment and capital. It is often discussed in studies that address the impact of inequality on growth. Some argue that unequal income growth can lead to an increase in national savings, as theorized by Kaldor (1957) in his thesis on the virtuous cycle. Others draw on Kuznets' work to confirm the positive impact that inequality can have on long-term growth (Forbes, 2000; Barro, 2000). On the contrary, several other studies reject this optimistic view (Banerjee and Duflo, 2003; Benhabib, 2003; Alesina and Rodrik, 1994; Persson and Tabellini, 1991; Bourguignon, 2015). Also, other studies testify to a qualitative impact of inequalities on the factors of production: deterioration in the market supply of jobs, instability of financial markets, a trap in access to the financial market for the poor and intermediate social class, etc.

**Figure 1** Household income inequality in the circulatory flow of the economy



Source: Own construction (adapted from Mankiw, 2014)

**Externalities (B):** This concerns the impact of inequalities on the economic, social, and societal environment. Many different studies aim to establish a link between inequalities and the determinants of their socioeconomic impact (Ostry et al., 2014; Alesina and Rodrik, 1994; Galor and Zeira, 1993). The major finding of this review is that there is a negative causal relationship in both directions. Thus, an unequal environment is unfavorable to economic development in the long term for multiple reasons, mainly: recession of social cohesion, political instability (risk of riots), emergence of a sense of injustice (leading to increased crime, breakdown of the political system, lack of general confidence and others). This reinforces the idea that inequalities are evolutionary, multiform and above all cumulative (Piketty, 2013).

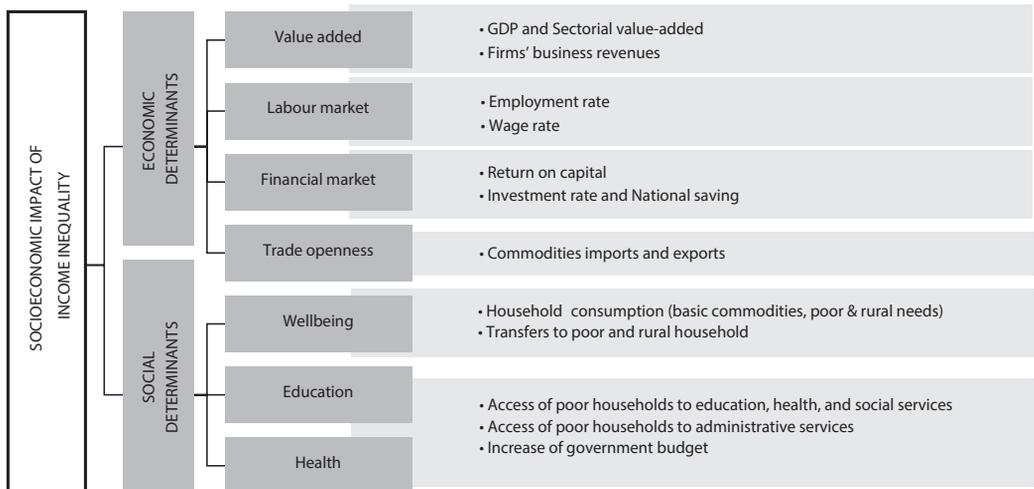
**Externalities (C):** It relates to the impact of inequalities on public policies. We support the principle that the social impact of income inequality – relating to education and mental and physical health - exerts a heavy burden on public funds by increasing the need for investment and current expenditure on social policies. As for the societal impact, although difficult to measure, we believe that its factors have effects that are undeniable: between the depreciation of trust, popular disengagement from political processes and the rise of corruption and criminality to the societal implications of gender inequality.

**1.2 Determinant of the socioeconomic impact of income inequality**

Since the 2007 crisis erupted, several researchers have become extremely concerned on whether these inequalities are an economic obstacle (Ostry et al., 2014; Bourguignon, 2015) or stimulus (Barro, 2000; Kuznets, 1955). Piketty (2013) reveals that, unlike the traditional view based on Kuznets (1955), developed economies do not systematically evolve towards more egalitarian societies. These facts have given rise to an intense and multidisciplinary debate to define the determinants of the impact of inequalities, mainly on macroeconomic standards and the foundations of social and environmental cohesion (Stiglitz, 2015; Nissanke and Thorbecke, 2006; Banerjee and Duflo, 2003; Alesina and Rodrik, 1994).

According to the scientific community, the study of the impacts of income disparities will be structured in two parts: (i) Economic impact, which concerns economic determinants such as growth (Kuznets, 1955), employment (Card and DiNardo, 2002; Acemoglu, 1999), financial stability (Brei et al., 2018; Beck et al., 2007), and trade openness (Daumal, 2013); (ii) Social impact, which includes social variables, namely: wellbeing (Berg and Veenhoven, 2010; Alessina et al., 2004), education (Acemoglu and Pischke, 2001), and health (Leigh et al., 2009). Therefore, our approach consists of studying the shift in some variables, shown in Figure 2, to illustrate the nature of their impacts.

**Figure 2** Description of the impact variables of income inequality in the CGEM



Source: Own construction

**2 METHODOLOGY**

In the methodology section, we will focus on the description of our CGE model, and the social accounting matrix (SAM) used to assess the Moroccan economy. Built on the above mentioned Walrasien theory,

the computable general equilibrium model (CGEM) is a system of simultaneous equations that makes it possible to define the equilibrium between the resources and uses of the different markets, in terms of factors, products, branches of activity and the different agents. The relationships between the different variables, in volume or in value, are described at the individual level (by agent) using Behavioral functions, equilibrium relationships or accounting identities. The latter, as its name suggests, is based on the theory of general equilibrium presented earlier.

The following model is a static and real CGEM inspired by the standard model produced by the PEP organization, namely the "PEP<sub>1-1</sub> model". As to the accounting component, the model structures its data supply via the Social Accounting Matrix (SAM). This matrix reproduces the overall flows of the Moroccan economy so that the income of each agent must be equal to all his or her expenditures. Also, the output of each branch of activity must be equal to the sum of the output sold on the local market and the exports of the branch (Raouf et al., 2021). The SAM is the result of extensive adaptation and disaggregation to meet the needs of this research. It is calibrated on data from the table of resource and employment for the year 2016. Thus, the main accounts of this matrix are distributed as follows:

- 19 branches of economic activity that can be consolidated into three sectors: Primary sector related to "agriculture", secondary sector related to "industries and manufacturing" and a tertiary sector for private and public services,
- 2 factors of production: labour and capital,
- 9 agents, including 4 households (poor urban household, poor rural household, rich urban household, and rich rural household),
- 3 additional accounts associated with taxes (indirect taxation "TI", direct taxation "TD" and customs import taxation "TM").

The selected model is composed of 96 blocks of equations and 1 674 singular equations for a total of 1 674 variables, of which 1 466 are free or endogenous. To allow the resolution of the model, the 208 variables presented in Table A2 in the Annex C are fixed and made exogenous including the parameters whose values are obtained by assignment or by the calibration of the model.<sup>5</sup> After the resolution, the general equilibrium verification variable "*Leon*" is equal close to a zero value (3.781 E-9). This is the minimum value we could obtain, given the parameters of the model. It seems marginal, very close to zero. At the end of this step, the basic solution, without shock, is found and all the model parameters are calibrated.

### 3 DATA DESCRIPTION AND MODELLING STRATEGY

#### 3.1 Household income inequality at base year of the CGE model

As mentioned earlier, national household income is divided into four representative household categories. Each of these categories includes a headcount in line with the HCP survey data (HCP, 2016). Thus, this structure does not follow a quartile split (25% for each category) but rather according to poverty rate and place of residence (HCP, 2019). As shown in Table 1, the overall household income is divided into three income categories: labour household income (YHL) with a share of 39.48%, capital household income (YHK) with a share of 33.92% and transfer household income (YHTR) with a share of 26.61%. The household with the lowest income is RPH<sup>6</sup> with a share of the national household income estimated at 2%. The richest household in the distribution, the UNPH household, has a share over 68% of the total household income. For capital income, we note that UPH has no capital.

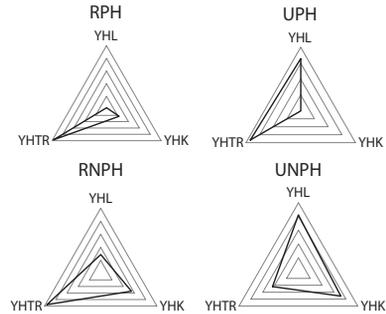
In terms of domestic demand, household consumption is distributed just as unequally as the income distribution, especially for urban household. This results from the fact that it includes the two household agents with the lowest and highest consumption shares. As for savings, the relationship is less unequal.

<sup>5</sup> Please refer to the Annex for more details on the variables fixed to solve the CGE model.

<sup>6</sup> For further details on the designation of each household agent, please refer to the Annex A.

**Table 1** Household income structure at the base year equilibrium

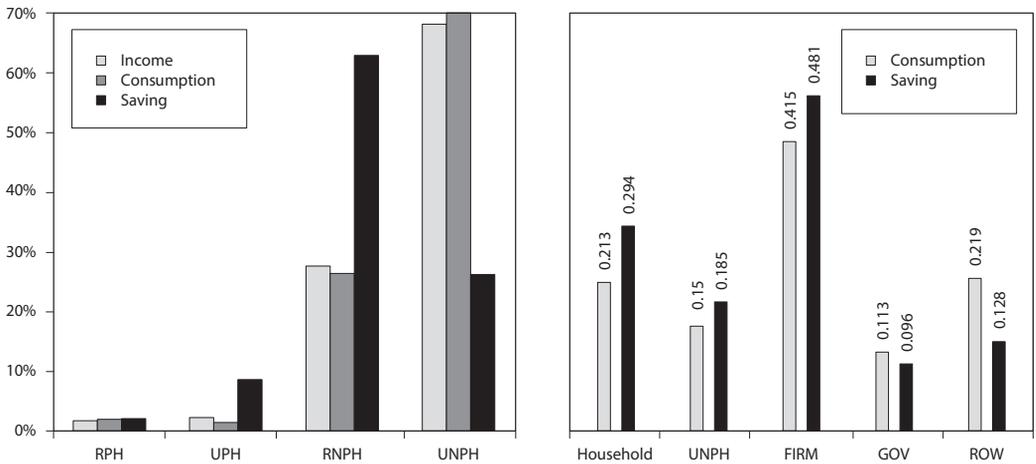
	YHL	YHK	YHTR	YH
<b>RPH</b>	0.10%	1.15%	4.85%	1.72%
<b>UPH</b>	3.29%	0%	3.68%	2.28%
<b>RNPH</b>	14.45%	27.38%	47.82%	27.71%
<b>UNPH</b>	82.15%	71.47%	43.65%	68.28%
<b>TOTAL</b>	<b>39.48%</b>	<b>33.92%</b>	<b>26.61%</b>	



Source: Model outputs estimated according to HCP database (2019)

In the case of the non-household agents, the income of public and private administrations is almost similar, but their consumption behaviour is not: the intermediate consumption of firms is four times greater than that of the public sector and almost twice as great as the total external demand for products intended for export.

**Figure 3** Share of consumption and savings by agents at the base year



Source: Model outputs estimated according to HCP database (2019)

Moreover, the consumption and savings of the FIRM agent represent about twice the consumption of households and more than three times the consumption of the government. Thus, the contribution of household consumption and savings, particularly the UNPH agent which represents approximately two thirds of the total, is considerable in the Moroccan economy. By studying household data in the SAM 2016, we note that savings (HS) and transfer income are among the least unequal household aggregates compared to consumption and other forms of household income.

### 3.2 Procedure for simulating the impact of inequalities in the CGE model

The procedure for incorporating the study of income inequality between parameterized households into our modelling is based on two overarching approaches.

### 3.2.1. Income inequality measuring approach

The measurement of income inequality on the CGEM is carried out via the Gini index (1921). In addition to the cumulative income share data ( $Y_k$ ), we use the headcount data ( $X_k$ ) that aggregates each of the representative households modelled.

$$I_{Gini} = \left| 1 - \sum_{k=0}^{n-1} (X_{k+1} - X_k)(Y_{k+1} - Y_k) \right|.$$

It is possible to measure the level of inequality, not only for income structures, but also for consumption and savings, as illustrated in the Annex. In our model, the Gini index of household income inequality (YH) in the basic equilibrium is estimated at 39.34%. This is consistent with the level of income inequality in the model's base year of 2016 (HCP, 2019).

### 3.2.2. CGEM simulation strategy

First, to stimulate the income inequality in CGEM, our approach consists of incorporating a mobilizing shock to household income gaps via two policies:

- (i) **Tax policy:** This consists of establishing an overtaxation of household incomes via a direct tax (DT). As shown later in the simulation plan, this overtaxation targets a variation of 25% on urban household incomes and 15% on rural household incomes.
- (ii) **Mixed policy:** This policy is composed of a fiscal and tax policy. The fiscal component uses the same measures as the first policy, while the second consists of a 20% increase in public current expenditure. The interest is to reduce the effect of the increase in government revenue generated by the direct tax on household income.

Regarding the policies explained previously, the simulation strategy is formulated to set up different scenarios where changes in income inequality impact the macroeconomic aggregates of the model. Our simulation strategy is summarized in three parts:

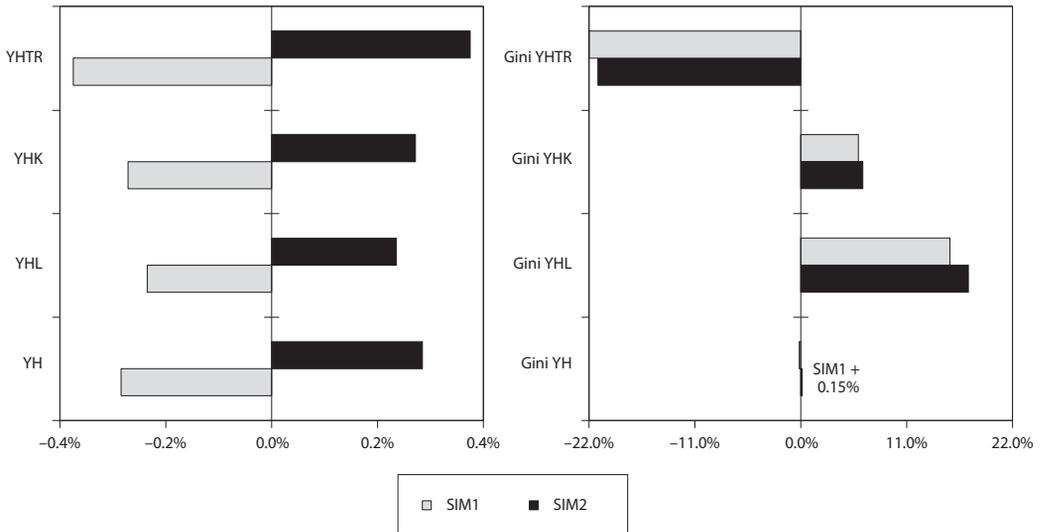
- **Simulation of the increase in inequality:** The impact of overtaxing the non-poor against a reduction in the direct tax on the poor is simulated in SIM1, SIM3 and SIM5. Although these policies aim at reducing the income gap between poor (UPH and RPH) and non-poor (UNPH and RNPH) households through taxation, the results show a relative increase in inequality in the sense of Gini, especially in SIM1 (increase in inequality of +0.15%).
- **Simulation of the reduction of inequalities:** The impact of overtaxing the poor against a reduction of the direct tax on the non-poor is simulated in SIM2, SIM4 and SIM6, which, in parallel with the other simulations, lead to a decrease in household income inequalities, especially in SIM2 (variation of -0.15% in the Gini sense).
- **Impact of public spending "SIM0":** This simulation is designed to assess the impact of a one-time increase in public spending on the Moroccan economy. This simulation is used only as a differential to the variations generated by the last four simulations, namely SIM3, SIM4, SIM5 and SIM6.

## 4 MAIN RESULTS OF THE CGEM SIMULATIONS

### 4.1 Effects of the simulated shocks on income redistribution

To provide a better understanding on the extent of the impact of the simulated shocks on inequality, our approach distinguishes these simulations into two groups: the impact of fiscal policy and the impact of mixed policy. Thus, the first group includes only SIM1 and SIM2. According to the results, we specify that the impact of SIM1 leads to results that are perfectly inverse to those of SIM2. In fact, reducing income inequality through SIM2 leads to an increase in income, mainly in transfer income. This increase is more beneficial to non-poor households, hence the increase in their shares of YHTR of (+0.2%) for UPH and (+0.1%) for RPH.

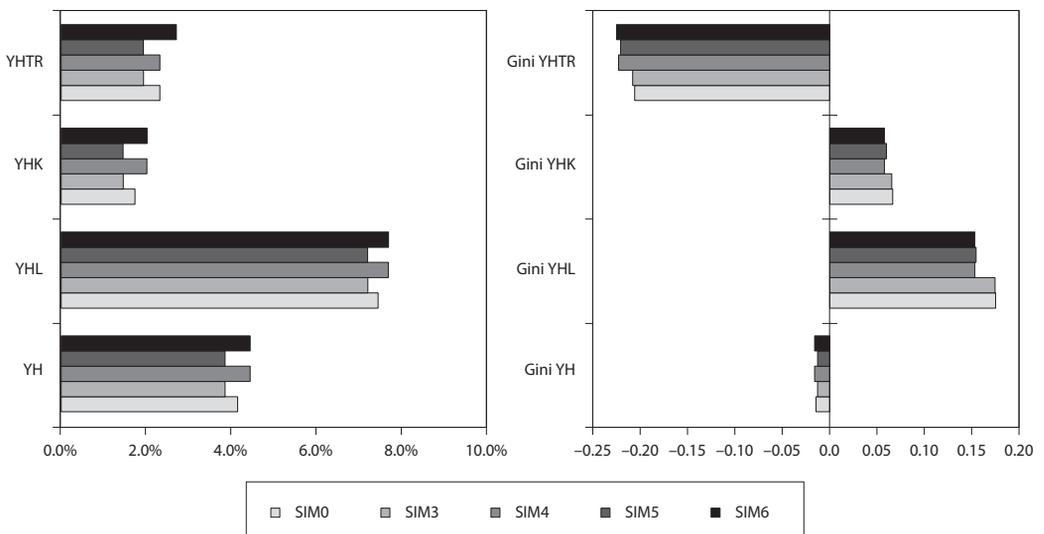
**Figure 4** Impact of fiscal policy on household income



Source: Model outputs estimated according to HCP database (2019)

The second group includes SIM3, SIM4, SIM5, and SIM6. We also add SIM0 to establish a baseline value for their changes. In contrast to the first group, inequality results of this second group are more pronounced in terms of the reduction in inequality, with a reduction that varies between (-1.62%) and (-1.30%). Assuming that the change in income inequality index for SIM0 is (-1.46%), we consider only those simulations that have decreased beyond this point, namely SIM4 and SIM6. Considering

**Figure 5** Impact of the mixed policy on household income



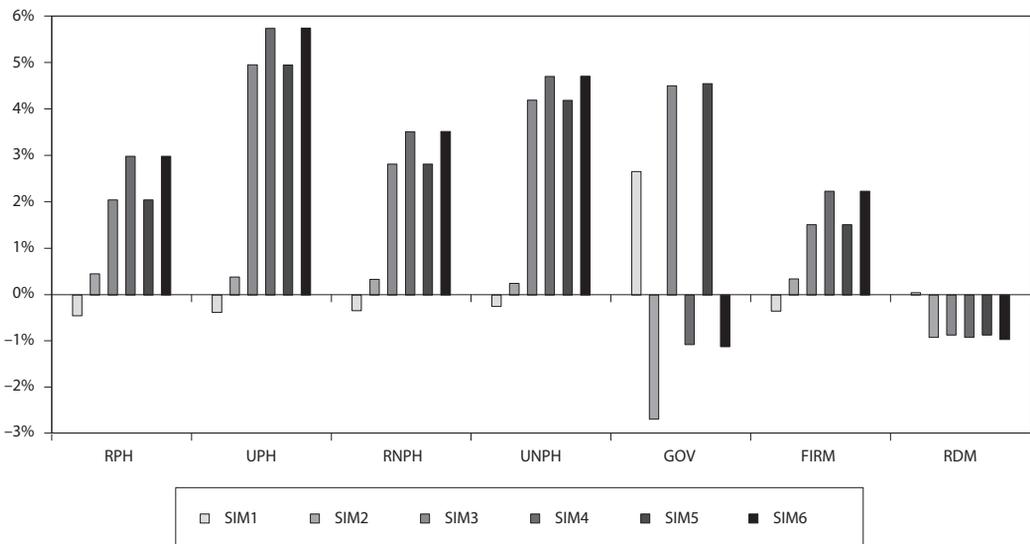
Source: Model outputs estimated according to HCP database (2019)

these assumptions, we note that fiscal restructuring in favor of poor households limits the positive effects generated by this expansionary fiscal policy, mostly in terms of limiting the equalizing effect of the increase in public spending.

Other than household income, these inequalities have a negative impact on the economic structure. Indeed, SIM1 causes a decrease in business revenues of (-0.35%). Instead, SIM4 and SIM6 cause an increase in firms' income at a similar rate of (+2.27%). Meanwhile, inequality has a stimulating effect on the public and external revenues. For the public agent, we relate this effect to the increase in tax revenue generated by the overtaxation of households. For the external agent, we find that the reduction in domestic firm's revenue is beneficial for the rest of the world. This is more strongly demonstrated by SIM4 and SIM6 results, where the decrease in the income of the "rest of the world" agent reflects a gain from the exchange, as it coincides with an increase in firm's revenue.

Given all results on the impact on revenue, the most economically beneficial policies are SIM4 and SIM6. However, we strongly recommend the policy simulated by SIM6. Although both confirm a positive correlation between inequality reduction and household income enhancement, SIM6 is technically and socially more adequate. As a matter of fact, SIM6 policy raises the incomes of the poorest without applying any tax pressure on household incomes. We find that an income tax cut of 25% for urban poor households and 15% for rural poor households allows them to increase their UPH income by (+5.844%) and their RPH income by (+3.036%) respectively, with a Gini index that decreases from 39.4% to 38.7%.

**Figure 6** Results of the simulations of the impact on the income of economic agents



Source: Model outputs estimated according to HCP database (2019)

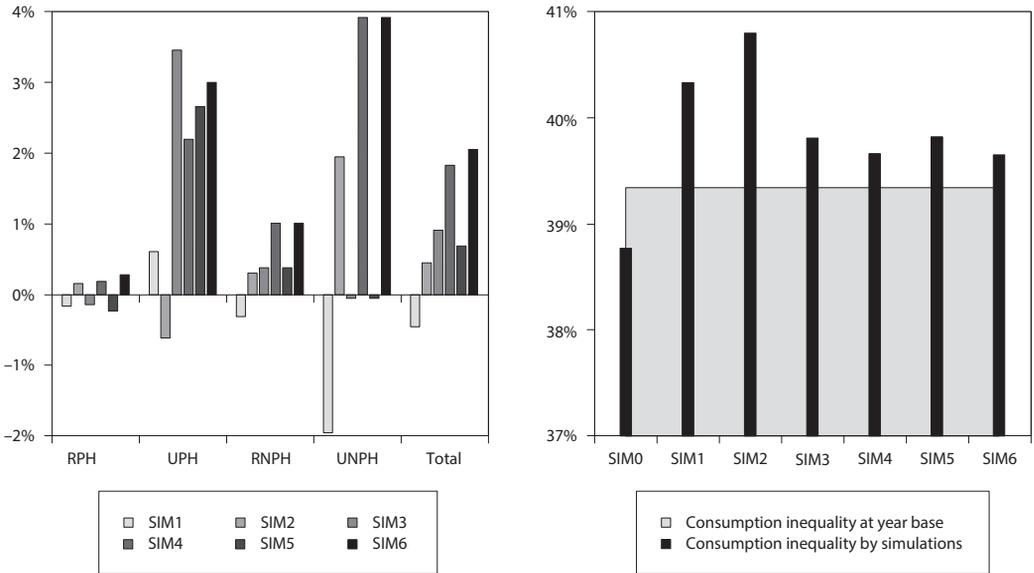
**4.2 Impact on the behaviour of different households**

Our results demonstrate that inequality has an impact on the individual households' behaviour, which are illustrated in the following three main components: consumption, savings, and transfers between agents.

**4.2.1 Impact on household consumption**

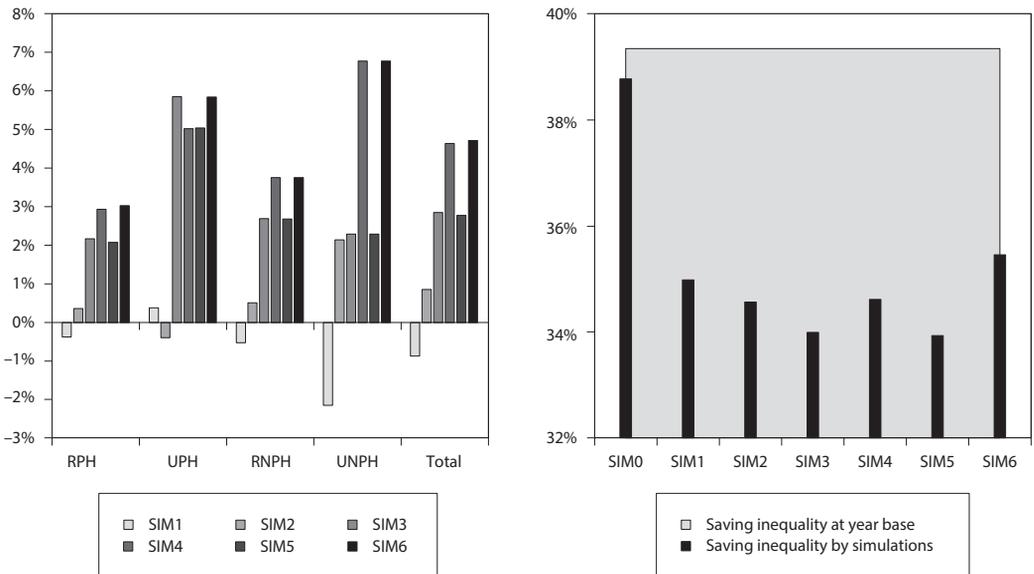
Income inequality increases consumption inequality and reduces the overall level of household consumption. As the results of the simulations show, the level of consumption inequality increases

**Figure 7** Results of simulations of the impact on household consumption



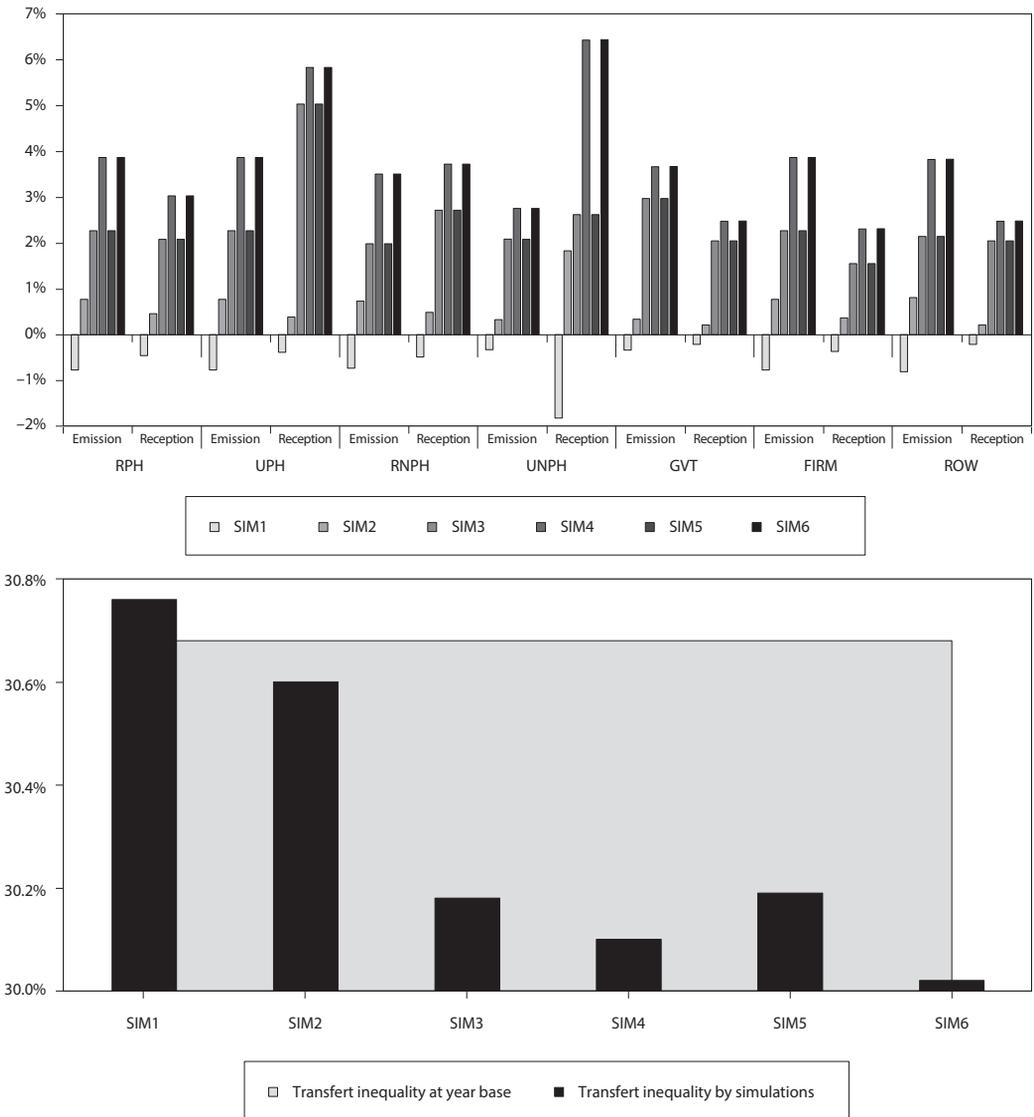
Source: Model outputs estimated according to HCP database (2019)

**Figure 8** Results of impact simulations on household savings



Source: Model outputs estimated according to HCP database (2019)

**Figure 9** Impact of the simulations on transfers between agents



Source: Model outputs estimated according to HCP database (2019)

in response to all shocks simulated, except for SIM0. In fact, any variation in income affects inequalities in household consumption demand. However, according to SIM2, the reduction in inequality increases the level of final household consumption, in particular that of the UNPH agent by (+1.96%), which represents 15% of overall consumption. Conversely, the UPH household increases its consumption expenditure in SIM1.

**4.2.2 Impact on household savings**

According to SIM1 results, income inequality increases savings' inequality and reduces national household savings. Noteworthy is that UPH increased both its savings and its consumption expenditure. When

a fiscal policy is added to SIM1's fiscal policy, in this case SIM3, UPH further increases its consumption and savings. We find that UPH's consumption and saving behaviour is particularly highly sensitive to increases in income. As for his rural counterpart, it is only savings that are sensitive to these shocks, in particular the mixed policy.

#### **4.2.3 Impact on the mutuality of household transfers**

The structure of income shows that transfers represent a total of 27% of household income. In fact, they are the least unequal, having a Gini index of 30.6%. The increase in inequality leads to a reduction in the mutuality of transfers between the different agents in the model, even reducing transfers from abroad, according to SIM1. In terms of household transactions, poor households' transfers to the government decreased by (-0.77%). This rate is near the decline in transfers issued by RNPH (-0.73%). In the case of the upper household UNPH, the issuance of transfers decreased only by (-0.33%). Similarly, UNPH is the only agent whose decrease in transfer receipt exceeds its issuance. However, its impact remains minor, given that UNPH's income represents only 17% of its total income.

The variation in the level of transfer inequalities per simulation is almost the same for all the shocks except for the fiscal policy simulated at SIM0 (inequalities increase by almost 8% compared to the baseline level). However, it is important to keep in mind that the redistribution hierarchy of transfer income is different from that of total income, where the higher income share is held mainly by rural households. To this end, the increase in inequality implies more transfers to RPH and RNPH. Therefore, the increase in income in SIM4 and SIM6 for urban income relatively reduces transfer inequalities. Our findings confirm that the redistribution of transfer income has a regulatory function on the level of inequality in Morocco. Similarly, a fiscal stimulus policy will strengthen transfers to the rural environment, while favoring the RNPH agent. As for the non-household agents, the most significant decrease in emissions is linked to the external agent ROW. Technically, the increase in inequality reduces external transfers and, thus, increases income for this external agent.

### **4.3 Impact on the components of market equilibrium**

Once the impact of income inequality on household behaviour has been highlighted, this section focuses on the impact on the various components of market equilibrium by presenting the results of the impact on the demand for factors of production, aggregate supply, and prices.

#### **4.3.1 Impact on aggregate demand**

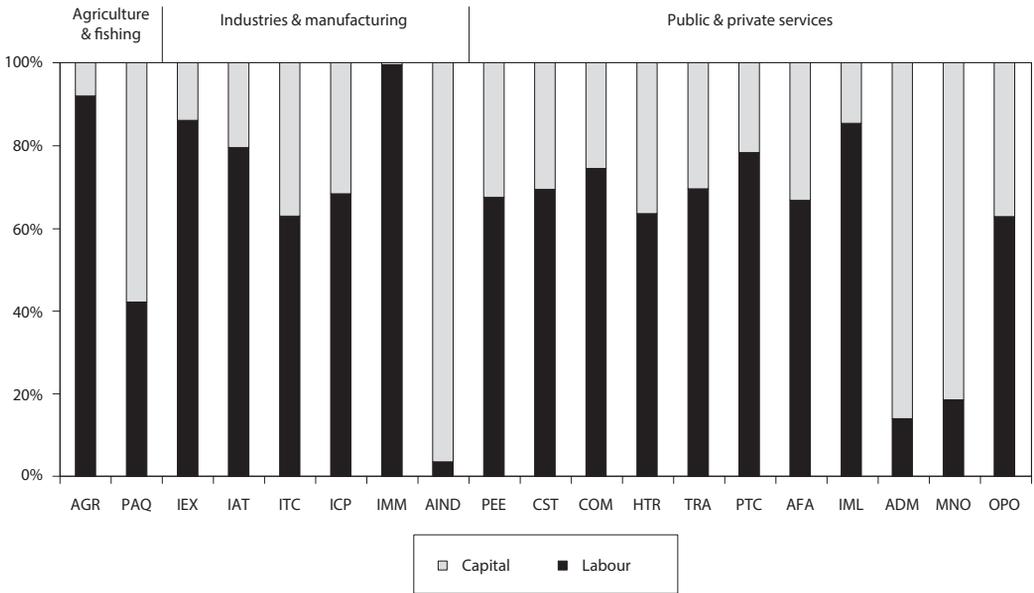
The presentation of the impact on aggregate demand concerns the exposition of impact results of the factors of production and commodities.

##### *Impact on the demand for factors of production*

The structure of demand for factors of production by branch is calibrated so that most branches are capital-dependent, except for fishing (PAQ), public services (ADM), social services (MNO), and other industries (AIND). By sector, we note that an increase in income inequality following SIM1 reduces the demand for factors of production in the primary sector of agriculture and the tertiary sector of services.

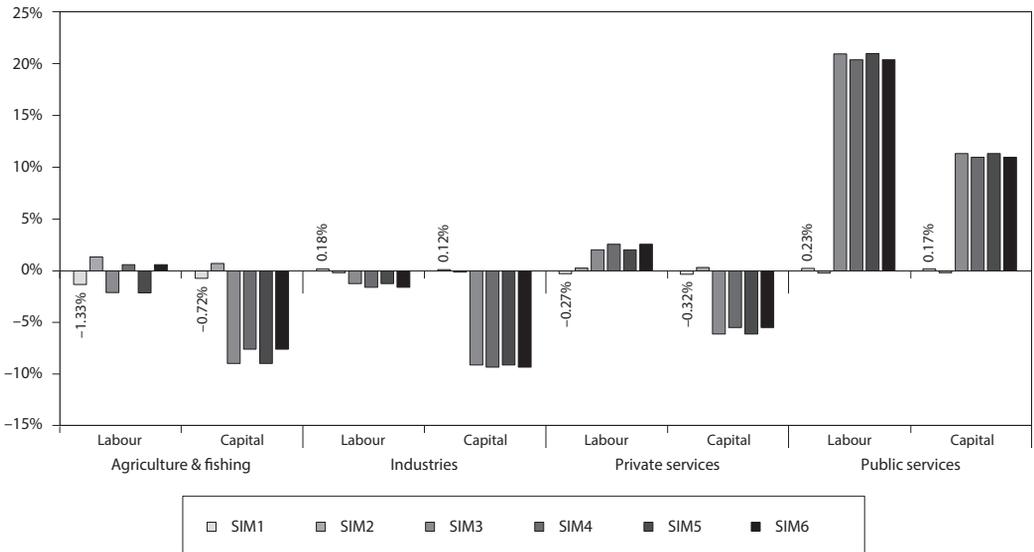
In contrast, it has a stimulating effect on the secondary sector of industry and manufacturing. The most impactful effect is associated with agriculture with a decrease in labour demand of (-0.66%) and a decrease in capital demand of (-0.72%). This effect is reflected in a risk of increased unemployment and the weakening of return on capital. We also find that introducing a fiscal policy has a negative effect on the demand for capital in all private sectors. Regarding employability, the mixed policy shock has a mixed effect depending on the sector of activity: negative effect for the secondary industrial sector, positive for the service sector and mixed for the primary sector of agricultural and fishing.

**Figure 10** Distribution of factors of production by branch



Source: Model outputs estimated according to HCP database (2019)

**Figure 11** Impact on the demand for factors of production by sector

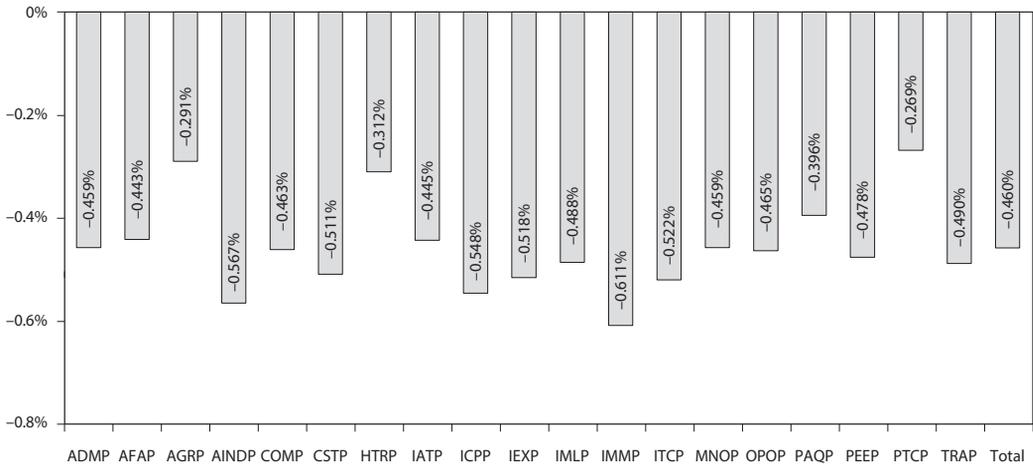


Source: Model outputs estimated according to HCP database (2019)

*Impact on demand on the goods and services market*

Demand on goods and services market is negatively impacted by the growth of income inequality in SIM1. For the mixed policy simulations that result in a relative reduction in inequality (SIM3 and SIM5), the commodities where consumption has declined are those belonging to the primary sector of agriculture and fishing (AGRP and PAQP) as well as education, health, and other social services (MNOP). Since these scenarios aim to simulate an eventual increase in income inequality during a period of sustained public policy stimulus, we consider that this increase in inequality has a reducing effect on the demand for these products that are fundamental to household social progress.

**Figure 12** Impact of the simulations on consumption by branch in SIM1<sup>7</sup>



Source: Model outputs estimated according to HCP database (2019)

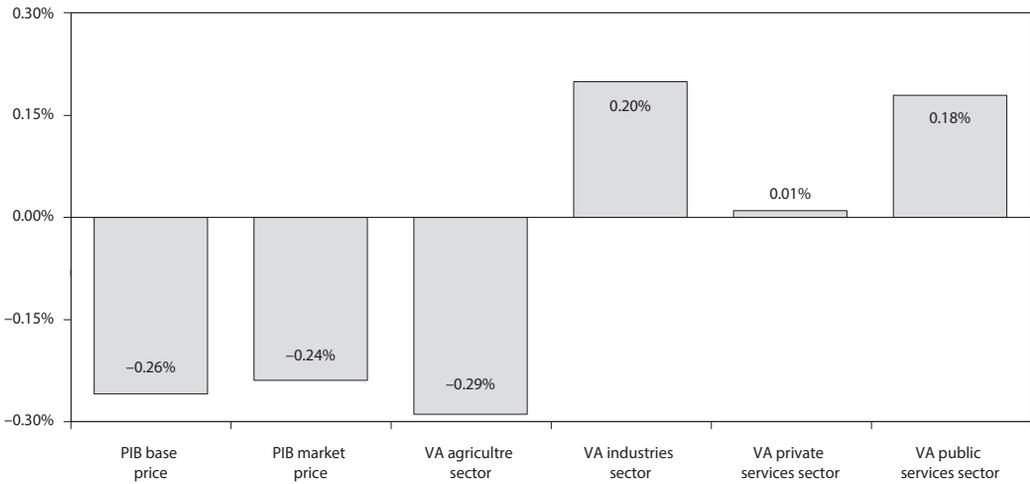
**4.3.2 Impact on aggregate supply: production and value added**

To assess the impact on production, we study the variation in GDP. We distinguish two forms of measurement: (1) GDP at market prices, which represents the sum of value added (VA) plus taxes net of subsidies on products. (2) GDP at basic prices excludes taxes on products and includes subsidies. Subsequently, we present the changes in wealth produced at the level of each of the economic sectors through the sum of the VA relative to the branches of activity that belong to them.

Without an increase in public spending, the simulation of an increase in inequality in the short term (SIM1) generates a decrease of (-0.24%) in GDP at market prices and (-0.26%) in GDP at basic prices. At the level of value added, we note a divergence in the sensitivity of each sector to this shock: a decrease in the primary sector of (-0.29%), a growth in industries of 0.2% and a quasi-stagnation in services (+0.01%). Indeed, this increase in inequalities simulated in SIM1 is accompanied by an increase in inequalities in labour income (YHL) of (+17.4%) and capital income (YHK) of (+6.45%) in the Gini sense. These results show that a rise in wage inequality causes a reduction in national GDP. This reduction is associated with the decline in primary sector output. Despite the increase in the VA of the industrial branches and public services, this loss of value added in the primary sector, composed of agriculture and fishing, causes not only a decrease in the income of all categories of households, but also in the private funds of firms illustrated by the FIRM agent, which loses (-0.32%) of its income.

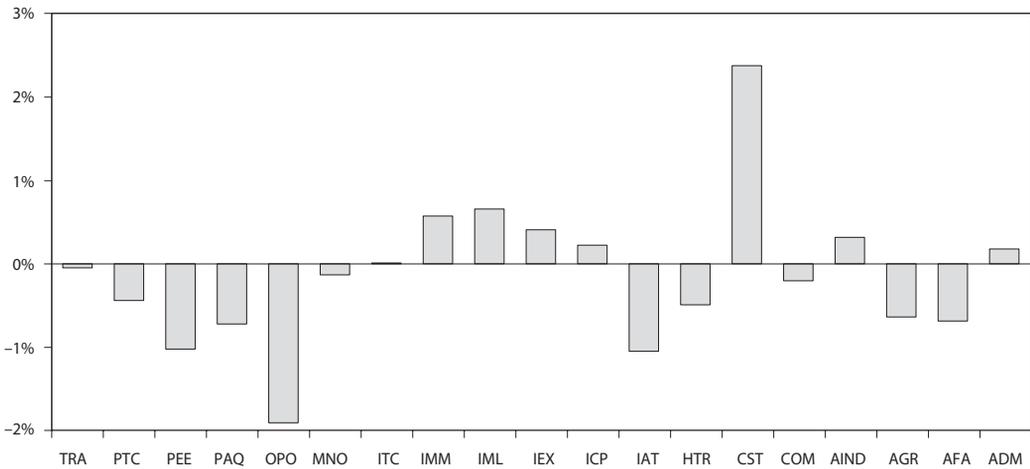
<sup>7</sup> In Figures 12 to 14, we will display only SIM1 results. Further detailed results are available in the Annex C.

**Figure 13** Impact on national and sectoral production in SIM1



Source: Model outputs estimated according to HCP database (2019)

**Figure 14** Impact of the simulations on value added by industry in SIM1



Source: Model outputs estimated according to HCP database (2019)

Through increased government intervention through current spending, output growth is higher. Indeed, the results of the last four simulations show both an increase in economic performance accompanied by an increase in household and business income, with more reduction in the overall income inequality. SIM6 and SIM4 produce the highest variation in output with a rate of (+4.07%) for GDP at basic prices, a rate of (+3.54%) for GDP at market prices, also an increase of (+5.28%) in primary value added. Under these same simulations, the two sectors, secondary and tertiary excluding the public sector, recorded a counter-performance estimated at an average of more than 3.5 points for industry and a quasi-stagnation for services.

The main variation generated by the shock of SIM1 is the increase in the value added of the "Construction and Public Works" branch (+2.38%). This result is explained in part by the reduction in prices associated with production costs compared to sales prices (with an index of 0.754). This index means that the cost of production has fallen by more than a quarter of the selling price, which leads to an increase in the value added in this sector. In addition to this industry, we note that activities that experienced deflation

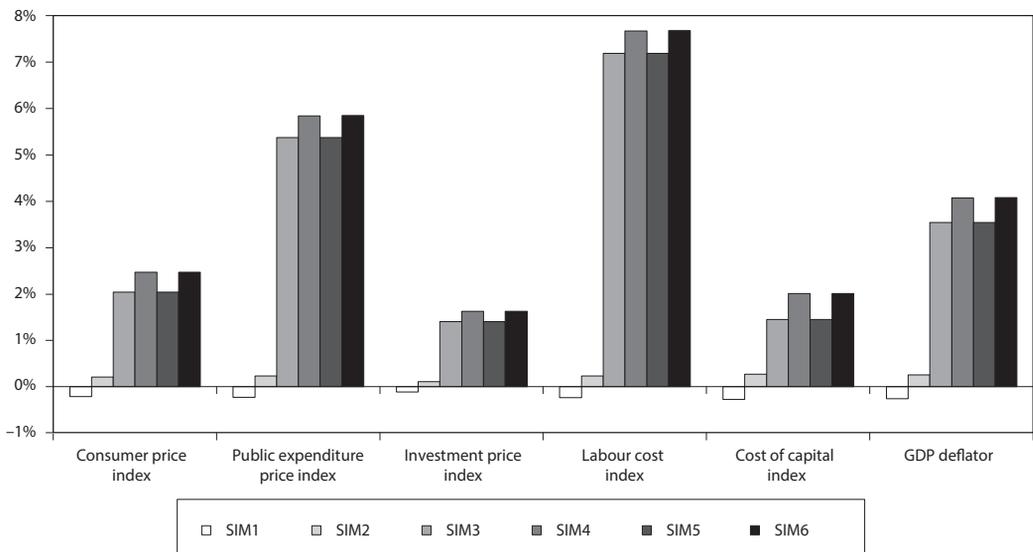
in production prices, as well as sales prices, also recorded an increase in value due to SIM1, with (+0.32%) of other industries (AIND) and (+0.66%) of mechanical, metallurgical, and electrical industries (MMI). SIM1 generates a generalized deflation on all branches, whether on sales prices or production costs, especially for production in the secondary industrial and tertiary services sectors. This explains the increase in industrial value added and the stagnation in the service sector.

On SIM1, the branches that recorded a decline in their value added are firstly other non-financial services (OPO), with a negative variation of (-1.91%), then food and tobacco (IAT) by (-1.05%), electricity and water (PEE) by (-1.03%), marine fishing and aquaculture (PAQ) by (-0.73%), hotels and restaurants (HTR) by (-0.49%), etc. When comparing sales prices to production costs, these industries show a sales price/production cost variation index greater than 1, with the variation in sales prices remaining higher than that of costs. This has the effect of minimizing the profits generated by these activities, explaining therefore the reduction in their contribution to total value added. Through these results, we can see that the performance of industries which production is intended for the larger demand, such as food and household services, declines as income inequality increases. Although, this same unequal environment is favorable to industries in need of strong investment, such as construction or capital goods maintenance. This is reinforced by the 2.35% increase in GFCF in SIM1.

### 4.3.3 Impact on price indices

With a rate of around 2%, inflation in Morocco is rather rampant. However, our analysis also includes a component that aims to measure the impact that the simulations may have on price stability. However, we believe that the inflationary effects can only be measured at a static level (in the very short term),

**Figure 15** Impact of the simulations on the main price indices



Source: Model outputs estimated according to HCP database (2019)

particularly in the context of a standard CGE model. Although, to assess the impact on prices, we will limit ourselves to the prices associated with the factors of production, labour, and capital, as well as the price indices, namely: The GDP deflator, the consumer price index, the investment price index, and the public expenditure price index.

The results of the simulations show that the tax-only policies (SIM1 and SIM2) have variations that do not exceed the 0.28%, where the values of the two simulations are perfectly opposite. Unlike SIM2, SIM1 shows a generalized decline in all indices, with a decline of (-0.213%) in the consumer price index. Although the employment cost of capital index is at its lowest point (down -0.272%), the smallest change is in the investment price index, at a rate of (-0.11%). Relating these results to those of income, we can see that an increase in income inequality by public policy (mainly fiscal) of 1% results in a fall in the CPI of 1.41%. This fall in consumer prices is accompanied by a deflation of GDP of 1.70%.

As our model represents a free economy, the risk of inflation is highly anticipated, especially through an increase in government current expenditure. Indeed, the last four simulations cause more inflation in the studied price indices, where the most significant impact is that of the labour index (reflecting wages) and that of public expenditure prices. The smallest variation is in the price index of investment and the cost of using capital. However, a specific feature emerges for each index in these simulations: Simulations SIM4 and SIM6 generate more inflation than SIM3 and SIM5, principally in the use of capital where the difference between these two groups of simulations is more intense.

## 5 ANALYSIS AND DISCUSSION

To summarize the results of the model, we provide an illustration of the socio-economic impact of income inequality using an extrapolation approach of an increase in inequality of 1% in the Gini index (Annex D). As shown in annex, we retain the three simulations outcomes, namely SIM1, SIM3 and SIM6. So, we note that an additional 1% in inequality limits not only the growth potential of poor households but also that of the richest. Encouraging these better-off households to lower their consumption and saving behaviour by more than 10%. An unequal environment is likely to disengage them from participating in the consumption and savings process.

Although it has a reducing effect on inflation, this decline in consumption affects the internal and external commodity markets. In addition to the negative effects on exports (-22.93%), we note that it has a negative impact on firms' private resources, where an increase of 1% leads to a decrease of (-2.23%). This has the effect of reducing the demand for production factors, mainly labour. As long as industrial emergence is not accompanied by an absorption of unemployment, this favorable economic impact on the industrial secondary sector is accompanied by a negative social impact relating to underemployment. Also, it is important to point out that any leveraging effect associated with investment and the budget surplus is not necessarily linked to inequalities, but rather to the fiscal policy used to chock the model.

On the social impact of a 1% increase in income inequality, we detect a decline of more than 2.5% in the income of poor households as well as rural households, since this reduction is associated with a decline of more than 5% in transfers destined to these households. In addition, we notice other factors of this reduction in income that are associated with the reduction in the demand for labour by (-3.13%) and the wage rate by (-1.57%). We also note a considerable decrease in household access to basic commodities (food, education, health and public). However, poor households show a small increase in their ability to access these products. This minor increase is due to the increase in consumption by poor urban households.

Regarding the theoretical implications that justify the results obtained from the model, Table 2 represents an interpretation of the set of economic and social impact determinants in relation to the theoretical contributions rooted in the economic literature.

**Table 2** Analysis of the socio-economic impact of income inequality

	Impact determinants	Effect	Analyze & discussions	
Economic impact	Production & economic growth	GDP	Negative	Increasing inequality affects demand in markets of goods and services which in turn affects the profitability of firms and the returns on investment for the richest and encourages rent-seeking (Rodrik, 1999; Nissanke and Thorbecke, 2006) resulting in sluggish growth and an inability to absorb unemployment and increase household incomes. Inequality imposes a cost on the economy (Stiglitz, 2015).
		Primary sector value added (agriculture & fishing)	Negative	As with industrial food production and financial services, the unequal environment appears to be incompatible with agricultural and fisheries production, where their value-added falls by an average of 0.6 points for every 1% increase in inequality. This is related to the decline in consumption of the basket of basic household products to the detriment of equipment and investment products, especially by non-poor urban households.
		Secondary value added (industries)	Positive	Income inequality increases the added value of the branches where the activity is based on industrial investment for two reasons: (i) the selling prices of these branches decrease more than the investment costs, generating economies of scale; (ii) the demand for industrial products increases as a substitute for products of a consumable nature, such as industrial foodstuffs, agricultural and fishing products, etc.
		Tertiary value added (services)	Mix	Inequality has, on average, little impact on the service sector. However, the construction and real estate branches, which are support services for the realization of durable physical assets, see their demand increase considerably with the rise in inequality. On the other hand, rising inequality affects the performance of the financial sectors by (-1.3%) in terms of average value added.
		Firms' income	Negative	Declining returns on capital and profits on sales lead to lower returns for companies.
	Labour market	Employment rate	Negative	The relationship between inequality and employment is marked by reciprocity. On the one hand, the rise in unemployment causes a growth in inequality (Tregenna, 2011). This growth in inequality impacts the demand for labour inputs, which leads to underemployment (Acemoglu, 1999).
		Wage rate	Negative	The decline in job demand results in a lower wage rate. This decline in wages is of little benefit to firms (because of their declining revenues).
	Financial market	Return on capital	Negative	The decline in demand for capital is relatively less extreme than that of labour. Consequently, this decline is associated with the decline in economic activity, especially financial.
		Investment rate	Positive	Inequalities have a positive effect on investment (Barro, 2000). However, the excessive rise in physical investment expenditures is accompanied by a limitation in human capital investment (Nissanke and Thorbecke, 2006). This weakens the share of income going to the middle class and reduces demand in the market of commodities.
		National savings/GDP	Negative	Contrary to Kaldor assumption (1957), rising inequality lowers national savings because of the generalized decline in resources in the economy.
	Trade liberalization	Exportation	Negative	For some (Colluch et al., 2001; Krugman, 2007; Daumal, 2013), trade openness is positively correlated with a decline in inequality, as a redistributive factor. In the case of an increase in income disparities, the factors of production are weakened, even weakening production for export, and reducing external trade.
		Importation	Negative	
	Social impact	Well-being (happiness)	Household consumption/GDP	Negative (Extreme)
Access to the food product			Negative	Decrease in the consumption of basic household products leads to a feeling of intense unhappiness that affects the well-being.
Accessibility of poor households to commodities			Positive (weak)	Despite the general decline in household consumption, the small increase in consumption by poor households is due to consumer price deflation, especially in urban region. This causes a slight increase in demand through the price effect.

Table 2

(continuation)

		Impact determinants	Effect	Analyze & discussions
Social impact	Well-being (happiness)	Transfers to the poor and rural household	Negative	Theoretically, households that receive additional income tend to invest more in their children's education (Akee et al., 2010). The 5-point drop in transfers following a 1-point increase in inequality has an atrocious effect on households that is not limited to education.
	Education and health	Access of poor household to Social Services	Negative	Economic impact generated by increases of income inequality limits access to social services, affecting human capital (Perotti, 1996; Aghion et al., 1999) which weighs on government spending and economic growth.
		Access of poor household to administrative services	Negative	The more egalitarian the society, the more public policies are oriented towards investment in human capital and social services (Perotti, 1994). This improves the quality and compatibility of public services for households.
		Government budget	Positive	In theory, an increase in the state budget means a possible increase in the budget for social policies, especially when an increase in inequality forces a correction of the redistribution function (Meltzer and Richard, 1981). However, it is important that the increase in inequality is not the origin of this increase in public funds, but rather an effect produced by the overtaxation of rich households. In this respect, the budget surplus only has a social effect when a stimulus policy is implemented.

Source: Own construction

## CONCLUSION

Even though the world is richer than it used to be, this enrichment is far from being beneficial to everyone (WID, 2018). As much as inequality continues to expand around the world (Lakner and Milanovic, 2016), it is not necessarily an issue in and of itself. What matters is whether they have a right to exist, or to put it another way, do not have a detrimental impact on economic and social stability (Piketty, 2021).

Our research aims to address the question of income inequality and its impact on social and economic structures. Therefore, we used a CGE model while disaggregating the households into four agents distinguished not only by their earnings but also by their place of residence (urban and rural). The choice of integrating this distinction comes down to the territorial nature of income inequalities in Morocco: Deficiency of social factors related to rural households (e.g., 93.3% of rural households have no family member with medical coverage, compared to 66.1% of urban households), the decline in their living standards (71% of rural households live in precarious or unhealthy housing) and increased vulnerability to economic shocks (during the confinement imposed by the Covid-19 crisis, the poverty and vulnerability rates in rural areas reached 57% and 64.4%, respectively, compared to 12.7% and 21.5% in urban regions).

In short, the modeling results show that household income inequality is a significant obstacle to Moroccan growth in the short run. This disproves the optimistic claims about the positive correlation between inequality and growth made since the work of Kuznets (Forbes, 2000; Barro, 2000). Indeed, the increase in income inequality leads to a less efficient equilibrium in terms of production, consumption, and savings, and to a greater lack of accessibility to social and public services for poor households. We note that the integration of an additional tax exoneration for poor households with a budgetary expansion policy, as shown in SIM6, helps to alleviate the adverse effects of income inequality. However, this fiscal and tax policy generates significant inflation, which is mainly reflected in the consumer price index. In this regard, we note that a policy approach to reduce inequality must include a monetary policy to control inflation.

## ACKNOWLEDGMENT

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## ANNEX A – DESIGNATION OF SECTORS, BRANCHES AND PRODUCTS ON THE MODEL

Sector	Code	Branche	Product	Designation
Primary sector (Agriculture & fishing)	A00	AGR	AGRP	Agriculture, forestry, and related services
	B05	PAQ	PAQP	Fishing, aquaculture
Secondary sector (Industries & manufacturing)	C00	IEX	IEXP	Extraction industry
	D01	IAT	IATP	Food and tobacco industries
	D02	ITC	ITCP	Textile and leather industries
	D03	ICP	ICPP	Chemical and Para-chemical industries
	D04	IMM	IMMP	Mechanical, metallurgical, and electrical industries
	D05	AIND	AINDP	Other industries
	Tertiary sector (Services)	E00	PEE	PEEP
F45		CST	CSTP	Construction and public works
G00		COM	COMP	Commerce
H55		HTR	HTRP	Hotels and restaurants
I01		TRA	TRAP	Transport
I02		PTC	PTCP	Post and telecommunications
J00		AFA	AFAP	Financial and insurance activities
K00		IML	IMLP	Real estate, renting and business services
L75		ADM	ADMP	General public administration
MN0		MNO	MNOP	Education, health and social work
OP0		OPO	OPOP	Other non-financial services
UFO		TRO		Territorial correction

Source: Model outputs estimated according to HCP database (2019)

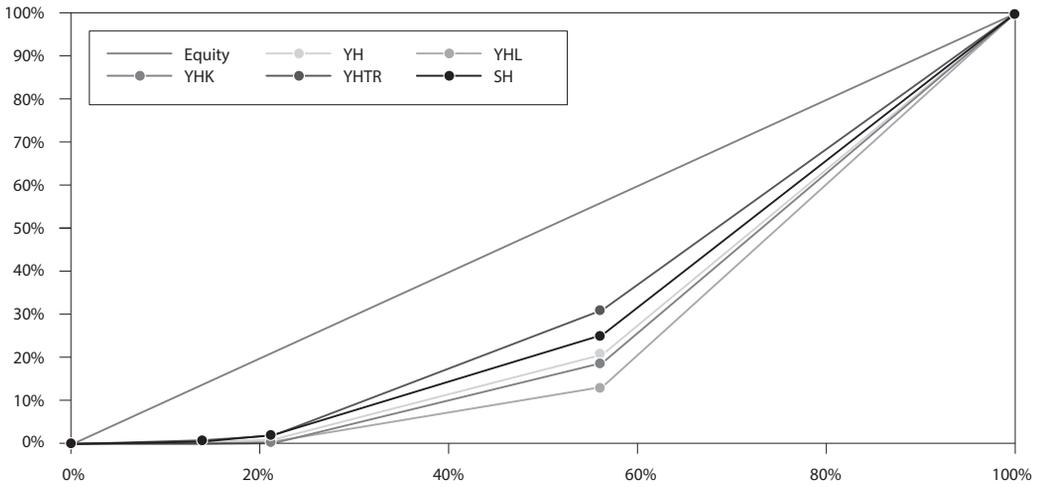
## ANNEX B – SOCIAL STRUCTURE AND HOUSEHOLD BEHAVIOR

**Table A1** Main indicators on economic agents in basic equilibrium

	Designation	Income	Consumption	Saving	Population
RPH	Rural Poor household	14 065.27	11 704.49679	2 077.78	14%
UPH	Urban Poor household	18 616.47	8 428.878059	8 751.19	8%
RNPH	Rural Non-Poor household	226 421.71	15 5502.6003	26 650.03	35%
UNPH	Urban Non-Poor household	557 864.53	413 015.0249	63 919.27	44%
FIRM	Economic structure (Firms)	302 378.73	1 143 361.042	165 908.7673	
GOV	Government	313 755.82	311 669.8678	33 113.98684	
ROW	Rest of the world	491 003.3	713 932.192	44 186	

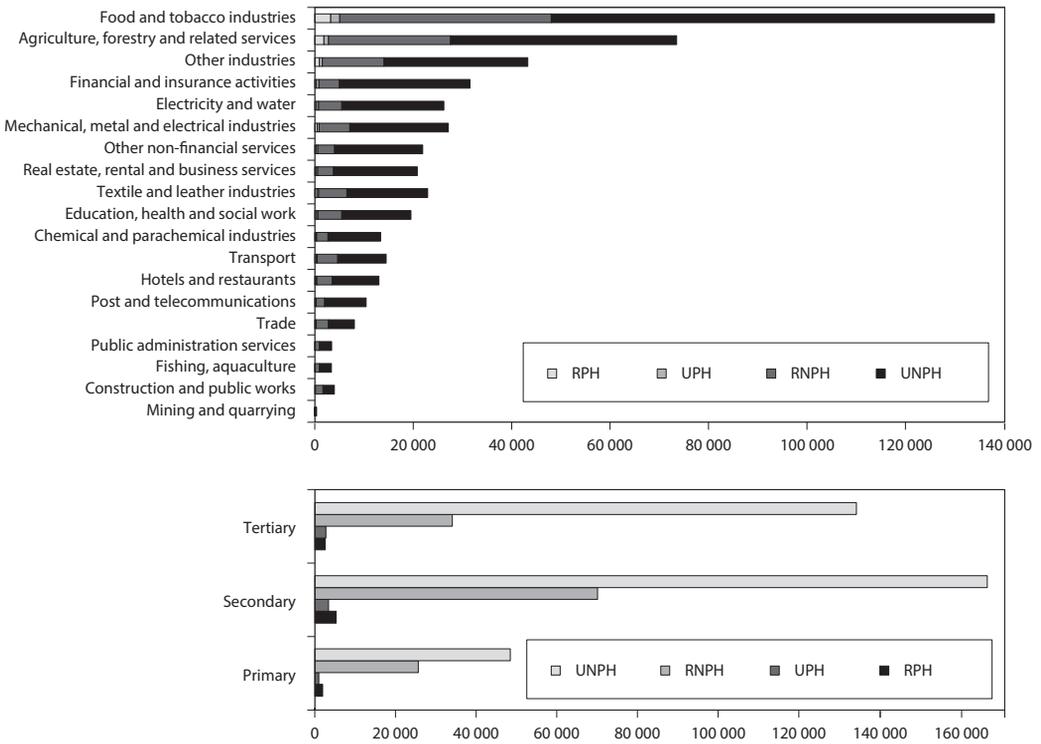
Source: Model outputs estimated according to HCP database (2019)

**Figure A1** Lorenz of income inequality, consumption, and savings



Source: Model outputs estimated according to HCP database (2019)

**Figure A2** Basic equilibrium consumption by product and sector



Source: Model outputs estimated according to HCP database (2019)

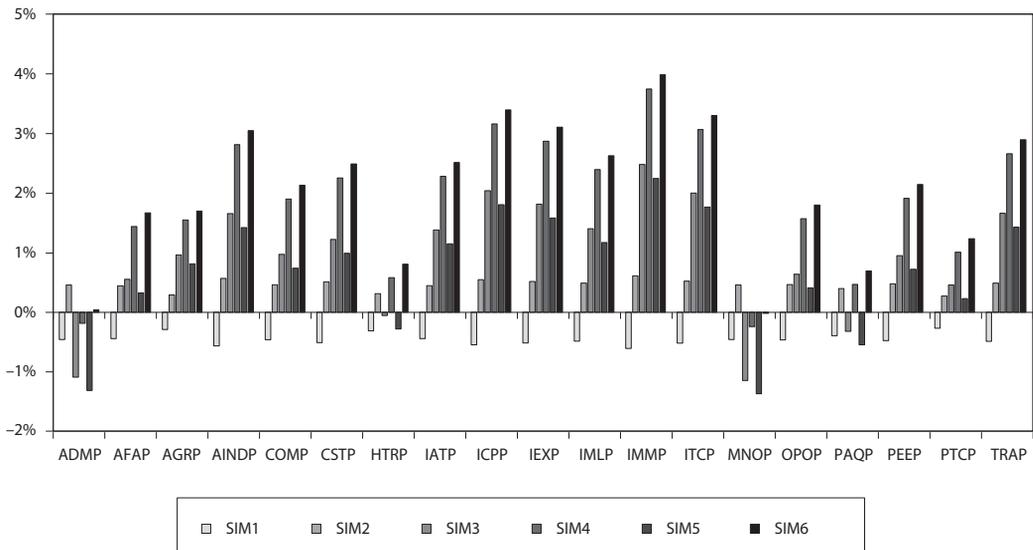
## ANNEX C – MORE DETAILS ABOUT CGE MODEL RESOLUTION

**Table A2** Fixation of the exogenous variables necessary to solve the CGE model

Variable	Designation	Dimension
$e$	Exchange rates	1
$CAB$	Current account balance	1
$C_{i,h}^{MIN}$	Minimum household consumption, in each product	$19 \times 4 = 76$
$G_{-i}$	Public expenditure	19
$LS_i$	Labour supply	1
$KS_k$	Capital supply	1
$PWM_i$	International price of imports, for each product	15
$PWX_i$	International export price, for each product	15
$VSTK_i$	Stock variation of product i	7
The variables of savings, transfers, direct and indirect taxation are fixed at their base year values, after allocation or calibration		$4 \times 4 = 16$ $1 \times 2 = 2$ $4 \times 2 = 8$ $19 \times 1 = 19$ 15 $19 \times 1 = 19$
<b>Total</b>		<b>208</b>

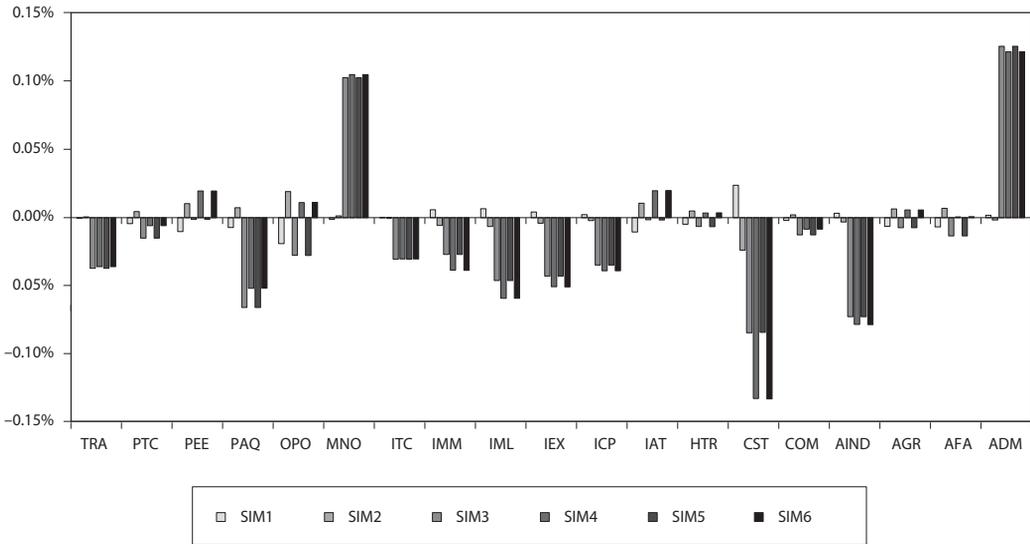
Source: Model outputs estimated according to HCP database (2019)

**Figure A3** Variation of consumption by branch in each simulation



Source: Model outputs estimated according to HCP database (2019)

**Figure A4** Impact of the simulations on value added by industry



Source: Model outputs estimated according to HCP database (2019)

## ANNEX D – RESULTS OF THE EFFECT OF A RISE ON 1% ON MODEL VARIABLES

**Table A3** Impact of inequalities on household living standards

	Impact of +1% of income inequality by fiscal policy (SIM1)	Impact of +1% of income inequality by mix policy (SIM3)	Impact of +1% income inequality within optimal policy (SIM6)
<b>Impact on household income (YH)</b>	-1.89%	2.97%	2.74%
RPH	-3.03%	1.60%	1.87%
UPH	-2.54%	3.88%	3.61%
RNPH	-2.29%	2.21%	2.21%
UNPH	-1.69%	3.28%	2.96%
<b>Impact on consumption income (YH)</b>	-3.07%	0.71%	1.29%
RPH	-1.07%	-0.11%	0.18%
UPH	4.12%	2.71%	1.88%
RNPH	-2.09%	0.30%	0.63%
UNPH	-13.22%	-0.04%	2.46%
<b>Impact on saving income (YH)</b>	-0.80%	0.56%	0.62%
RPH	-2.47%	1.67%	1.87%
UPH	2.53%	4.50%	3.61%
RNPH	-3.40%	2.07%	2.32%
UNPH	-14.27%	1.77%	4.18%

Source: Model outputs estimated according to HCP database (2019)

**Table A4 Economic impact of 1% of income inequality in CGEM**

	<b>Impact of +1% of income inequality by fiscal policy (SIM1)</b>	<b>Impact of +1% of income inequality by mix policy (SIM3)</b>	<b>Impact of +1% income inequality within optimal policy (SIM6)</b>
<b>National and sectoral production</b>			
GDP at basic prices	-1.73%	2.72%	2.51%
GDP at market prices	-1.60%	2.35%	2.19%
<b>Value added by sector</b>			
Primary (agriculture and fisheries)	-1.93%	3.62%	3.26%
Secondary (industry)	1.33%	-2.76%	-2.46%
Tertiary (services)	0.07%	-0.03%	-0.04%
including public services (ADM)	1.20%	9.69%	7.53%
<b>Consumption &amp; investment</b>			
Household final consumption/GDP	-9.37%	-0.45%	1.40%
Consumer price index	-1.42%	1.58%	1.53%
National household savings/GDP	-4.18%	-0.15%	0.70%
Investment rate (GFCF/GDP)	17.33%	-7.50%	-9.24%
Investment price index	-0.74%	1.09%	1.01%
Capital demand	-0.02%	-0.06%	-0.04%
of which non-public	-0.02%	-0.06%	-0.05%
Rate of return on capital	-1.81%	1.12%	1.25%
<b>Public and private institutions</b>			
Government budget (YG)	18.03%	3.53%	-0.70%
Price index of public expenditure	-1.53%	4.15%	3.62%
Government transfers to households	-1.42%	1.58%	1.53%
Revenue from taxes on products and imports	-0.35%	-0.41%	-0.27%
of which indirect taxes on consumption	-0.10%	-0.48%	-0.37%
Private funds of enterprises (YFIRM)	-2.35%	1.19%	1.40%
Corporate tax revenue	-1.81%	1.12%	1.25%
<b>Trade openness</b>			
Exports of goods and services	-22.93%	-5.02%	-4.30%
Imports of goods and services	-6.00%	-3.12%	-2.79%

Source: Model outputs estimated according to HCP database (2019)

**Table A5** Social impact of 1% of income inequality in CGEM

	Impact of +1% of income inequality by fiscal policy (SIM1)	Impact of +1% of income inequality by mix policy (SIM3)	Impact of +1% income inequality within optimal policy (SIM6)
<b>Standard of living of poor households</b>			
Income of poor households	-2.79%	2.74%	2.74%
Consumption of poor households	1.52%	1.30%	1.03%
Savings of poor households	0.03%	3.09%	2.74%
Transfers to poor households	-5.13%	1.75%	2.39%
<b>Standard of living of rural households</b>			
Rural household income	-2.66%	1.91%	2.04%
Rural household consumption	-1.58%	0.09%	0.41%
Savings of rural households	-2.94%	1.87%	2.10%
Transfer to rural households	-5.01%	1.64%	2.28%
<b>Access to the labour market</b>			
Need for recruitment (demand for labour)	-3.13%	0.13%	0.70%
of which non-public	-3.13%	-0.33%	0.33%
Labour compensation rate (wages)	-1.57%	5.55%	4.76%
<b>Market access for goods and services</b>			
Access to agricultural and industrial food products	-2.52%	0.52%	1.01%
of which poor households	0.57%	0.39%	0.31%
Access to education, health, and social services	-3.07%	-0.88%	-0.01%
of which poor households	0.54%	-0.29%	-0.22%
Access to government services	-3.07%	-0.84%	0.02%
of which poor households	0.54%	-0.27%	-0.20%

Source: Model outputs estimated according to HCP database (2019)