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Abstract

This paper aims at bringing out the determinants of the significant poverty alleviation observed in Cameroon between 1993 and 2001. It focuses on the decomposition of poverty and growth changes, in order to assess the intrinsic contribution of each major economic policy implemented in Cameroon during this period. A double calibration technique, within a micro-simulated computable general equilibrium model was used to that effect. Findings obtained reveal that the devaluation, the rehabilitation of infrastructures, and the VAT enforcement respectively contributed for two percent, 9 percent and -4 percent in the poverty alleviation; for one percent, 11 percent, and three percent in explaining GDP growth; and for 65 percent, zero percent and 11 percent in the rise of the consumer price index (CPI). Beside revealing the intrinsic impacts of aforementioned policies, the double calibration approach made it possible to realize that technological changes arose between 1993 and 2001 alone stand to explain up to 31 percent of the nationwide decline in poverty, 45 percent of the GDP growth, and 4 percent of the CPI increase. The notion of technological changes refers here to changes occurred across the time in the values of scale parameters contained in production and product differentiation functions.

Key terms: Double calibration, Impacts decomposition, Micro simulation, Devaluation, CGE models, Technological changes, Tax and Customs reforms, Basic infrastructure.

JEL Codes: C68, D58, H22, H54, I32.

1. Introduction

During the second half of the nineties, Cameroon recorded a sharp decline in poverty. For instance, the proportion of people counted as poor, the so-called “poverty headcount” or FGT0 index, fell from 53.3 percent in 1996 to 40.2 percent in 2001¹; i.e. a drop of 13.1 percentage points of poor people in five years (Table 1). This period corresponds in fact to the economic recovery Cameroon registered beyond 1994, after a decade of recession which lasted from 1985 till 1994 and which was translated by a drastic deterioration in the household standard of living (the consumption per capita fell by 40 percent between 1986 and 1993, see Graph 1 for trends relating to GDP). Thanks to the economic recovery, the real GDP grew at around 4.5 percent yearly from 1996 to 2001, and the estimated average income in terms of adult-equivalent spending increased by 14.8 percent during the same five year period.

Table 1: Changes in Poverty Indices arose between 1996 and 2001: Decomposition under Growth effects and Income Redistribution effects

Change in Poverty Indices Socio-economic Areas	Total Variation		Growth Effect		Income Redistribution Effect	
	FGT0 ^(a)	FGT1 ^(a)	FGT0	FGT1	FGT0	FGT1
Rural Areas	-9.8	-3,1	-13.3	-6.6	1.7	3.4
Urban Areas	-19.3	-8,3	-9.0	-4.7	-8,4	-4.7
Cameroon	-13.1	-4.9	-11.8	-5.9	-1.8	0.6

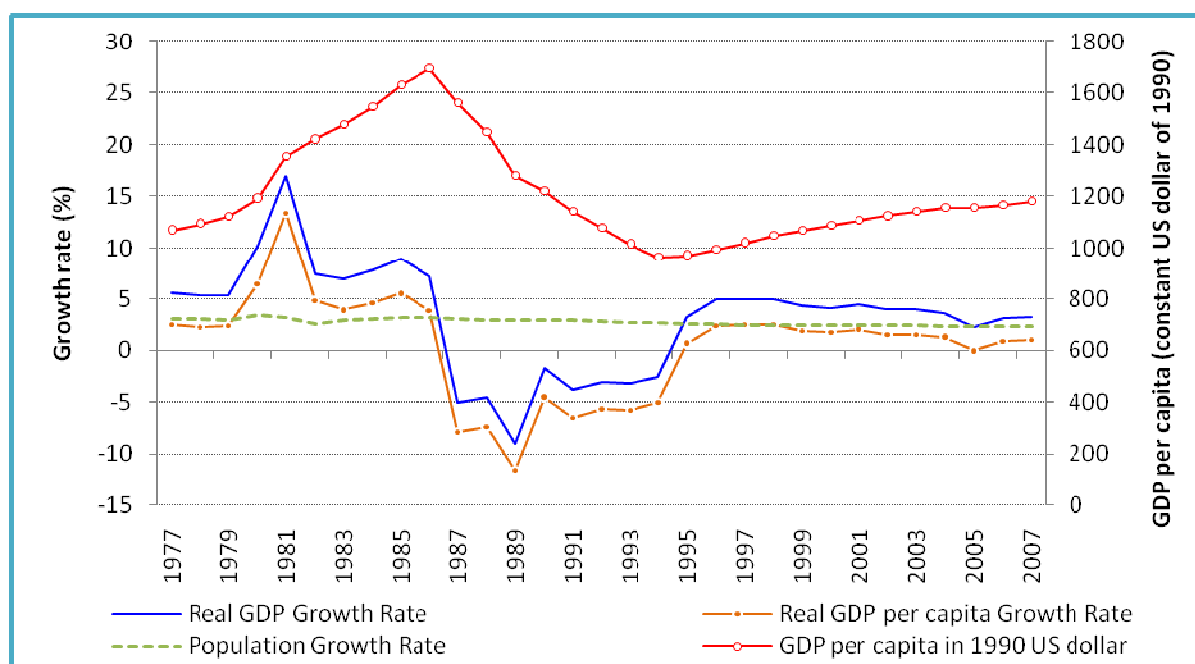
(a): FGT0 =Poverty headcount Index; FGT1 = Poverty gap Index.

Source: République du Cameroun (2002); Republic of Cameroon (2003).

This study aims at shedding light on how much the major policies implemented during this period contributed to the above-mentioned economic resurgence and poverty alleviation. To what extent those policies might explain this economic improvement? In other words, the exercise consists on breaking down the intrinsic contribution of each single policy considered to that economic performance. Three key policies are assessed: the tax reform, including mainly the gradual introduction of the VAT, from its embryonic phase in 1994 until the implementation of its uniform rate in 1999; the 50 percent devaluation of the CFA franc in January 12, 1994; and the rehabilitation and development of some basic infrastructures since 1996.

¹ Republic of Cameroon (2003); République du Cameroun (2002).

Graph 1: Trends relating to GDP, Population and per Capita GDP (*)



(*) GDP expressed in U.S. dollars 1990 constant parity, converted in Geary Khamis' purchasing power.

Source: The Conference Board and Groningen Growth and Development Centre (2008).

In spite of the retrospective scope of the study, this exercise also has a topical interest. In fact, since 2001, economic growth has proven to be very weak in Cameroun and the growth rate is almost shrinking from year to year. The poverty prevalence remains high and the recent economic pace is not enough for Cameroon to achieve the Millennium Development Goal in terms of poverty alleviation. At the same time, EPA hangs the prospect of the replacement taxes; the continuous decline of the Dollar with regard to Euro contributes to artificially appreciate CFA franc; and on the other hand, infrastructure development is one of the most important levers Government of Cameroon envisions to activate in order to boost economic growth. Then, it could be worth drawing lessons from the experience of the nineties and see whether the three main economic policies applied during that period could successfully be re-utilized, revamped or should be avoided in similar circumstances or so.

To carry out this study and therefore to disentangle the own impact of each economic policy, we use a double calibration approach within a microsimulation CGE model. One could consider that the use of double calibration approach, applied in empirical works only since the beginning of the third millennium, also gives fundamental dimension to this research by digging deeper into this new technique. The basic mechanics of this methodology is explained in section III whereas the key features of the CGE model are presented in the fourth. Section five set about the scenarios simulated and analyses the consecutive results. But in the first instance, section two gives some insights into the economic policies examined.

2. Overview of reviewed policies

2.1 Trends in basic infrastructures

The controversial performances of macroeconomic reform programmes in Africa have, under the new poverty reduction strategy, incited international financial institutions to show particular interest in the links between economic growth on the one hand, and on the other hand, both physical and social infrastructures and the support of productive activities; though such infrastructures are generally under Government's responsibility. Infrastructures may finally be a key determinant of a country's economic performance since they impact on capital accumulation and on the productivity of private sector, and they can portray the efforts made by the public sector to secure both a conducive environment for enterprises and good living conditions for the populations.

The basic infrastructures include: telecommunications, transport infrastructures, water supply services, health care services and electrical facilities. Most economic development experts agree on the idea that these infrastructures considerably contribute towards growth than the other forms of public investments. They as well contribute significantly in reducing poverty, most particularly in the rural areas. Insofar as some of the entry/exit indicators of poverty are measured on the basis of access to basic services, the enhancement of such access contributes in reducing poverty, and in securing better standards of living to the populations. Particular attention should be paid to the rural areas where access to basic services is poor and where, on the contrary, most poor people live.

In spite of the overall drop in poverty indices registered between 1996 and 2001, an analysis of datasets of ECAM I and ECAM II household surveys reveals that poverty gaps between the urban areas and the rural areas have deepened during the period under consideration, at the level of either poverty headcount ratio or poverty gap index (Table 2). Besides the direct influence that the improvement infrastructures would have on both poverty and the quality of life of the populations, there is an indirect impact on poverty that is worth being mentioned. A qualitative and quantitative consolidation of basic infrastructures may induce a much greater increase in the productivity of production factors in enterprises, while being likely at the same time to play a major role in overall capital accumulation.

After the 1980 decade which had been characterized by the deterioration of public infrastructures of all categories, Cameroon resumed efforts to rehabilitate and develop most of basic infrastructures (Table 3). Investments initiated for basic infrastructures were in majority conducted under the Public Investments Budget, either through Joint Economy Corporations or directly by key ministries. Such investments mainly consisted of works

concerning roads construction and rehabilitation, water supply, telecommunications, electrical energy supply and installations, and building of health centres.

Table 2: Trends of the gaps between Poverty Indices in Urban Areas and in Rural Areas, during the period 1996-2001.

Poverty Indices Socio-economic Areas	Poverty Headcount (FGT ₀)		Poverty Gap (FGT ₁)	
	1996	2001	1996	2001
Rural Areas	59.6	49.9	21.5	18.3
Urban Areas	41.4	22.1	14.7	6.3
Cameroon	53.3	40.2	19.1	14.1
Gap between Rural Areas and Urban Areas	18.2	27.8	6.8	12

Source: République du Cameroun (2002).

Table 3: Accessibility to infrastructures for safe drinking water, electricity supply, and telecommunications, in rural and urban areas

Year /Area Infrastructures	1996		2001	
	Urban	Rural	Urban	Rural
% of population having access to safe drinking water				
Poor people	56.6	22.4	71.5	28.2
Non poor people	81.0	28.4	88.3	33.4
All categories	73.6	25.5	86.2	31.3
% of population having access to electricity				
Poor people	61.4	9.6	68.2	14.9
Non poor people	82.9	13.6	91.0	29.0
All categories	76.3	11.7	88.2	23.4
Time spent to access a paved road (in minutes)				
Poor people			8.4	75.1
Non poor people			6.0	62.0
All categories			6.3	67.1
% of population having a Fixed Telephone (%)				
Poor people			06.2	0.4
Non poor people			51.6	2.5
All categories			46.0	1.6

Source: Republic of Cameroon (2002).

2.1.1 Investments initiated for rehabilitation or new works in the roads sector

These investments fall under a special Program for Transports Sector (PST) which has been implemented since 1996. The creation of the National Roads Infrastructures Fund (*Fonds National Routier – FNR*) to allow the financing of construction works for new road infrastructures, and the strategy adopted for the maintenance and rehabilitation of roads in the rural areas are the two major options of the above program. The initial orientation of this programme is translated in practice by the resumption of programmes relating to trans-Africa highway and the road network of the CEMAC region.

2.1.2 Investments made to secure access to safe drinking water

As above-mentioned, access to safe drinking water (checked in terms of quality) increased favorably between 1996 and 2001: the ratio of people enjoying access to safe drinking water increased from 73.6 to 86.2 percent in urban areas, and from 25.5 to 31.3 percent in rural areas. These statistics reveal the widening disparity between both areas as concerns access to safe drinking water, and simply testifies the fact that the rural areas are relatively lagging behind in terms of infrastructural development.

The time spent to fetch safe drinking water is also a revealing indicator of that gap: some 51.5 percent among the populations enjoying access to safe drinking water throughout the country can fetch it within less than 15 minutes. In urban areas, 72.1 percent of such people can do so, as against 41.5 percent only, in the rural areas. The time spent to fetch safe drinking water averagely is 10.9 minutes on the whole in the country, while this same time is 5.7 minutes in urban areas and 15.7 minutes in the rural areas.

The supply of safe drinking water in the rural areas is essentially incumbent on the governing Ministry, but it also benefits the support of donors who provide for water supply investments (drilled water points and improved boreholes) within the framework of the rural hydraulics global programme.

Concerning access to safe drinking water in urban areas during the period in review, Cameroon enjoyed the technical services of a specific operator, namely the National Water Corporation (SNEC). This State Corporation enjoys financial autonomy, and has had to sign a performance agreement with the Government under the structural adjustment programmes. The analysis of figures provided in Table 4, relating to safe drinking water consumption and production in urban areas, may be compared with the socio-economic context as well as with data indicating trends of the technical and financial development of this State Corporation.

Data provided by the SNEC indicate that the volume of water produced between the 1989-1990 and 1999-2000 financial years registered a 32 percent increase. This production increased from 69 million to 92 million cubic meters in rural areas during the above period. Also worthy of note is the 32 percent increase in the number of subscribers, which had been registered between 1989 and 2000. The number of subscribers to water supply networks connected by the SNEC in the cities and towns actually increased from 128,250 to 170,264 subscribers.

It should however be indicated that the budget share allocated to the Ministry of Water and Energy out of the total budget of the Cameroon Government is low. In 1991, that allocation was equal to 0.02 percent, against 0.01 percent only, in 2002. This budget had hit the peak

during the 1991-1992 financial year (over 15 folds the budget amount of the previous year) but such movements are on the whole erratic. This feature even stands to explain the gaps experienced from one year to another in the efforts made to supply water in the rural areas.

Table 4 : Trends of data relating to the production and consumption of safe drinking water distributed by the National Water Corporation (SNEC) in Cameroon (in thousands of m³, number of subscribers excepted)

Items	Years			
	1995 - 1996	1996 - 1997	1997 - 1998	1998 - 1999
Total Production	78 563	78 563	85 622	86 854
Distribution	74 200	74 201	78 543	79 934
Consumption	42 446	42 446	49 361	55 551
<i>Industries</i>	2 900	2 936	3 670	3 941
<i>Individuals</i>	26 178	25 830	28 439	30 466
<i>Administrations</i>	10 132	10 915	12 325	13 401
<i>Public water points</i>	1 474	1 361	3 757	6 962
<i>SNEC Services and Agents</i>	614	569	778	732
<i>Council-owned Buildings</i>		835	392	499
Number of subscribers	148 112	149 337	154 438	161 304

Source: SNEC; refer to: DSCN (2000).

2.1.3 Electricity infrastructures

Figures provided in the Human Development Report produced by the UNDP reveal that the per capita consumption of electricity in terms of kilowatt/hour has increased from 154 to 183 between 1980 and 2000. This trend correlates with the improvement witnessed in the access to electrical energy by the populations, and may be explained by the increase observed in data relating to the production, distribution and consumption of electrical energy, presented in Table 5.

Table 5: Trends of data relating to the production, distribution and consumption of electrical energy in Cameroon (in thousands of KWH, number of subscribers excepted)

Items	Years			
	1995 -1996	1996 -1997	1997-1998	1998 -1999
Total Production	2 823 503	3 013 482	3 114 800	3 296 503
<i>Thermal</i>	33 149	34 433	49 736	44 397
<i>Hydraulic</i>	2 790 354	2 979 049	3 065 064	3 252 106
Distribution	2 795 835	2 978 481	3 087 116	3 266 946
Consumption	2 222 958	2 443 159	2 531 039	2 897 613
<i>Low tension</i>	468 589	559 421	634 842	727 409
<i>Mean tension</i>	444 320	472 625	529 314	727 962
<i>High</i>	1 310 049	1 411 113	1 366 883	1 442 242
Number of subscribers	401 873	420 995	428 269	447 936

Source: DSCN (2000).

2.1.4 Healthcare infrastructures

Accessibility to healthcare infrastructures may be appreciated on the basis of the distance separating the households housing units and the nearest healthcare facility, and the time spent by the populations, depending on the means of transport often used, to get to the said facility. At national level in 2001, populations had to brave an average of four kilometres distance to reach the nearest health centre. The difference is important between the rural areas, where this distance is five kilometres long, and the urban areas where it is only one kilometre. As concerns the average time spent to reach the nearest healthcare facility, an average 25 minutes is needed for non poor people, whereas poor people need 40 minutes to cover this distance.

An examination of the trends of public spending, from one year to another, reveals a regular increase in the budget allocated to health sector, which has increased from 22.757 billion CFA francs in 1990/1991 to 46.108 billion CFA francs in 2001/2002.

2.2. The 1994 Devaluation of the CFA Franc

African countries in the Franc zone (PAZF), since the mid 1980s till 1994 at least, have experienced deteriorating terms of trade. According to Rama (2001), the substantial appreciation of the French Franc vis-à-vis the U.S Dollar has come to add to the dramatic drop in the prices of export products such as coffee, cocoa, and oil. The Maastricht convergence criteria have yet reduced the capacity of France's Treasury to continue to sustain its long time support to the CFA Franc. This has caused the parity between this currency and the French Franc to go high, and thus become incompatible with the continuous deterioration of the terms of trade (nearly 50 percent) experienced by African countries in the Franc zone (PAZF) from 1985 to 1993. Devarajan (1996) holds that the currency used at the time by major oil producing countries in the CFA zone, which notably include Cameroon and Gabon, was rather over evaluated. According to this author, the effective real exchange rate was on the whole close to its pre-1986 equilibrium level, until a severe shock affected the terms of trade, following the drop in oil prices and the collapse of the U.S Dollar which brought about a considerable over evaluation that more or less persisted afterwards. This turned out to be non conducive for competitiveness in the world market.

Governments in African countries in the Franc zone (PAZF) undertook to restore competitiveness at world market level without reviewing the parity of the CFA franc. Unfortunately, this policy which consisted in carrying out domestic adjustments failed to help achieve the deflation needed to reinstate the competitiveness at world market level, which disappeared as the years went by. One of the underlying factors of this failure was the

rigidity of prices to fall which, in turn, resulted from the rigidity of salaries in the formal sector to fall below a certain threshold. Under such nominal rigidity, the CFA Franc devaluation then appeared to be but the only way to exit recession.

Authors like Cogneau and Collange (1997), Tybout, Gauthier, Navaretti and De Melo (1996) hold that the devaluation of the CFA Franc was a success, when looking at its impact on the state budget, productivity and international trade of countries considered. This success of the devaluation seems to be important when compared to the real adjustment alternative. Both imports and exports actually increased, but under the impact of a growth differential that revealed to be more profitable to exports, some improvement was registered in the balance of trade, as compared to the year before the change of the parity (See Table 6).

Table 6: Pre- and Post-Devaluation Trade Ratios as compared to GDP (in %)

Ratios	Years of reference			Differential between 1993 and 1994	Differential between 1993 and 1995
	1993	1994	1995		
Export Ratios, compared to GDP	14.3	24.1	24.7	+ 9.8 points	+10.3 points
Import Ratios, compared to GDP	8.7	17.6	15.0	+ 8.8 points	+ 6.3 points
Ratios of the Balance of Trade compared to GDP	5.6	6.5	9.7	+ 1.0 point	+ 4.1 points

Source : Conté (1998).

Success concerning the exportation of manufactured products is, to a large extent, dependent on the competitiveness of the producers, which may notably be influenced by factors such as productivity, and the appropriate management of the effective real exchange rate . Ndulu and Semboja (1995) have highlighted the fact that in Africa, the depreciation in real terms, of national currencies – following a devaluation – did bear a positive and considerable incidence on exports of manufactured products from the countries subjected to this devaluation. Söderling (2001) believes that there is some logic in thinking that the implementation of inappropriate economic policies had seriously jeopardized the exports of manufactured products after the year 1980, and that this situation was considerably improved upon thanks to the devaluation of the CFA Franc.

2.3 Enforcement of the Value Added Tax (VAT)

The Value Added Tax (VAT) was introduced in Cameroon in 1994 and was at that time timidly levied on imported products and on the sales of some large manufacturing companies and wholesalers only. However, a number of marginal reforms of that VAT seminal system have since been gradually undertaken in a bid to institute a more perfect and improved VAT scheme. It is worth indicating in this regard that the levying scope of this

tax had been extended to some retail trading, as well as to activities relating to the provision of services, and to some relatively small-scale manufacturing firms. The basic condition these legal tax payers were called upon to fulfil was, on the one hand to abide by the requirements relating to subscription to the Trade Registry, to reliable accountancy, and on the other hand to prove justification of a turnover above some minimum amounts determined on the basis of the nature of activities carried out. Other important amendments aimed at improving on the VAT scheme have been made since 1999. They include: (1) the suppression of the reduced VAT rate, and the subsequent implementation thereon, of the unique 17 percent rate (plus the 1.7 percent representing additional municipal surtax) irrespective of the category of either the taxpayer or the product subjected to VAT; (2) the right of firms in a situation of structural accumulations of their VAT credits, to henceforth be paid the related dues in cash.

It is however worth indicating that in spite of the amendments mentioned above, Cameroon's VAT Scheme remains imperfect. Its neutral character for instance is still very partial vis-à-vis the production system: (1) the one month retardation principle, by virtue of which tax payers must wait for a whole month (at least) before claiming their « right to benefit from some deductions » of their VAT credits remains applicable; (2) two VAT schemes, namely the normal, or so-called VAT real regime, and the simplified VAT, continue to coexist. Subjection to this last VAT scheme does not provide for any deduction of VAT tax paid on inputs, and as a result, companies falling under this simplified scheme are permanently subjected to the payment of VAT dues. Besides, companies falling under the normal VAT scheme may not claim VAT credits over the purchase of their inputs sold by taxpayers subjected to the simplified VAT scheme. Lastly, lots of activities are yet to be subjected to either of these two VAT schemes, and are consequently excluded from VAT levies, either because their turnover is below the required threshold, or because they fall under the informal sector.

3. Methodology: Double Calibration Micro Simulated General Equilibrium Model

3.1 An Overview of the Notion of Calibration in Computable General Equilibrium (CGE) Models²

Implementing a CGE model requires that all basic data be reproduced in a format likely to illustrate the benchmark equilibrium of the economy the model is applied to. The elaboration of a well-balanced Social Accounting Matrix (SAM) aims at meeting this requirement. However, some parameters generally happen to be unavailable, and equally do not appear

² For more details on this issue, useful reference shall be made to Abdelkhalek (1993) and Abdelkhalek (2001).

automatically in the SAM. Calibration is thus a technique often used to complement the range of parameters pertaining to the model.

Set a CGE model represented by a correspondence f , which is generally nonlinear, such as:

$$Y = f(X, \beta, \gamma) \quad [\text{a.1}]$$

Where Y represents the vector of endogenous variables; X , the vector of exogenous variables; β and γ represents vectors of the parameters. The benchmark values of both the endogenous and exogenous variables are known, and naturally derive from the model's underlying SAM. The basic values of the β parameters are provided by isolated econometric estimations or by data deemed valid for other countries (likely to be assimilated by virtue of their structure to the country of interest for the study). Sometimes values of the β parameters are just picked up from the literature reviews and lead to sensitive analysis.. Parameters represented by γ are those that ever remain unavailable. In order to complement the range of parameters pertaining to the model, consideration is given to the relation hereafter:

$$Y_0 = f(X_0, \beta, \gamma) \quad [\text{a.2}]$$

Where Y_0 and X_0 are respectively values of endogenous and exogenous variables at the benchmark year "0". Equation [a.2] is then solved for γ to read as:

$$\gamma = g(Y_0, X_0, \beta) \quad [\text{a.3}]$$

The process used in resolving the above relation is named "model calibration" or in the language used by CGE modellers. As revealed under relation [a.3], this procedure returns to undertake a *back to front* resolution of the model, in the sense that parameters γ (which are exogenous in principle) are considered as unknown of the model while initial values extracted from the SAM are rather considered as parameters in this circumstance. In fact, the model must actually be resolved in a *back to front* manner in order to determine the values of parameters γ consistent with available benchmark data; that is: values that will allow replicating the benchmark equilibrium when the model is ran in *the right way round*.³ In the case of dynamic CGE models, apart from allowing that the benchmark equilibrium observed during the reference year be replicated, calibration should be performed in such a way as to ensure that the model also outlines the *business-as-usual* path; that is a reference path the economy is supposed to follow if the evolution of that economy is not perturbed by any controlled or uncontrolled shock. Parameters γ are then named calibrated parameters, while parameters β

³ As stated by Schubert, Katheline (1993), p. 808.

are pointed out as strategic, predetermined or free parameters, i.e. parameters involved within the prior minimum range of data necessary to perform calibration.⁴

3.2 The Double Calibration Principle and Rationale

By virtue of the traditional approach to the construction of CGE models, vectors of the γ parameters are calibrated upon use of observed data of only one reference year. To assess the impacts of a shock on a given economy, one considers that parameters β and γ do not change during the time scale of the shock. The equilibrium after the shock is therefore the counterfactual state of the economy computed through equation [a.4]⁵:

$$Y_{cf} = f(X_{cf}, \beta_0, \gamma_0) \quad [a.4]$$

Where, the only vector that has been modified is the vector X of exogenous variables.

Yet, except in the event of a fortuitous coincidence, this equilibrium is always different from a situation really observed after the shock occurred. This divergence from the evidence may partly be explained by the fact that technological and behavioral parameters of a given economy could change considerably after a given time horizon, such that:

$$Y_{cf} = f(X_{cf}, \beta_0, \gamma_0) \neq Y_1 = f(X_1, \beta_1, \gamma_1) \quad [a.5]$$

The overall change observed in the economy under study between the baseline period 0 and the ex-post period 1 is equal to:

$$CG = Y_1 - Y_0 \equiv f(X_1, \beta_1, \gamma_1) - f(X_0, \beta_0, \gamma_0) \quad [a.6]$$

This change stems from the dual effect of both exogenous shocks and economic policy on the one hand (« EE = economic effect »), and from changes in the values of parameters, on the other hand (« CE = calibration effect »).

The double calibration techniques are therefore used for the sake of decomposition of these two effects, or in a bid to at least disentangle the effect of parameters variations from the whole change. To this effect, the values of parameters β and γ are determined for not only the “0” ex-ante period, but also for ex-post period “1”. Considering the relations:

$$CG = EE + CE = Y_1 - Y_0 \quad [a.7]$$

and

$$EE = Y_{cf} - Y_0 = f(X_{cf}, \beta_0, \gamma_0) - f(X_0, \beta_0, \gamma_0) \quad [a.8]$$

we have:

⁴ As stated by Cogneau, Denis and François Roubaud (1994), p. 7.

⁵ The subscript *cf* indicates the counterfactual state.

$$CE = CG - EE = (Y_1 - Y_0) - (Y_{cf} - Y_0) = Y_1 - Y_{cf} \quad [a.9]$$

$$CE = Y_1 - f(X_{cf}, \beta_0, \gamma_0) \quad [a.10]$$

Abdelkhalek (2001) suggests the decomposition approach here above. However, in order to isolate the calibration effect that has been determined in equation [a.10], the economic effect formulated in equation [a.8] must encompass all the economic policies that have been implemented within periods 0 and 1. Under other circumstances, where *EE* would simply be the expression of the effect of only some of economic shocks – which happens to be the most obvious case–, equation [a.10] would then not be representative of the sole effect of technological changes, but would as well include the effects of other unidentified (and non simulated) policies and exogenous shocks. An alternative double calibration approach, applied by Weerahewa (2002), and Mujeri and Khondker (2002), consists in computing the calibration effect by substituting values of γ_1 for those of γ_0 within the base model, in such a way as to obtain:

$$CE = f(X_0, \beta_1, \gamma_1) - f(X_0, \beta_0, \gamma_0) = f(X_0, \beta_1, \gamma_1) - Y_0 \quad [a.11]$$

A median variant is used in this study, and is set up between that second approach (WMK approach⁶) and the one advocated by Abdelkhalek (2001):

- Under the WMK approach (equation [a.11]), the simulation of the calibration effect consists in replacing the values of the technological parameters of period 0 with those of period 1, on the basis of the model using data associated to period 0.

- Under the variant proposed here, on the contrary, we start with the model which basically utilizes data of the **final period 1** and the simulation of calibration effect consists in **replacing the values of technological parameters of period 1 by those of period 0**, and in such a way as to obtain:

$$CE = f(X_1, \beta_1, \gamma_1) - f(X_1, \beta_0, \gamma_0) = Y_1 - f(X_1, \beta_0, \gamma_0) \quad [a.12]$$

Instead of the WMK equation [a.11], it is rather equation [a.12] that is adopted because of the lack at the time of conduct of this study - period 0 (before the 1994 recovery), of the household survey data needed for the micro simulations. These data are however available for period 1 (year 2001).

- It is possible to note that the formulation of the calibration effect as suggested in equation [a.12] is almost similar to the one in the approach initiated by Abdelkhalek (2001), in equation [a.10]. However, in the proposal made here, the difference between the

⁶ Refer to WMK for : Weerahewa (2002), and Mujeri and Khondker (2002).

counterfactual situation $Y'_1 = f(X_1, \beta_0, \gamma_0)$ and the economic situation during period 1 ($Y_1 = f(X_1, \beta_1, \gamma_1)$) is actually due to changes in the values of parameters β and γ alone, whereas this same difference may be justified by phenomena other than technological changes in equation [a.10]. For instance, the counterfactual equilibrium $Y_{cf} = f(X_{cf}, \beta_0, \gamma_0)$ computed with equation [10] by simulating some economic policies and exogenous shocks in period 0 does not incorporate the whole shocks occurred between periods 0 and 1. Yet, as already indicated above, such an integral consideration of this nature constitutes the compulsory requirement for the residual effect $f(X_1, \beta_1, \gamma_1) - f(X_{cf}, \beta_0, \gamma_0)$ to be attributed to technological changes alone.

3.3 Decomposing the effects of various shocks using double calibration techniques

The use of the double calibration approach has in recent years, revealed to be important in assessing the intrinsic impacts attributable to specific shocks.. Abrego and Whalley (2000) have used this technique in decomposing the respective contributions of shocks associated to both trade shocks and technological changes, in order to provide some explanations for the dispersion between the incomes of skilled labour and unskilled labour in the United States of America. Mujeri and Khondker (2002) have conducted a similar study to assess the contribution of diverse factors (change in world market prices, technological changes, and changes in the allocation of production factors), and in explaining the differential observed in the wages between skilled and unskilled workers in Bangladesh, between 1985 and 1996. It is also worth mentioning the works of Jeevika Weerahewa (2002), in which the researcher carries out an assessment of the role of technology, world market prices and public transfers in the evolution of poverty in Sri Lanka between 1977 and 2000; these works actually show that the increase in both imports and exports world market prices stands to largely explain the reduction of absolute poverty and the aggravation of relative poverty in that country during the period under consideration.

Generally speaking, isolating the effect of a given shock by means of the double calibration approach requires the use of the model during the initial period under consideration, and a simulation then after, of the technological change, through the replacement of values of the parameters calibrated during the initial period with those calibrated during the final period (this is the simple technological scenario). The second step to be undertaken consists in simulating the shock under consideration, by using the initial model and the values of technological parameters of the final period (technological scenario with shock).. The impact specifically associated to the simulated policy (or exogenous shock under consideration) is therefore assessed by determination of the discrepancy between the findings under the

second scenario and those obtained under the first one. This same approach is used in the present research work, though in a « backward looking version »: since the households data for the final year of the study (2001) are more complete, that year is rather considered as the reference year of the simulations in this study. The backward looking method thus consist here in using the model in final year, replacing the values of technological parameters of this year by those calibrated in the initial year (1993) in order to perform technological scenario, and assessing the specific impacts of each shock considered, by estimating the incidence that the absence of that shock would have had on the observed results of the reference year 2001.

4. The CGE Model with Microsimulations

The decomposition of the effects of the shocks referred to above is undertaken by using a CGE model with micro simulations. A model with micro simulations entails an explicit association of micro data concerning individuals or micro agents (households, enterprises and / or other micro decision-making units) interacting within a given economy, and the simulation of either policies or exogenous shocks over each of the micro-agents. Microsimulation approach thus allows to as much as possible take into consideration the wide range of available information concerning an economy, with the representation of more interdependence loops and distinct objective functions of micro units, compared to the standard representative agent rationale. Moreover, it provides the possibility to carry out impact analyses at a very detailed and targeted level as well as at a macro level of the economy⁷.

Micro simulations here specifically focus on the analysis of poverty within households in Cameroon. In the case of this study, all the 10992 households of the ECAM II household survey undertook in 2001 are included within the model. Technically, microsimulations are made by building upon the studies of Cockburn (2001), Cockburn and Cloutier (2002), and Cloutier and Cockburn (2002). The general architecture of the model EGC is based on the EXTER archetype (Decaluwé et al., 2001), version 2 (Fofana, Cockburn and Decaluwé, 2003).

The exhaustive list of equations is presented in the appendix; some peculiarities introduced in modelling the production, the VAT, and indicators of either poverty or inequalities are presented here below. Likewise, information on the model's underlying empirical data will also be provided alongside equations that are specific to the study.

⁷ Refer to: Mitton, Sutherland and Weeks (2000); Cockburn and Cloutier (2002) ; Cogneau and Robilliard (2000); Cockburn (2001) ; Cloutier and Cockburn (2002).

4.1. Production Structure and Technology

The model involves 10 production sectors. To produce, each sector uses a production technology with multiple nesting levels which combines several primary factors, either through a Constant Elasticity of Technical Substitution (CETS) function or through a Leontief-type function. The foodstuffs agriculture sector and the cash crops agriculture sector utilize four primary production factors: unskilled labor $NQLD$, skilled labor QLD , capital KD and the land $LAND$ (figure 1).⁸ The eight other sectors, named thereafter non agricultural sectors and identified by the index $nagr$, use only the three initial production factors mentioned above (figure 2).

Compared to the EXTER archetype, the specificity of this model, at the level of the production equations, is the incorporation of a transmission mechanism which allows shocks on public infrastructures to be channeled towards Total Productivity of Factors (TPF)⁹. TPF is represented by the endogenous variable A^{va} in equations **Erreur ! Source du renvoi introuvable.** and [2] which compute value added VA in agricultural and non agricultural sectors respectively:

$$VA_{agr} = A_{agr}^{va} \left[\alpha_{agr}^{cfl} CF_{agr}^{-\rho_{agr}^{cfl}} + (1 - \alpha_{agr}^{cfl}) LAND_{agr}^{-\rho_{agr}^{cfl}} \right]^{-1/\rho_{agr}^{cfl}} \quad [1]$$

$$VA_{nagr} = A_{nagr}^{va} \left[\alpha_{nagr}^{kl} LD_{nagr}^{-\rho_{nagr}^{kl}} + (1 - \alpha_{nagr}^{kl}) KD_{nagr}^{-\rho_{nagr}^{kl}} \right]^{-1/\rho_{nagr}^{kl}} \quad [2]$$

where α^{kl} , ρ^{kl} , CF , $LAND$, LD and KD are respectively the share parameter, technical substitution parameter, the demand of capital/labor composite factor, the demand of land, the demand of the gross labor, and the demand of capital.

In nongovernmental sectors ngs , total productivity of factors A^{va} (equation [3]) is positively linked to the stock of public capital in infrastructures KG . But the positive externalities of public infrastructures on TPF depend on the extent to which those infrastructures are available or accessible with regard to the size of the economy. In other words, the positive externalities are mitigated by the congestion effects; i.e. the level of difficulty economic agents face in accessing basic services provided by public goods.

⁸ Identification index agr indicates the subset composed of these two sectors named thereafter agricultural sectors unless otherwise specified.

⁹ We apply a rationale used by Dumont and Mesplé-Somps (2000).

Figure 1: Production functions and factors in agricultural sectors

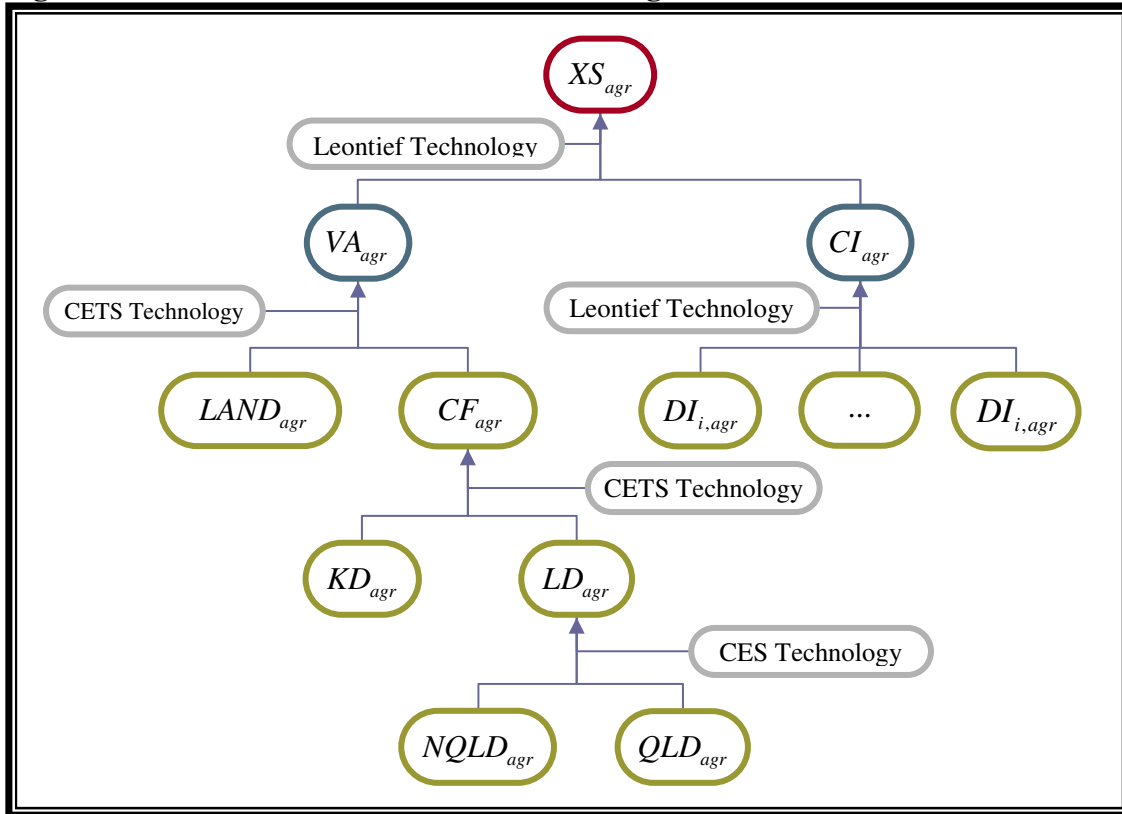
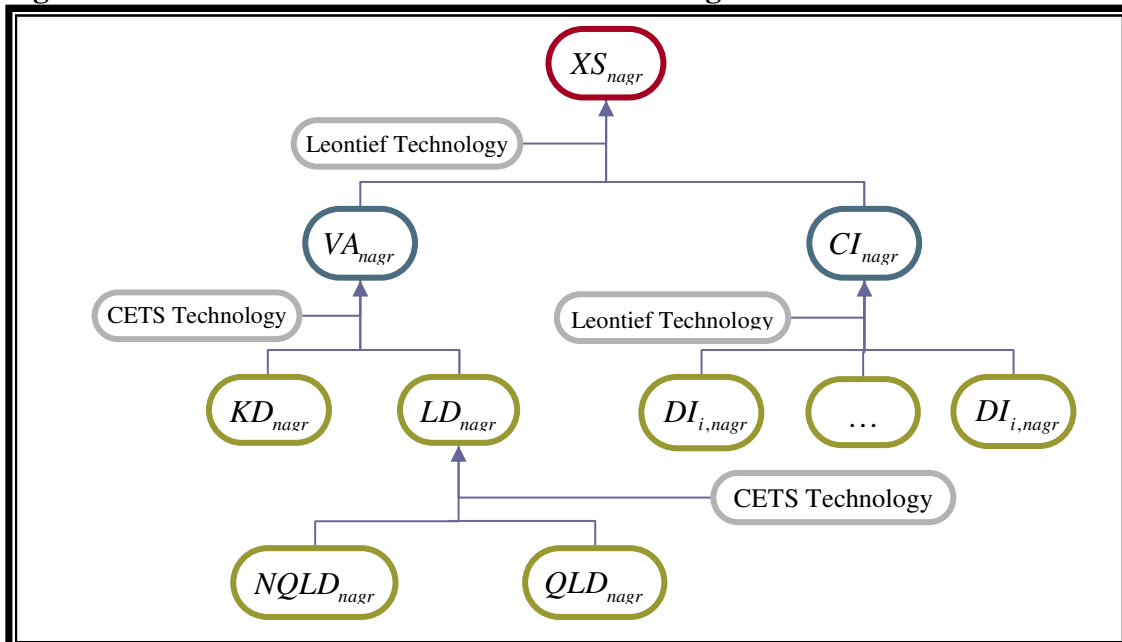


Figure 2: Production functions and factors in non agricultural sectors



Key : agr = Agricultural sector; nagr = Non agricultural sector; XS = Production; VA = Value Added; CI = Total of Intermediate consumptions; LAND = Land; CF = Composite factor including labor in the whole and capital; DI = Intermediate consumption in a specific product; KD = Capital; LD = Composite labor; NQLD = Unskilled labor; QLD = Skilled labor; CETS = Constant Elasticity of Technical Substitution.

In this model, congestion effects are approximated by dividing the public capital in infrastructures by the capital stock of the whole private sectors:

$$A_{ngs}^{va} = B_{ngs}^{va} \left(\frac{KG}{\left(\sum_{ngsj} KD_{ngsj} \right)^{cef}} \right)^{\varepsilon_{ngs}} \quad [3]$$

where B^{va} , ε and cef are respectively the scale parameter, the elasticity which measures the sensitivity of TPF following a relative change in public capital stock with regard to private capital stock, and the elasticity which measures the magnitude of the disincentive effect of the congestion on productive activities.

Another special feature of the model is to take into account the production tax and the non refundable VAT (applied on some intermediate consumptions) in the computation of the production at factor costs:

$$XXS_i = \left(XS_i + \sum_j DI_{ji} (1 - CIF_i) LCI_{ji} TVG \right) (1 + tp_i) \quad [4]$$

4.2 Specific equations related to VAT modeling and to VAT substitution for previous taxes on goods and services

Indirect taxes are modeled with special care for at least two reasons: first, the imperfect VAT introduced since 1994 has peculiar features to be appropriately taken into account; and in addition, a replacement tax mechanism needs to be built within the model for a better simulation of the cancellation of old indirect taxes, and for their replacement by the VAT system.

Apart from customs duties on imports and exports, indirect taxes in force since the 1994 tax reform are the VAT (TVA), excise duties levied on domestic goods ($TIAL$) and those levied on imports ($TIAM$). The domestic taxation prevailing before that 1994 tax reform are synthesized as “taxes applied to domestic products sold in local market” ($TINDL$) on the one hand and those levied on imports ($TINDM$) on the other hand.

In equation [5], all these indirect taxes, those in force before 1994 tax reform as well as those introduced through that reform, coexist in the function of government’s total revenue (YG). However, at the reference period (2001), the previous domestic taxes $TINDL$ and $TINDM$ are nil, while variables TVA , $TIAL$ and $TIAM$ keep their values as of year 2001. When the *backward simulation* consisting in coming back to the former domestic indirect

taxation shall be performed for ex-post analysis, the three variables TVA , $TIAL$ and $TIAM$ will rather be reduced to zero while $TINDL$ and $TINDM$ will regain their respective 1993 levels.

$$\begin{aligned}
YG = & \lambda^{kg} \sum_i r_i KD_i + \sum_i PTAX_i + \sum_i TVA_i + \sum_i TIAL_i + \sum_m TIM_m \\
& + \sum_m TIAM_m + \sum_x TIE_x + \sum_h DTH_h + DTF + \sum_{inst} TRF_{gov,inst} \\
& + \sum_i TINDL_i + \sum_m TINDM_m
\end{aligned} \tag{5}$$

with λ^{kg} : The government's share in total remuneration of capital;

$PTAX_i$: The amount of production tax levied on sector i ;

TIM_m : The amount of customs duties levied on imported product m ;

TIE_x : Amount of customs duties levied on exported product x ;

DTH_h : Proceeds from income tax applied to household h ;

DTF : Proceeds from income tax applied to firms;

$TRF_{gov,inst}$: Transfer received by government gov from the economic agent $inst$.

The VAT rate is uniform no matter the nature or the origin of the product, but is set to zero for exports and capital goods. This rate is applied on a tax base exclusive of VAT; hence the use of the price exclusive of VAT $PCHT$ in the VAT settlement, in equation [6]. For each composite good i the VAT base includes the final consumption of household h ($C_{h,i}$), the government's consumption (CG_i), and intermediate consumptions $DI_{i,j}(1 - CIF_j)$ not liable to the VAT legislation (not "VATable").

$$TVA_i = TVG \cdot PCHT_i \left(\sum_h LCH_{h,i} C_{h,i} + LCG_i CG_i + \sum_j LCI_{i,j} DI_{i,j} (1 - CIF_j) \right) \tag{6}$$

Variables $LCH_{h,i}$, LCG_i , and $LCI_{i,j}$ are effective rates to which composite good i is liable to VAT, respectively for the quantity consumed by household h , by the government, and by the production sector j . These variables are endogenous and are determined by equations [7], [8][8][8] [8] [8] and [9] in the case of importable products m , and are exogenous in the case of products nm that do not have imported substitutes.

$$LCH_{h,m} = \frac{\xi_{h,m}^{chl} PL_m (1 + tal_m) D_m + \xi_{h,m}^{chm} PWM_m e (1 + tm_m + tam_m) IM_m}{PL_m (1 + tal_m) D_m + PWM_m e (1 + tm_m + tam_m) IM_m} \quad [7]$$

$$LCG_m = \frac{\xi_m^{cgl} PL_m (1 + tal_m) D_m + \xi_m^{cgm} PWM_m e (1 + tm_m + tam_m) IM_m}{PL_m (1 + tal_m) D_m + PWM_m e (1 + tm_m + tam_m) IM_m} \quad [8]$$

$$LCI_{m,j} = \frac{\xi_{m,j}^{cil} PL_m (1 + tal_m) D_m + \xi_{m,j}^{cim} PWM_m e (1 + tm_m + tam_m) IM_m}{PL_m (1 + tal_m) D_m + PWM_m e (1 + tm_m + tam_m) IM_m} \quad [9]$$

with $\xi_{h,m}^{chl}$: Effective rate to what extent the local product m consumed by household h is liable to VAT;

$\xi_{h,m}^{chm}$: Effective rate to what extent the imported product m consumed by household h is liable to VAT;

ξ_m^{cgl} : Effective rate to what extent the local product m consumed by the government is liable to VAT;

ξ_m^{cgm} : Effective rate to what extent the imported product m consumed by the government is liable to VAT;

$\xi_{m,j}^{cil}$: Effective rate to what extent the local product m consumed by the production sector j is liable to VAT;

$\xi_{m,j}^{cim}$: Effective rate to what extent the imported product m consumed by the production sector j is liable to VAT;

D_m : Total volume of locally-produced goods m sold in the domestic market;

IM_m : Total volume of imported product m ;

PL_m : Producer price of locally-produced goods sold in the domestic market;

PWM_m : World price of imported goods m ;

e : Nominal exchange rate;

tal_m : Tax rate of excises and other taxes levied on D_m ;

tam_m : Tax rate of excises and other taxes levied on IM_m ;

tm_m : Tariff rate of customs duties applied on imports.

Equations [10], [11], and [12] show how VAT levied on each composite product is broken down into VAT on locally-produced goods (equations [10] and [11]) and VAT on imported goods (equation [12]):

$$TVAL_m = TVA_m \frac{lr_l PL_m (1 + tal_m) D_m}{lr_l PL_m (1 + tal_m) D_m + lrm_m PWM_m (1 + tm_m + tam_m) IM_m e} \quad [10]$$

$$TVAL_{nm} = TVA_{nm} \quad [11]$$

$$TVAM_m = TVA_m \frac{lrm_m PWM_m (1 + tm_m + tam_m) IM_m e}{lr_l PL_m (1 + tal_m) D_m + lrm_m PWM_m (1 + tm_m + tam_m) IM_m e} \quad [12]$$

where parameters lr_l and lrm_m are respectively the broad effective rates to what extent domestic product D_m and imports IM_m are VATable.

Although the uniform nominal rate of VAT (TVG) is the same no matter whether the product is of local or imported origin, effective rates of the VAT may instead be different from one type of goods to another, and depending on whether the good is locally produced or imported. The variable tv_l is then the VAT effective rate applied to the good i produced in the country (equation [13]), while the variable tv_m is the VAT effective rate applied to the imported good m (equation [14]).

$$tv_l = \frac{TVAL_i}{PL_i (1 + tal_i) D_i} \quad [13]$$

$$tv_m = \frac{TVAM_m}{PWM_m e (1 + tm_m + tam_m) IM_m} \quad [14]$$

Besides VAT, the other taxes levied since 1994 are computed through equations [15] and [16], respectively for taxes on domestically produced products and taxes on imported substitutes.

$$TIAL_i = tal_i PL_i D_i \quad [15]$$

$$TIAM_m = tam_m PWM_m IM_m e \quad [16]$$

The domestic indirect taxes in force before the 1994 tax reform, $TINDM_m$ and $TINDL_i$, are determined by equations [17] and [6], where tx_l and tx_m are effective tax rates applied on domestically produced and import goods, respectively.

$$TINDL_i = tx_l PL_i D_i \quad [17]$$

$$TINDM_m = txm_m PWM_m IM_m e \quad [18]$$

The variable $ITAX$ (equation [19]) encompass the whole revenue generated from domestic indirect taxes in force before as well as after the 1994 tax reform.

$$ITAX = \sum_i TVAL_i + \sum_m TVAM_m + \sum_i TIAL_i + \sum_m TIAM_m + \sum_i TINDL_i + \sum_m TINDM_m \quad [19]$$

Production tax $PTAX$ is determined by equation [20], where the production tax rate is applied on a tax base which includes non refundable VAT paid on intermediate consumptions DI_{ji} , to the proportion of $(1 - CIF_i)$.

$$PTAX_i = tp_i P_i \left(XS_i + \sum_j DI_{ji} (1 - CIF_i) LCI_{ji} TVG \right) \quad [20]$$

In fact, for each sector, only activities that are subject to VAT system (proportion CIF within the sector) have the right to claim VAT rebates.¹⁰ This is also illustrated in equation [21] for the computation of value added price PV , where the exclusive-of-VAT price $PCHT$ is applied to intermediate consumptions just to the amount of the proportion CIF , which represents the share of activities that are authorized to benefit from VAT rebates. Activities out of this share bear permanently the VAT levied on their inputs. The price inclusive of VAT, $PCCI_j$, is then applied for the settlement of these inputs.

$$PV_i = \frac{P_i XS_i - PTAX_i - \sum_j PCHT_j DI_{j,i} CIF_i - \sum_j PCCI_j DI_{j,i} (1 - CIF)_i}{VA_i} \quad [21]$$

The prices exclusive of VAT are determined through equation [22] concerning importable composite goods m , and through equation [23] for non importable goods nm .

$$PCHT_m = \frac{PL_m (1 + tal_m + txl_m) D_m + PWM_m e (1 + tm_m + tam_m + txm_m) IM_m}{(1 + tal_m + txl_m) D_m + (1 + tm_m + tam_m + txm_m) IM_m} \quad [22]$$

$$PCHT_{nm} = \frac{PL_{nm} (1 + tal_{nm} + txl_{nm}) D_{nm}}{(1 + tal_m + txl_m) D_m} \quad [23]$$

¹⁰ All activities within a production sector are not covered by the VAT legislation. Small businesses and informal sector for instance are excluded from the VAT base, and their outputs are not "VATable".

Equations [24] and [25] compute market prices inclusive of VAT, respectively for the absorption of locally-produced goods and for absorption of imported goods. The algebraic juxtaposition of different tax rates implies that all taxes but VAT are included in the VAT taxation base.

$$PD_i = PL_i (1 + tal_i + txl_i)(1 + tvl_i) \quad [24]$$

$$PM_m = PWM_m e(1 + tm_m + tam_m + txm_m)(1 + tvm_m) \quad [25]$$

Apart from the market prices of absorption formulated in equations [24] and [25], the model computes specific market prices inclusive of VAT, applied to product i bought by a household h (equation [26]), by the government (equation [27]), or by a production sector (equation [28]).

$$PCCH_{h,i} = PCHT_i (1 + LCH_{h,i} TVG) \quad [26]$$

$$PCCG_i = PCHT_i (1 + LCG_i TVG) \quad [27]$$

$$PCCI_{i,j} = PCHT (1 + LCI_{i,j} TVG)_i \quad [28]$$

These market prices are subsequently considered in various accurate equations to determine households' consumptions (equation [29]) and the change in their welfare – the Hicks Equivalent Variation – (equation [30]), the quantities of goods consumed by government (equation [31]).

$$C_{h,i} = C_{h,i}^{MIN} + \frac{\gamma_{h,i}}{PCCH_{h,i}} \left(CTH_h - \sum_j C_{h,j}^{MIN} PCCH_{h,j} \right) \quad [29]$$

$$EV_h = \prod_i \left(\frac{PCCHO_{h,i}}{PCCH_{h,i}} \right)^{\gamma_{h,i}} \left(CTH_h - \sum_j C_{h,j}^{MIN} PCCH_{h,j} \right) - \left(CTHO_h - \sum_j C_{h,j}^{MIN} PCCHO_{h,j} \right) \quad [30]$$

$$CG_i = \frac{G_i}{PCCG_i} \quad [31]$$

With respect to capital goods and to intermediate consumptions that open onto VAT rebates, market prices applied for their settlement are excluding VAT (at the end of the VAT rebate process), as in equations [32], [33], and [34].

$$INV_i = \mu_i \frac{IT}{PCHT_i} \quad [32]$$

$$\sum_i INV_i PCHT_i = \sum_h SH_h + SF + SG + e \cdot CAB \quad [33]$$

$$PC_i Q_i = \sum_h PCCH_{h,i} C_{h,i} + PCCG_i CG_i + PCHT_i \left(\sum_j DI_{i,j} CIF_j + INV_i \right) + \sum_j PCCI_{i,j} DI_{i,j} (1 - CIF_j) \quad [34]$$

Equilibrium equation [34] emphasizes the fact that the variable PC is a weighted mean price of total absorption for each composite good. Prices excluding VAT apply to some components of this absorption, while prices including VAT permanently apply to others.

The VAT modeled in this way is an imperfect VAT, as currently implemented in Cameroon.

The complete list of the equations is provided in appendix.

4.3. Poverty and inequality indicators

- **Indicators of Poverty: the FGT indices.** The model integrates the P_α category of poverty indices developed by Foster, Greer and Thorbecke (1984), which are otherwise known as « FGT indices ». The general formula of this category of indices is provided in equation [35], and reads as :

$$P_\alpha = \frac{1}{n} \sum_{i=1}^q \left(\frac{z - y_i}{z} \right)^\alpha \quad [35]$$

with : n being the number of households within population studied;
 q , the number of poor households;
 z , the poverty line;
 y_i , the consumption expense of individual i ; and
 α , the parameter measuring the aversion towards poverty.

When the analysis unit is the household as it is the case in this study, statistic observation might be weighted by the size w_i of the household; hence:

$$P_\alpha = \frac{1}{\sum_{i=1}^n w_i} \left(\sum_{i=1}^q w_i \left(\frac{z - y_i}{z} \right)^\alpha \right) \quad [36]$$

Parameter α alternatively bears the values 0, 1 and 2. When $\alpha = 0$, P_α indicates the ratio of the population living below the poverty line and stands as the poverty Headcount Ratio in terms of percentage of poor people out of total population. To assess how far the expenses of poor people are under the poverty line, i.e. the poverty gap index or income gap ration, one computes P_1 (i.e. $\alpha = 1$). A value $\alpha \geq 2$ implies a higher preoccupation about or aversion against poverty: in this regard the index P_2 measures the poverty severity and

considers not only the poverty gap and the percentage of poor, but also the distribution scheme of resources amongst people counted as poor.

- **Indicators of inequality: the Gini index.** The Gini index is computed here according to the “relative deprivations” method widely utilized in numerous studies. In terms of modeling, this method has the advantage not to require to arrange household income vector in increasing or decreasing order prior to computing the Gini index, as it is the case for instance with trapezium and triangle methods. For each individual or household, the relative deprivation measures the distance between his income and the income of all those relative to whom he feels deprived. With relative deprivations method, Gini index corresponds to the half of the mean of means of the average absolute deviations of incomes for each couple of individuals within the total population studied. In other words, it is the mean of relative deprivations of individuals, divided by the mean of incomes of those individuals, and reads as follows:

$$G = \frac{1}{2\mu_y \tilde{N}^2} \sum_{i=1}^N \sum_{j=1}^N |y_i - y_j| \cdot pds_i \cdot pds_j \quad [37]$$

with: μ_y , the mean income of the population; \tilde{N} , total population (weight); pds_i , the weight of the household i within the population. The term $|y_i - y_j|$ is the absolute value of the difference between the mean income in household i and the mean income in household j . Otherwise expressed, it measures the absolute value of the **mean absolute deprivation** of i in comparison to j . This mean absolute deprivation becomes a **mean relative deprivation** when it is divided by the mean income of the household sample considered. In our case, μ_y constitutes this mean income.

The numerical value of the Gini index ranges from « 0 » to « 1 » inclusively. The more this value tends to be equal to 1, the higher the corresponding level of inequality: a coefficient worth nil (minimal inequality or perfect equality) will correspond to an egalitarian society where each member earns exactly the same income as the other members. On the contrary, a Gini coefficient equal to 1 would represent an extremely non egalitarian society where only one member earns all the incomes, while the other members earn nothing, and consequently experience a nil income situation.

4.4. Two Social Accounting Matrices (SAM) Needed for Double Calibration

Applying a Computable General Equilibrium (CGE) model generally entails the construction of a Social Accounting Matrix (SAM). Building a model with a double calibration approach however requires two Social Accounting Matrices (SAMs), one for each of the two periods

subjected to calibration. The first period which represents the reference year of the initial matrix is the 1993 financial year. In fact, this period happens to be the one that directly preceded the major economic reforms under analysis in this study. The second period of calibration is the 2001 financial year which corresponds to the second Social Accounting Matrix (SAM). The Supply and Use Tables (SUT) and the Integrated Economic Account Tables (IEAT) published for these two periods by the National Institute of Statistics of Cameroon were used to this end.¹¹

5. Scenarios and Simulations Results

Besides the shock of double calibration, three scenarios are performed:

- The implementation of the VAT in 1994 and replacement of the previous indirect taxes; coupled with the review of customs duty rates and the suppression of numerous tax exemptions granted before the 1994 tax reform.
- The rehabilitation and development of public infrastructures since 1996; and
- The 50 percent devaluation of the CFA franc in 1994, through the real exchange rate. It is worth noting that one cannot simulate a nominal devaluation itself using a model involving only the real sphere of the economy. In fact, given that there is no monetary sector in the model, the variable “e” which acts as nominal exchange rate in the model is not really a nominal exchange rate as such; rather, it is actually but a simple conversion device which allows converting the “prices expressed in foreign currencies” into “prices expressed in CFA franc”. However, a proxy of 50 percent devaluation of CFA franc was simulated by making use of its likely effect on the real effective exchange rate (REER); that is, by hypothesis, doubling this REER. Bearing in mind the fact that the REER is equal to the ratio of world prices level on domestic prices level (consumer price index in this case), multiplied by the nominal exchange rate (here the conversion factor “e”), doubling the REER returns to multiply “e” by 2.¹² The Backward looking approach being the one used for the simulation here as a result of the year 2001 having been considered as the reference year, rather than the year 1993, the devaluation simulation has instead consisted in dividing the converting factor “e” by 2.

¹¹ The SUT and the IEAT are new national accounts concepts of the SCN93 system of the United Nations. They respectively correspond to the well-known concepts of Input-Output Table and of the Comprehensive Economic Table.

¹² World prices used in the formula of the REER are exogenous, considering the small country hypothesis and the consumer price index is endogenous.

5.1 Impacts of technological changes

The concept of technological changes refers here to the variations experienced between 1993 and 2001, in the values of the scale parameters of both the production functions and functions of the differentiation of products, either by origin or by destination.

5.1.1 Price impacts of the changes in parameter values

It arises from the double calibration simulation that changes in scale parameters occurred between 1993 and 2001 generally contributed to lower prices at national level. Apart from domestic export prices which have undergone no nominal effect, and the index of domestic prices of imports which had registered a slight increase (0.16 percent), the other price indices under consideration in this study all dropped by almost 3 percent. Based on the empirical increase witnessed between 1993 and 2001 in the consumer price index (77.04 percent), it is possible to conclude that technological changes have held back the said increase by contributing to it negatively (by -3.98 percent).

5.1.2 Volume effects of the changes in parameter values

Unlike the effects on prices, technological changes have instead contributed to the increase of the various product aggregates in volume terms: they have intrinsically led to a 12 percent increase of the national production, among which 0.21 percent increase of the export-oriented production and 13.98 percent increase of production intended for domestic market. 12.33 percent increase of the whole products consumed in the country (absorption) has been registered, that included a 0.25 percent increase in imported products, alongside a 12.06 percent increase in the quantities of products consumed by households.

Bearing in mind that the real GDP in factor costs witnessed a 36.82 percent increase between 1993 and 2001, it appears that technological changes contributed very strongly to that growth, to the amount of 44.78 percent.

At sector-based level, technological changes have been unfavourable to the crude oil production and the public services sectors only; where some drops in the volumes of production worth -44.58 and -2.77 percent respectively have been registered. On the contrary, sectors of activities in which production benefited most from this overall improvement include the cash crops agriculture (42.87 percent), wood industries (22.00 percent), manufacturing industries (19.99 percent), oil refinery (17.72 percent), and trade services (18.17 percent).

The weak incidence on the exports and the imports, in volume at the national level, stems from the fact that the strong positive variations of trade flows recorded in some sectors are mitigated by the negative variations registered in other sectors. The decrease in exports of

non processed timber (-20.50 percent) and crude oil (-44.8 percent) stands to counterweight the increase of exports in all the other exporting sectors, such as the cash crops agriculture (68.96 percent), the sector of tradable services (36.84 percent), etc. Similarly, the drop in imports of various manufactured products (-3.70 percent) and tradable services (-8.52 percents) is compensated by the increase in crude oil imports (15.81 percent) refined oil (7.31 percent) and manufactured food products (3.96 percent).

5.1.3 Impacts of technological changes on the incomes and welfare of households

The technological changes have had a positive influence on the incomes and consumption budgets of the households. The total income and consumption budget of households respectively increased by 17.32 percent and 17.54 percent due to these changes in scale parameters. The combination of the increase in consumption budget and the abovementioned decline in consumer price index has consequently led to a strong increase of household welfare: the whole Hicksian Equivalent Variation due to this shift in parameter values amounted to 19.93 percent of the household total consumption in 2001.

This scenario has borne a stronger positive influence on factors remuneration, translated by an average 23.01 percent increase of wage rates, whereas the average increase of the rate of return to capital stands at 12.68 percent, and the increase of the rate of return to land amounts to 7.70 percent. Remuneration rates of production factors improved more in the non agricultural sectors: 23.62 percent increase against 21.64 percent in agriculture for wage rate; 13.55 percent increase in the non agricultural sectors against 4.82% in the agricultural sector for rate of return to capital. Besides, the increase of wage rates was greater for skilled workers (24.50 percent) than for unskilled workers (20.40 percent).

The ratio of the remuneration generated by skilled labor in the total factor income is higher for urban households (58.10 percent) than for rural households (34.40 percent). Likewise, the proportion of return to non agricultural capital earned by urban households is higher than the one earned by rural households (22.01 against 7.01 percent). This explains the more important increase in total factor income earned by urban households (23.45 percent) compared to rural households (19.88 percent). This impact differential is also observed for total incomes (17.83 percent and 16.58 percent increase respectively), for consumption budgets (17.67 versus 17.33 percent increase), and for welfare (20.67 versus 18.80 percent). The distributional structure of factor incomes also influenced the impact differential in total income, consumption and welfare of households distinguished according to the sex of the household head. In this regard, these three variables increased more strongly in households headed by a man (17.59, 18.76 and 21.17 percent respectively) than in those headed by a woman (16.27, 13.75 and 16.09 percent respectively).

5.1.4 Impacts of technological changes on poverty and inequalities

The changes in scale parameter values have led to substantial poverty alleviation between 1993 and 2001 in Cameroon. The national headcount ratio (FGT0) declined by 6.50 percentage points; that is a contribution of about one-third (31.01 percent) in the overall decline in poverty witnessed during the period 1993 to 2001.

A reduction of 3.21 and 1.87 percentage points was equally recorded at national level for the poverty gap and poverty severity ratios (FGT1 and FGT2) respectively, under the influence of the same technological changes, despite the very light increase in inequalities, as measured using the Gini index.

FGT0, FGT1 and FGT2 declined in male-headed households as well as in female-headed households; in urban households as well as in rural households, though more importantly in urban zone. So, shifts values in scale parameters have contributed to the empirical widening of the gap between values of poverty indices in the urban areas and the values of these same indices in the rural areas.

Technological changes essentially reduced the poverty through their growth effects, whereas their redistributive effects somewhat helped to aggravate poverty. At national level, the contribution of growth stands at 100.52 percent of the reduction of the FGT0 index induced by the technological changes, while the contribution of redistribution effect stands at -0.52 percent. Depending on the area of residence, the impact of redistribution turned out to be negative in the rural households only (-1.56 percent against 101.6 percent for the contribution of growth), whereas its contribution to the reduction of poverty in the urban areas has been positive (20.29 percent as against 79.71 percent for the contribution of growth). As regard the sex of the household Head, the contribution of the redistribution of incomes to poverty reduction in households headed by women is known to have been negative (-5.26 percent against 105.26 percent for the growth effect), while this same contribution has revealed to have been slightly positive within the group of male-led households (3.11 percent as against 96.89 percent for the growth contribution).

5.2 Impacts of the 50 percent Devaluation of the CFA Franc in 1994

5.2.1 Impacts on prices

Decomposing the effects shows that devaluation has contributed a great deal in the rise in price levels witnessed between the years 1993 and 2001. This impact of devaluation in prices accounts for 65 percent in the 77 percent increase in consumer prices index empirically experienced during that period. The increase in actually all domestic price indices stands in nominal terms around the 50 percent devaluation rate.

5.2.2 Impacts of the devaluation on volumes

Devaluation intrinsically contributed, but just for a very little proportion, to the growth observed between years 1993 and 201. This contribution to the overall increase of real GDP at factor costs actually amounted to 0.82 percent. Nevertheless, for the whole period, devaluation has led to the increase of exports in real terms (4.99 percent) and a decrease in imports in real terms as well (3.34 percent); thus translating the classical functioning of its mechanical impacts on the country's international trade transactions.

The overall volume of exports has increased under the combined effects of a light increase of the national production (0.22 percent) and a cutback of the production intended for the domestic market, which fell by 0.56 percent. The sectors where exports essentially grew thanks to increase alongside with increase of their underlying production are foodstuffs agriculture, cash crops agriculture, crude oil, wood processing and miscellaneous manufacturing industries. Those where the production was essentially diverted towards foreign market, following a decline in that production, are the forestry sector, the food industry, the refined petroleum and the sector of trade services.

Devaluation has led to a 0.89 percent decrease in the whole volume of absorption, given the decline of imports as well as of the domestic production intended for the domestic market. In this absorption negative change, household consumption has undergone the most drastic decline (-17.49 percent), auguring in the same line a deterioration of the overall household welfare at the national level.

5.2.3 Impacts of Devaluation on households incomes and welfare

Devaluation has induced a 30.31 percent increase of the incomes of the households and a consecutive 30.71 percent increase of their consumption budgets. However, the level of welfare has undergone a severe degradation (-17.6 percent), as the consumption budget increase revealed to be relatively weak compared to the increase in the consumer price index (50.15 percent).

The increase in the incomes mentioned above derives from the rise of factor incomes: 37.78 percent for the average wage rate, 42.12 percent for the average rate of return to capital, and 51.70 percent for the average rate of return to land productivity. Unskilled workers registered the most important rise in wages (41.60 percent) than skilled workers (35.60 percent). With the agriculture being more intensive in unskilled labor, comparing to non agricultural sectors, the improvement of average wage rate in agriculture was therefore more important compared to the mean wage rate in the whole economy.

As a consequence, households in the rural areas have enjoyed more important increases in incomes than households in the urban areas (35.74 percent as against 26.52 percent in

terms of total income). In fact, over 60 percent of primary income earned by households living in rural areas is generated from production factors allocated to agriculture, which have registered the most important increases in rates of return. Urban households earned only 10 percent of these factor incomes. Welfare has consequently deteriorated more drastically among urban households (-25.2 percent) than among inhabitants of the rural areas (-5.96 percent). The increase in total income is virtually the same (standing around 30 percent), be it in households headed by men or in female-headed households. However the consumption budget of female-headed households increased relatively less (25.48 percent against 32.40 percent for male-led households) because they are in situation of dissaving at the benchmark state. Consequently, the loss in welfare is more important for woman-headed households (-31.08 percent) than for man-headed households (-13.20 percent).

5.2.4 Poverty and inequality impacts of devaluation

Findings relating to the impact of devaluation pretty well illustrate the fact that welfare and poverty within a given households group do not vary automatically in opposite directions. While devaluation has strongly lowered the overall welfare of the households, it has at the same time contributed in reducing poverty at national level. The decreases in poverty gap and poverty severity under the influence of devaluation were most important, with reductions of 7.72 and 8.53 percentage points at national level, respectively, whereas the national headcount index only decreased by a 0.36 percentage point. It consequently appears that the contribution of devaluation in the poverty alleviation recorded between 1993 and 2001 amounted to 1.72 percent, considering the poverty headcount ratio.

Inequalities also reduced considerably (0.11 drop of the Gini index at national level) correlatively to the sharp drop of the poverty gap and poverty severity indices, and to the significant redistribution of incomes among households.

Indeed, the net decline in national poverty headcount (-0.36 percentage point) is made of a redistribution effect that favours such a drop (-7.04 percentage points) and a growth effect that is rather conducive to an increase of poverty (+6.68 percentage points).

Devaluation has had diametrically opposed incidences on poverty, depending on depending on whether a household is situated in urban zone or in rural: while the number of people counted as poor decreased in rural zone (-1.74 percentage point of FGT0), it rather increased in urban areas (+2.20 percentage points). The growth impact of devaluation has contributed in reducing poverty in the rural areas (by 2.11 percentage points of FGT0) and in aggravating the latter in urban areas (+11.10 percentage points). Conversely, the redistribution effect of devaluation has contributed in mitigating the increase of poverty in

urban areas (-8.90 percentage points) and in slowing down its reduction in rural areas (+0.37 percentage point of FGT0).

When taking into consideration the sectors of activity in which household Heads are involved, it is observed that poverty has regressed in most households, except in the ones where the household Head is essentially active in either of the sectors including Public Services, Construction, Trade and Public Works, or has no occupation at all.

5.3 Impacts of the 1994 tax reform

5.3.1 Prices impacts

Beside the 1994 devaluation, the reform of the indirect tax system engaged in 1994 is another reform which strongly contributed to the rise in prices during the period in review. Its contribution in the 77.07 percent increase of the consumer price index witnessed between 1993 and 2001 amounts to 10.60 percent. This positive contribution to the rise in prices is due not only to both the review of customs duty rates and the introduction of VAT, but also to the suppression of numerous tax exemptions granted before the tax reform.

5.3.2 Impacts of the tax reform on volumes

The tax reform accounts for nearly 3 percent of the real GDP growth registered between 1993 and 2001. The increase of production has been coupled with a serious reorientation of the latter towards the domestic market that culminated to a considerable drop in export volumes. The increase of the production intended for domestic market did more than simply compensating the reduction of imports, since the net incidence on absorption at national level ended up being positive. However, with the consumption of households having dropped considerably, this increase of absorption solely concerns intermediate and investment goods (see Table 7).

5.3.3 Impacts of the tax reform on households incomes and wellbeing

The welfare of households has reduced considerably (3 percent decrease in terms of consumption volume of 1993) as a result of tax reform effects, the consecutive increase of incomes (3.62 percent) and of the consumption budget (3.66 percent) having been weak when comparing to the rise in the consumption prices (8.17 percent).

The incomes of households living in the rural areas (the majority of which work in the agricultural sector) increased more than those of households living in urban areas, following a more important increase in the rates of remuneration of the production factors used in agriculture sector. This situation stands to explain the more drastic deterioration of welfare observed within urban household compared to rural households. Gender wise, welfare

suffered more degradation in households led by women than in those headed by men as the consumption budgets in the former increased less than in the latter.

5.3.4 Impacts of the tax reform on poverty and inequalities

At the national level, the tax reform raised the poverty headcount ratio (FGT0) by 0.71 percentage point. Its relative contribution to the empirical reduction of the FGT0 index witnessed between the years 1993 and 2001 (-21.96 percentage points) has consequently been negative (-3.39 percent). On the contrary, this reform has positively, though slightly, contributed towards the reduction of poverty gap (0.19 percentage points) and poverty severity (0.30 percentage points), and towards the reduction of the Gini inequality index as well (-0.01).

According to the residential area, the rise in FGT0 due to the tax reform was in relative terms more drastic among the urban households (+1.69 percentage point) than within the rural households (+0.18 percentage point). The reduction of FGT1 and FGT2 induced at the national level is in fact effective only for the rural households. The slight shrinkage of the Gini index has been effective in both rural and urban areas.

Depending on the sex of the household Head, the incidence of both poverty and inequalities within the two groups of households remains practically the same as at national level, with the exception that the poverty severity has worsened within female-led households.

Apart from households whose heads mainly work in the sectors of agriculture, fishing, hunting, textile, chemical industry or construction materials, all other groups of households, considered according to the main occupation of their leader, recorded an increase of their respective poverty headcount ratios.

On the national level as well as according to gender or the residence milieu of the household, the unfavourable growth effect of tax reform dominated its favourable redistribution effect with regard to poverty alleviation.

5.4 Impact of the rehabilitation of basic infrastructures

5.4.1 Impacts on prices

The rehabilitation of basic infrastructures hardly has borne some incidence on the prices. Its contribution towards the increase in the consumer prices index during the period under review is worth 0.06% only.

5.4.2 Impacts of the rehabilitation of basic infrastructures on the volumes

Contrary to the incidence on prices, the impact on volumes was much greater. The rehabilitation of infrastructures actually contributed by 11.37 percent towards the increase in

real GDP experienced during the period under review. The increase in production was translated by an increase in both export volumes and products intended for the local market. The increase of absorption resources was on its part justified by the increase in both imports and production, which itself was translated by an increase in the consumption of households.

5.4.3 Impacts of the rehabilitation of basic infrastructures on the households incomes and welfare

Rates of return to production factors have registered less increase in this scenario than in the previous ones (see Table 7). However, given the weak rise in consumption prices, the household welfare has increased appreciably, at the national level and whatever the sex of the household head, and whether the household belongs to rural zone or urban zone. (See Tables 7 and 9).

The total incomes of households living in the rural areas (which are more actively involved in agricultural activities) and their welfare have increased more than those of households living in urban areas, as the increase in the rates of returns to production factors used in the agricultural sectors is more important than in the non agricultural sectors, in which members of households living in urban areas are mostly employed.

5.4.4 Impacts of the Rehabilitation of basic Infrastructure on poverty and inequalities

Infrastructure rehabilitation has induced reduction of all the poverty indices FGT0, FGT1 and FGT2, as well as of the Gini index, not only at the national level, but also in both rural and urban areas, and indifferently within male-headed and female-headed households.

Thus, considering the empirical reduction of poverty headcount ratio recorded between 1993 and 2001, infrastructure rehabilitation has contributed to that reduction by 8.9 percent at the national level, by 4.53 and 13.45 percent in urban and rural areas respectively, and by 9.24 and 12.76 percent within male-led and female-led households respectively.

The growth effect associated to the rehabilitation of basic infrastructures was more important than its redistribution effect on poverty, irrespective of the group of households considering both the sex and areas of residence of the Head of the households.

6. Conclusion

The findings of this research work give an indication of the intrinsic impacts of the shocks analysed, on the evolution of growth and poverty in Cameroon between the years 1993 and 2001. It therefore appears that devaluation policies on the one hand, and the rehabilitation of basic infrastructures on the other hand, positively contributed in alleviating poverty within the period mentioned above, while the tax reform instead rolled against this reduction.

Besides the analysis of the impacts associated to these three shocks, the double calibration approach adopted for the purpose of this study has revealed the considerable contribution of the technological changes that occurred between the years 1993 and 2001. These changes alone account for 31 percent of the whole poverty headcount shrinkage witnessed during the period under review, for 45 percent of the real GDP growth, and for -4 percent of the increase in the consumer price index registered during the same period¹³. The own contributions of devaluation, basic infrastructures rehabilitation and tax reforms stands at respectively 2 percent, 9 percent, and -4 percent as concerns the reduction in the national poverty headcount ratio, one percent, 11 percent, and three percent for real GDP growth, and 65 percent, 0 percent and 11 percent as regards the increase in consumer prices index.

Both technological changes and the rehabilitation of basic infrastructures have led to poverty alleviation in both rural and urban areas, and this, irrespective of the sex of the household head. On the contrary, devaluation actually helped to effectively reduce poverty at national level and in the rural areas only, while it did aggravate this phenomenon in urban areas. In fact, sectors of activity in which production and exports happened to be boosted upon devaluation were basically those of the rural economic sphere, while the increase in the prices of imported products induced by devaluation essentially hit the households living in urban areas.

This study reveals that the direct contributions of strategic policies to the achievement of developmental objectives may be considerable, and that both technological changes and the indirect incidences of these policies on the adoption of best technological processes are likely to be very important as well. Besides, the study comes to comfort the measures presently under implementation, or those that are envisioned by policymakers in Cameroon, which aim at pursuing the rehabilitation and the development of basic infrastructures. The negative impacts of the tax reforms initiated since 1994 on poverty implies the necessity to wisely implement ad-hoc fiscal measures and cleverly negotiate ongoing trade agreements within the framework of both the World Trade Organization (WTO) and Economic Partnership Agreements with the European Union, since the risk of an aggravation of poverty proves to be plausible if for instance tax-replacement measures are used to offset tariff losses.

¹³ The -4% contribution towards the increase in the price index implies that despite the increase of this index that has been observed between 1993 and 2001, technological changes have instead exerted pressure on the drop in prices during the same period; yet this effect of the drop in prices simply revealed to be low when compared to the combined effect of the increase induced by other economic policies.

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APPENDICES

Equations of the model

Block number	Formulation	Number
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I. Production

[1]	$LD_i = A_i^{sk} \left[\alpha_i^{sk} QLD_i^{-\rho_i^{sk}} + (1 - \alpha_i^{sk}) NQLD_i^{-\rho_i^{sk}} \right]^{-1/\rho_i^{sk}}$	10
[2]	$\frac{NQLD_i}{QLD_i} = \left[\left(\frac{1 - \alpha_i^{sk}}{\alpha_i^{sk}} \right) \left(\frac{wq_i}{wnq_i} \right) \right]^{\sigma_i^{sk}}$	10
[3]	$CF_{agr} = A_{agr}^{cf} \left[\alpha_{agr}^{kl} LD_{agr}^{-\rho_{agr}^{kl}} + (1 - \alpha_{agr}^{kl}) KD_{agr}^{-\rho_{agr}^{kl}} \right]^{-1/\rho_{agr}^{kl}}$	2
[4]	$VA_{nagr} = A_{nagr}^{va} \left[\alpha_{nagr}^{kl} LD_{nagr}^{-\rho_{nagr}^{kl}} + (1 - \alpha_{nagr}^{kl}) KD_{nagr}^{-\rho_{nagr}^{kl}} \right]^{-1/\rho_{nagr}^{kl}}$	8
[5]	$\frac{KD_i}{LD_i} = \left[\left(\frac{1 - \alpha_i^{kl}}{\alpha_i^{kl}} \right) \left(\frac{w_i}{r_i} \right) \right]^{\sigma_i^{kl}}$	10
[6]	$VA_{agr} = A_{agr}^{va} \left[\alpha_{agr}^{cfl} CF_{agr}^{-\rho_{agr}^{cfl}} + (1 - \alpha_{agr}^{cfl}) LAND_{agr}^{-\rho_{agr}^{cfl}} \right]^{-1/\rho_{agr}^{cfl}}$	2
[7]	$\frac{LAND_{agr}}{CF_{agr}} = \left[\left(\frac{1 - \alpha_{agr}^{cfl}}{\alpha_{agr}^{cfl}} \right) \left(\frac{rc_{agr}}{rl_{agr}} \right) \right]^{\sigma_{agr}^{cfl}}$	2
[8]	$A_{ngs}^{va} = B_{ngs}^{va} \left(\frac{KG}{\left(\sum_{ngsj} KD_{ngsj} \right)^{cef}} \right)^{\varepsilon_{ngs}}$	9
[9]	$XS_i = \frac{VA_i}{v_i}$	10
[10]	$CI_i = io_i XS_i$	10
[11]	$DI_{i,j} = aij_{i,j} CI_j$	100
[12]	$XXS_i = \left(XS_i + \sum_j DI_{ji} (1 - CIF_i) LCI_{ji} TVG \right) (1 + tp_i)$	10

II. Incomes and Savings of Resident Agents

$$\begin{aligned}
 YG &= \lambda^{kg} \sum_i r_i KD_i + \sum_i PTAX_i + \sum_i TVA_i + \sum_i TIAL_i + \sum_m TIM_m \\
 [13] \quad &+ \sum_m TIAM_m + \sum_x TIE_x + \sum_h DTH_h + DTF + \sum_{inst} TRF_{gov,inst} \quad 1 \\
 &+ \sum_i TINDL_i + \sum_m TINDM_m \\
 [14] \quad &TVA_i = TVG \cdot PCHT_i \left(\sum_h LCH_{h,i} C_{h,i} + LCG_i CG_i + \sum_j LCI_{i,j} DI_{i,j} (1 - CIF_j) \right) \quad 10 \\
 [15] \quad &LCH_{h,m} = \frac{\xi_{h,m}^{chl} PL_m (1 + tal_m) D_m + \xi_{h,m}^{chm} PWM_m e (1 + tm_m + tam_m) IM_m}{PL_m (1 + tal_m) D_m + PWM_m e (1 + tm_m + tam_m) IM_m} \quad 98928 \\
 [16] \quad &LCI_{m,j} = \frac{\xi_{m,j}^{cjl} PL_m (1 + tal_m) D_m + \xi_{m,j}^{cim} PWM_m e (1 + tm_m + tam_m) IM_m}{PL_m (1 + tal_m) D_m + PWM_m e (1 + tm_m + tam_m) IM_m} \quad 90 \\
 [17] \quad &LCG_m = \frac{\xi_m^{cgl} PL_m (1 + tal_m) D_m + \xi_m^{cgm} PWM_m e (1 + tm_m + tam_m) IM_m}{PL_m (1 + tal_m) D_m + PWM_m e (1 + tm_m + tam_m) IM_m} \quad 9 \\
 [18] \quad &TVAL_m = TVA_m \frac{lrl_m PL_m (1 + tal_m) D_m}{lrl_m PL_m (1 + tal_m) D_m + lrm_m PWM_m (1 + tm_m + tam_m) IM_m e} \quad 9 \\
 [19] \quad &TVAL_{nm} = TVA_{nm} \quad 1 \\
 [20] \quad &TVAM_m = TVA_m \frac{lrm_m PWM_m (1 + tm_m + tam_m) IM_m e}{lrl_m PL_m (1 + tal_m) D_m + lrm_m PWM_m (1 + tm_m + tam_m) IM_m e} \quad 9 \\
 [21] \quad &tv_m = \frac{TVAM_m}{PWM_m e (1 + tm_m + tam_m) IM_m} \quad 9 \\
 [22] \quad &tv_l = \frac{TVAL_i}{PL_i (1 + tal_i) D_i} \quad 10 \\
 [23] \quad &PTAX_i = tp_i P_i \left(XS_i + \sum_j DI_{ji} (1 - CIF_i) LCI_{ji} TVG \right) \quad 10 \\
 [24] \quad &TIAL_i = tal_i PL_i D_i \quad 10 \\
 [25] \quad &TIAM_m = tam_m PWM_m IM_m e \quad 9 \\
 [26] \quad &TINDL_i = txl_i PL_i D_i \quad 10 \\
 [27] \quad &TINDM_m = txm_m PWM_m IM_m e \quad 9 \\
 [28] \quad &ITAX = \sum_i TVAL_i + \sum_m TVAM_m + \sum_i TIAL_i + \sum_m TIAM_m \quad 1 \\
 &+ \sum_i TINDL_i + \sum_m TINDM_m \\
 [29] \quad &TIM_m = tm_m PWM_m IM_m e \quad 9 \\
 [30] \quad &TIE_x = te_x PE_x EXS_x \quad 9 \\
 [31] \quad &DTH_h = cty_h ty_h YH_h \quad 10992 \\
 [32] \quad &DTF = tyf \cdot YF \quad 1
 \end{aligned}$$

$$[33] \quad SG = YG - \sum_i G_i - \sum_{ins} TRF_{ins,gov} \quad 1$$

$$[34] \quad \begin{aligned} YH_h = & \lambda_h^{wq} \sum_i wq_i QLD_i + \lambda_h^{wnq} \sum_i wnq_i NQLD_i + \lambda_h^{kh} \sum_i r_i KD_i \\ & + \lambda_h^{lh} \sum_{agr} rl_{agr} LAND_{agr} + \sum_{inst} TRF_{h,inst} \end{aligned} \quad 10992$$

$$[35] \quad YDH_h = YH_h - DTH_h - \sum_{inst} TRF_{inst,h} \quad 10992$$

$$[36] \quad SH_h = mps_h YDH_h cmps + TRSH_h \quad 10992$$

$$[37] \quad YF = \lambda^{kf} \sum_i r_i KD_i + \lambda^{lf} \sum_{agr} rl_{agr} LAND_{agr} + \sum_{inst} TRF_{firm,inst} \quad 1$$

$$[38] \quad SF = YF - DTF - \sum_{ins} TRF_{ins,firm} \quad 1$$

III. Demand by Resident Agents

$$[39] \quad CTH_h = YDH_h - SH_h \quad 10992$$

$$[40] \quad C_{h,i} = C_{h,i}^{MIN} + \frac{\gamma_{h,i}}{PCCH_{h,i}} \left(CTH_h - \sum_j C_{h,j}^{MIN} PCCH_{h,j} \right) \quad 109920$$

$$[41] \quad CG_i = \frac{G_i}{PCCG_i} \quad 10$$

$$[42] \quad DIT_i = \sum_j DI_{i,j} \quad 10$$

$$[43] \quad INV_i = \mu_i \frac{IT}{PCHT_i} \quad 10$$

$$[44] \quad ITVOL = \frac{IT}{PINDEXHT} \quad 1$$

IV. Foreign Trade

$$[45] \quad EXD_x = EXDO_x \left(\frac{PWE_x}{PFOB_x} \right)^{\sigma_x} \quad 9$$

$$[46] \quad XXS_x = B_x^E \left(\beta_x^E EXS_x^{\kappa_x^E} + (1 - \beta_x^E) D_x^{\kappa_x^E} \right)^{1/\kappa_x^E} \quad 9$$

$$[47] \quad XXS_{nx} = D_{nx} \quad 1$$

$$[48] \quad \frac{EXS_x}{D_x} = \left[\left(\frac{1 - \beta_x^E}{\beta_x^E} \right) \left(\frac{PE_x}{PL_x} \right) \right]^{\tau_x^E} \quad 9$$

$$[49] \quad Q_m = A_m^M \left(\alpha_m^M IM_m^{-\rho_m^M} + (1 - \alpha_m^M) D_m^{-\rho_m^M} \right)^{-1/\rho_m^M} \quad 9$$

$$[50] \quad Q_{nm} = D_{nm} (1 + tal_{nm} + txl_{nm}) (1 + tvl_{nm}) \quad 1$$

$$[51] \quad \frac{IM_m}{D_m} = \left[\left(\frac{1 - \alpha_m^M}{\alpha_m^M} \right) \left(\frac{PD_m}{PM_m} \right) \right]^{\sigma_m^M} \quad 9$$

$$[52] \quad CAB \cdot e = \sum_m PWM_m IM_m e + \sum_{inst} TRF_{row,inst} - \sum_x PFOB_x EXS_x e - \sum_{ins} TRF_{ins,row} \quad 1$$

V. Prices

$$[53] \quad r_{nagr} = \frac{PV_{nagr} VA_{nagr} - w_{nagr} LD_{nagr}}{KD_{nagr}} \quad 8$$

$$[54] \quad r_{agr} = \frac{rc_{agr} CF_{agr} - w_{agr} LD_{agr}}{KD_{agr}} \quad 2$$

$$[55] \quad rc_{agr} = \frac{PV_{agr} VA_{agr} - rl_{agr} LAND_{agr}}{CF_{agr}} \quad 2$$

$$[56] \quad w_i = \frac{wq_i QLD_i + wnq_i NQLD_i}{LD_i} \quad 10$$

$$[57] \quad PV_i = \frac{P_i XXS_i - PTAX_i - \sum_j PCHT_j DI_{j,i} CIF_i - \sum_j PCCI_j DI_{j,i} (1 - CIF)_i}{VA_i} \quad 10$$

$$[58] \quad P_x = \frac{PL_x D_x + PE_x EXS_x}{XXS_x} \quad 9$$

$$[59] \quad P_{nx} = \frac{PL_{nx} D_{nx}}{XXS_{nx}} \quad 1$$

$$[60] \quad PE_x = \frac{PFOB_x e}{1 + te_x} \quad 9$$

$$[61] \quad PD_i = PL_i (1 + tal_i + txl_i) (1 + tvl_i) \quad 10$$

$$[62] \quad PM_m = PWM_m e (1 + tm_m + tam_m + txm_m) (1 + tvm_m) \quad 9$$

$$[63] \quad PC_m = \frac{PD_m D_m + PM_m IM_m}{Q_m} \quad 9$$

$$[64] \quad PC_{nm} = \frac{PD_{nm} D_{nm}}{Q_{nm}} \quad 1$$

$$[65] \quad PCHT_m = \frac{PL_m (1 + tal_m + txl_m) D_m + PWM_m e (1 + tm_m + tam_m + txm_m) IM_m}{(1 + tal_m + txl_m) D_m + (1 + tm_m + tam_m + txm_m) IM_m} \quad 9$$

$$[66] \quad PCHT_{nm} = \frac{PL_{nm} (1 + tal_{nm} + txl_{nm}) D_{nm}}{(1 + tal_m + txl_m) D_m} \quad 1$$

$$[67] \quad PCCH_{h,i} = PCHT_i (1 + LCH_{h,i} TVG) \quad 109920$$

$$[68] \quad PCCG_i = PCHT_i (1 + LCG_i TVG) \quad 10$$

$$[69] \quad PCCI_{i,j} = PCHT_i (1 + LCI_{i,j} TVG)_i \quad 100$$

$$[70] \quad PINDX = \sum_i \delta_i PV_i \quad 1$$

$$[71] \quad PINDEXQ = \sum_i PC_i \frac{Q_i}{\sum_j Q_j} \quad 1$$

$$[72] \quad PINDEXHT = \sum_i PCHT_i \frac{Q_i}{\sum_j Q_j} \quad 1$$

$$[73] \quad PINDEXC = \frac{\sum_h \left(\sum_i PCCH_{h,i} C_{h,i} \right)}{\sum_h \left(\sum_j C_{h,j} \right)} \quad 1$$

VI. Welfare Indicator

$$[74] \quad EV_h = \prod_i \left(\frac{PCCHO_{h,i}}{PCCH_{h,i}} \right)^{\gamma_{h,i}} \left(CTH_h - \sum_j C_{h,j}^{MIN} PCCH_{h,j} \right) - \left(CTHO_h - \sum_j C_{h,j}^{MIN} PCCHO_{h,j} \right) \quad 10992$$

VII. Equilibriums

$$[75] \quad EXS_x = EXD_x \quad 9$$

$$[76] \quad \sum_i INV_i PCHT_i = \sum_h SH_h + SF + SG + e \cdot CAB \quad 1$$

$$[77] \quad KST = \sum_{ngs} KD_{ngs} \quad 1$$

$$[78] \quad r_{ngs} = rf \quad 9$$

$$[79] \quad LANST = \sum_{agr} LAND_{agr} \quad 1$$

$$[80] \quad rl_{agr} = rlf \quad 2$$

$$[81] \quad QLST = \sum_i QLD_i \quad 1$$

$$[82] \quad wq_i = wqf \quad 10$$

$$[83] \quad NQLST = \sum_i NQLD_i \quad 1$$

$$[84] \quad wnq_i = wnqf \quad 10$$

$$[85] \quad cty_h = ctyf \quad 10992$$

$$\begin{aligned}
PC_{wl1}Q_{wl1} &= \sum_h PCCH_{h,wl1}C_{h,wl1} + PCCG_{wl1}CG_{wl1} \\
[86] \quad &+ PCHT_{wl1} \left(\sum_j DI_{wl1,j}CIF_j + INV_{wl1} \right) \\
&+ \sum_j PCCI_{wl1,j}DI_{wl1,j}(1 - CIF_j)
\end{aligned}
\tag{9}$$

$$\begin{aligned}
LEON_{wl2} &= PC_{wl2}Q_{wl2} - \sum_h PCCH_{h,wl2}C_{h,wl2} - PCCG_{wl2}CG_{wl2} \\
[87] \quad &- PCHT_{wl2} \left(\sum_j DI_{wl2,j}CIF_j + INV_{wl2} \right) \\
&- \sum_j PCCI_{wl2,j}DI_{wl2,j}(1 - CIF_j)
\end{aligned}
\tag{1}$$

VIII. Objective Function

$$[88] \quad \Omega = \omega \tag{1}$$

Total number of equations 396453

GLOSSARY OF THE VARIABLES AND PARAMETERS OF THE MODEL

I. Endogenous Variables:

Acronym	Designation	Number
1.1 Production		
LD_i	: Global demand for labour in sector i	10
$NQLD_i$: Demand for unskilled labour in sector i	10
QLD_i	: Demand for skilled labour in sector i	10
KD_{ngs}	: Demand for capital in non-governmental sectors (ngs)	9
CF_{agr}	: Composite capital-labour factor used in the agricultural sector	2
$LAND_{agr}$: Land factor used in the agricultural sector	2
A_{ngs}^{va}	: Total factors productivity in the ngs	9
VA_i	: Value Added per sector i	10
$DI_{i,j}$: Intermediate consumption of product i in sector j	100
CI_i	: Total intermediate consumptions per sector	10
XS_i	: Duty free production at factors costs per sector	10
XXS_i	: Production at factors costs including tax on production	10
1.2 Incomes and Savings of Resident Agents		
YG	: Government overall income	1

TVA_i	: VAT levied on composite produce i	10
$LCH_{h,m}$: Liability rate upon VAT for composite product m consumed by household h	98928
$LCI_{m,j}$: Liability rate upon VAT for composite product m consumed by sector j	90
LCG_m	: Liability rate upon VAT for composite product m consumed by Government	9
$TVAL_i$: VAT levied on locally produced good i	10
$TVAM_m$: VAT levied on imported good i	9
tvm_m	: VAT effective rate applied to imported good m	9
tvI_i	: VAT effective rate applied to local good i	10
$PTAX_i$: Tax revenue on production per sector	10
$TIAL_i$: Revenue of other indirect taxes levied on local product i	10
$TIAM_m$: Revenue of other indirect taxes levied on imported produce m	9
$TINDL_i$: Revenue of indirect taxes levied on local product i on the basis of the taxation system applied before the 1994 reform	10
$TINDM_m$: Revenue of indirect taxes levied on imported produce m on the basis of the taxation system applied before the 1994 reform	9
$ITAX$: Total amount of local taxes levied on products	1
TIM_m	: Amount of customs duties on imported product m	9
TIE_x	: Tax revenue from exports of produce x	9
DTH_h	: Amount of income taxes levied from household h	10992
DTF	: Amount of income taxes levied from enterprises	1
SG	: Government budget balance	1
YH_h	: Total incomes of household h	10992
YDH_h	: Available incomes of household h	10992
SH_h	: Savings of household h	10992
YF	: Total incomes of enterprises	1
SF	: Savings of enterprises	1

1.3. Demand for Resident Agents

CTH_h	: Total budget allocated by household h to the consumption of goods and services	10992
cty_h	: Variable of adjustment of the household's income tax	10992
$C_{h,i}$: Consumption (in volume) of good i by household h	109920
CG_i	: Volume of public consumption of good i	10
DIT_i	: Volume of the intermediate consumption of good i	10
INV_i	: Volume of good i used as an investment good /asset	10
IT	: Value of the total investment	1
$ITVOL$: Volume of the total investment	1

1.4 Foreign Trade and International Differentiation of Products

EXD_x	: International demand for export product x	9
EXS_x	: Offer of export product x	9
D_i	: Domestic product intended for the Local market	10
IM_m	: Imports of product m	9
Q_i	: Composite product i	10

1.5 Prices

wq_i	: Skilled labour wage rate	10
wnq_i	: Unskilled labour wage rate	10
w_i	: Composite labour average wage rate	10
r_i	: Rate of return on capital / Capital remuneration Rate	10
rc_{agr}	: Composite capital-labour factor remuneration rate	2
rl_{agr}	: Land factor remuneration rate	2
PV_i	: Added-value price in sector i	10
P_i	: Producer's composite price in sector i	10
PL_i	: Producer's price of domestic local products meant for the local market	10
PE_x	: Producer's price of exported products	9
$PFOB_x$: FOB price of exported produce x	9
PD_i	: All tax-included market price of domestic products meant for the local market	10
PM_m	: All tax-included market price of imported products	9
PC_i	: All tax-included average price of absorption of good i	10
$PCHT_i$: Price of composite good i , exclusive of VAT	10
$PCH_{h,i}$: All tax-included market price of good i consumed by household h	109920
$PCCG_i$: All tax-included market price of good i consumed by Government	10
$PCCI_{i,j}$: All tax-included market price of good i consumed by sector j	100
$PINDEX$: Index of value added prices	1
$PINDEXQ$: Index of all tax-included absorption prices	1
$PINDEXHT$: Index of absorption prices, exclusive of VAT	1
$PINDEXC$: Households' Consumer Prices Index	1

1.6 Welfare Indicator

EV_h	: Hicks's equivalent variation for household h	10992
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1.7 Equilibriums

rf	: Uniform equilibrium rate of return on capital in non-governmental sectors	1
rlf	: Uniform equilibrium rate of return on the land factor	1
wqf	: Uniform equilibrium rate of return on skilled labour	1
$wnqf$: Uniform equilibrium rate of return on unskilled labour	1
$LEON_{wl2}$: Walras Law General Equilibrium Checking Variable	1

1.8 Objective Function

Ω	: Variable of the objective function to be optimised using the GAMS Modelling software	1
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Total Number of Endogenous Variables: 396453

II. Exogenous Variables:

Acronym	Designation	Number
A_i^{sk}	: Scale variable in CETS function combining skilled labour and unskilled labour	10
A_{agr}^{cf}	: Scale variable of the CETS function of the composite labour-capital in the agricultural sectors	2
A_{gse}^{va}	: Total productivity of production factors in non-governmental sectors	1
B_{ngs}^{va}	: Scale variable of the total productivity of production factors in non-governmental sectors	9
A_m^M	: Scale variable in the function of differentiation by origin, between domestic products and imported products	9
B_x^E	: Scale variable in the function of differentiation by destination of goods, between export products and products intended for the local market	9
CAB	: Current Account Balance of the Balance of Payment	1
KD_{gse}	: Demand for capital in Government sectors	1
KG	: Government infrastructure capital	1
CIF_i	: Share of intermediate consumptions pertaining to the sub-sector subjected to VAT	10
$C_{h,i}^{MIN}$: Minimum volume of product i consumed by household h	109920
$TRF_{ins,inst}$: Transfers paid by the $inst$ agent to the ins agent	120890025
$LCH_{h,nm}$: Rate of liability of importable product nm consumed by household h	10992
$LCI_{nm,j}$: Rate of liability of non-importable nm consumed by sector j	10

LCG_{nm}	: Rate of liability of non – importable produce nm consumed by government	1
TVG	: General VAT rate	1
$TRSH_h$: Transitional savings of household h	10992
KST	: Total supply of capital in the economy	
$LANST$: Total supply of the land factor in the economy	1
$QLST$: Total supply of skilled labour in the economy	1
$NQLST$: Total supply of unskilled labour in the economy	1
e	: Nominal exchange rate	1
$cmps$: Households savings adjusting variable	1
tp_i	: Rate of the production tax	10
tal_i	: Rate of levy of other taxes on domestic products required on the local market	10
tam_m	: Rate of levy of other taxes on imported products	9
tm_m	: Rate of levy of customs duties on imports	9
te_x	: Rate of levy of duties and taxes on exports	9
txl_i	: Rate of domestic taxation of local products before the 1994 tax reform	10
txm_m	: Rate of domestic taxation of products imported before the 1994 tax reform	9

Total Number of Exogenous Variables: 121022066

III. Parameters:

Acronym	Designation	Number
$CTHO_h$: Total budget allocated to consumption during the baseline period, by household h	10992
$EXDO_x$: International demand for exported products during the baseline period	9
$PCCHO_{h,i}$: Market price x afforded by household h during the baseline period, for the purchase of product i	109920
α_i^{sk}	: Parameter of the ratio of skilled labour in the overall demand for the labour factor	10
α_{agr}^{fl}	: Parameter of the ratio of composite labour-capital factors in the value added of the agricultural sector	2
α_i^{kl}	: Parameter of the ratio of the overall demand for labour in the value added of non agricultural sectors, or in the composite labour - capital factors of agricultural sectors	10
α_m^M	: Parameter of the ratio of imported substitutes in composite product m	9

β_x^E	: Parameter of the ratio of exports in the production of sector x	9	
ρ_i^{sk}	: Parameter of substitution between skilled labour and unskilled labour under CETS functions of overall demand for labour	10	
ρ_{agr}^{cfl}	: Parameter of substitution between composite labour-capital factors and land under agricultural value added CETS functions	2	
ρ_i^{kl}	: Parameter of substitution between labour and non agriculture value added under CETS functions and of composite labour-capital factors in the agricultural sectors	10	
ρ_m^M	: Parameter of substitution between imported products and local substitutes under CETS functions of composite goods	9	
κ_x^E	: Parameter of transformation between exported products and products meant for the local market under CET functions of distinction based on the destination of the production	9	
σ_i^{sk}	: Elasticity of substitution between skilled labour and unskilled labour	10	
σ_{agr}^{cfl}	: Elasticity of substitution between the land factor and the composite labour- capital factor in agricultural sectors	2	
σ_i^{kl}	: Elasticity of substitution between labour and capital	10	
σ_m^M	: Elasticity of substitution between local products and imported substitutes	9	
τ_x^E	: Elasticity of transformation between exports production and production meant for the local market	9	
σ_x^X	: Elasticity relating to the measurement of the sensitivity associated to international demand for products exported following a variation in the ratio of world market prices on FOB exports prices	9	
δ_i	: Share of sector i in the economy's total added value	10	
ε_{ngs}	: Elasticity relating to the measurement of the sensitivity associated to factors total productivity vis-à-vis the external aspects of public infrastructures	9	
cef	: Elasticity relating to the measurement of congestion effects on factors total productivity	1	
v_i	: Fixed ratio of added value in the production sector		10
io_i	: Fixed ratio of intermediate consumptions in the production sector	10	
$aij_{i,j}$: Technical coefficients of intermediate consumptions	100	
$\xi_{h,i}^{chl}$: Rate of tax liability to VAT of local product i consumed by household h		109920
$\xi_{h,m}^{chm}$: Rate of tax liability to VAT of imported product m consumed by household h		98928
$\xi_{i,j}^{cil}$: Rate of tax liability to VAT of local product i consumed by sector j	100	
$\xi_{m,j}^{cim}$: Rate of tax liability to VAT of imported product m consumed by sector j		90
ξ_i^{cgl}	: Rate of tax liability to VAT of local product i consumed by Government		10

ξ_m^{egm}	: Rate of tax liability to VAT of imported product m consumed by Government	9
lrl_i	: Overall rate of tax liability to VAT of local product i	10
lrm_m	: Overall rate of tax liability to VAT of imported product as a whole	9
tyh_h	: Tax rate on the income of household h	10992
tyf	: Tax rate on the income of enterprises	1
$\gamma_{h,i}$: Budget share of good i consumed by household h	109920
mps_h	: Marginal propensity to save of household h	10992
λ_h^{wq}	: Ratio of remuneration of skilled labour paid to household h	10992
λ_h^{wnq}	: Ratio of remuneration of unskilled labour	10992
λ_h^{lh}	: Ratio of remuneration of land paid to household h	10992
λ^lf	: Ratio of remuneration of land paid to enterprises	1
λ_h^{kh}	: Ratio of capital remuneration owned to household h	10992
λ^{kf}	: Ratio of capital remuneration owned to enterprises	1
λ^{kg}	: Ratio of capital remuneration owned to the State	1
μ_i	: Share of investment for good i in the total investment	10
ω	: Level parameter in the objective function	1

Total Number of Exogenous Variables	506153
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Table 7: Changes in some macro-economic target variables following simulations

SCENARIOS	Technological changes	Devaluation	Fiscal Reforms	Public Infrastructures
VARIABLES				
EFFECTS ON PRICES				
Index of Producer Prices	-2.60	49.78	4.73	0.16
Index of exports domestic prices	0.00	50.00	0.00	0.00
Index of tax-exempted prices of production meant for the local market	-3.03	49.75	5.51	0.14
In Index of all taxes included-prices of production meant for the local market	-3.02	49.68	5.13	0.13
Index of all taxes included-domestic prices of imports	0.16	49.27	7.70	-0.09
Index of all taxes included-domestic prices of absorption (composite products)	-2.64	49.63	5.43	0.09
Index of households' consumer prices	-3.07	50.15	8.17	0.05
EFFECTS ON VOLUMES				
Production	12.05	0.22	0.75	3.06
Exports	0.21	4.99	-7.08	3.68
Production meant for the local market	13.98	-0.56	2.01	2.96
Imports	0.25	-3.34	-8.47	4.40
Composite products	12.33	-0.89	0.76	3.14
Households' consumption	12.06	-17.49	-3.17	2.54
Effects on Factors Remuneration				
Average wage rate	23.01	37.78	4.42	2.42
<i>In the agricultural sectors</i>	21.64	39.78	4.98	2.62
<i>In the non agricultural sectors</i>	23.62	36.95	4.15	2.32
<i>Skilled labour</i>	24.50	35.60	3.80	2.20
<i>Unskilled labour</i>	20.40	41.60	5.50	2.80
Rate of return on capital	12.68	42.12	3.17	2.65
<i>In the agricultural sectors</i>	4.82	54.46	9.21	3.75
<i>In the non agricultural sectors</i>	13.55	40.76	2.51	2.53
Rate of return on land	7.70	51.70	11.20	3.80
EFFECTS ON HOUSEHOLDS' BUDGET AND WELFARE				
Total households' incomes	17.32	30.31	3.62	1.96
Households' consumption budget	17.54	30.71	3.66	1.98
Hicks Equivalent Variation in percentage for households' initial consumption level (*)	19.93	-17.56	-3.01	1.88

Source: Construction made by the authors based on findings of the simulations. (*) A positive variation implies some improvement in the welfare and a negative variation implies degradation in the welfare.

Table 8: Contribution of scenarios in the changes in macro-economic variables witnessed between 1993 and 2001

Variables	Changes between 1993 and 2001 (in %)	Relative Contribution to the Changes (in %)			
		Technological Changes	Devaluation	Fiscal Reforms	Public infrastructures
Consumer Prices Index	77.04	-3.98	65.10	10.60	0.06
Real GDP at factors costs	36.82	44.78	0.82	2.79	11.37

Source: Construction made by the authors based on findings of the simulations.

Table 9: Variations in the incomes and wellbeing of households

Households Groups, Income and Wellbeing Categories	Shares in the total factor incomes for 2001	Variations (in %)				
		Technological Changes	Dévaluation	Fiscal Reforms	Public Infrastructures	
Urban Households	Income derived from skilled labour in agricultural sectors	1.86	15.51	52.44	8.89	3.76
	Income derived from unskilled labour in agricultural sectors	2.54	17.68	49.48	7.93	3.47
	Income derived from skilled labour in non agricultural sectors	56.24	25.35	32.92	2.79	1.99
	Income derived from unskilled labour in non agricultural sectors	12.21	24.37	30.73	2.11	1.77
	Income derived from the capital allocated to agriculture	4.99	3.49	55.27	8.08	3.78
	Income derived from the capital allocated to non agricultural activities	22.01	24.07	34.26	3.67	2.12
	Land Income	0.15	7.76	53.50	11.22	3.75
	Total Factors Income	100.00	23.45	34.88	3.43	2.16
	Total Income	-	17.83	26.52	2.61	1.64
	Consumption Budget	-	17.67	26.29	2.58	1.63
Hicks Equivalent Variation	-	20.67	-25.22	-4.16	1.55	
Rural Households	Income derived from skilled labour in agricultural sectors	13.41	15.48	52.48	9.00	3.77
	Income derived from unskilled labour in agricultural sectors	33.12	17.66	49.51	8.00	3.48
	Income derived from skilled labour in non agricultural sectors	20.99	28.17	32.46	3.38	2.06
	Income derived from unskilled labour in non agricultural sectors	10.78	23.98	30.71	1.90	1.76
	Income derived from the capital allocated to agriculture	12.39	3.82	55.07	8.34	3.78
	Income derived from the capital allocated to non agricultural activities	7.51	24.49	34.05	3.95	2.14
	Land Income	1.80	7.72	53.51	11.14	3.75
	Total Factors Income	100.00	19.88	42.88	6.09	2.90
	Total Income	-	16.58	35.74	5.07	2.41
	Consumption Budget	-	17.33	37.41	5.31	2.52
Hicks Equivalent Variation	-	18.80	-5.96	-1.26	2.39	

Male-headed Households	Income derived from skilled labour in agricultural sectors	7.20	15.48	52.48	8.99	3.77
	Income derived from unskilled labour in agricultural sectors	14.71	17.67	49.50	7.98	3.47
	Income derived from skilled labour in non agricultural sectors	42.29	26.09	32.88	2.97	2.02
	Income derived from unskilled labour in non agricultural sectors	11.65	24.38	30.93	2.17	1.79
	Income derived from the capital allocated to agriculture	5.73	3.66	55.17	8.21	3.78
	Income derived from the capital allocated to non agricultural activities	17.58	24.32	34.25	3.84	2.14
	Land Income	0.85	7.74	53.50	11.18	3.75
	Total Factors Income	100.00	22.14	38.20	4.57	2.47
	Total Income	-	17.59	30.35	3.63	1.96
	Consumption Budget	-	18.76	32.40	3.88	2.10
Hicks Equivalent Variation	-	21.17	-13.20	-2.67	2.00	
Female-headed Households	Income derived from skilled labour in agricultural sectors	5.46	15.49	52.47	8.97	3.76
	Income derived from unskilled labour in agricultural sectors	20.00	17.65	49.53	8.03	3.48
	Income derived from skilled labour in non agricultural sectors	35.82	25.43	32.50	2.68	1.93
	Income derived from unskilled labour in non agricultural sectors	11.39	23.49	29.92	1.46	1.68
	Income derived from the capital allocated to agriculture	7.51	3.69	55.15	8.23	3.78
	Income derived from the capital allocated to non agricultural activities	18.91	23.74	33.98	3.46	2.09
	Land Income	0.92	7.66	53.53	11.04	3.75
	Total Factors Income	100.00	21.00	38.87	4.59	2.49
	Total Income	-	16.27	30.12	3.56	1.93
	Consumption Budget	-	13.75	25.48	3.01	1.64
Hicks Equivalent Variation	-	16.09	-31.08	-4.07	1.54	

Source: Construction made by the authors on the basis of the findings following simulations.

Table 10: Intrinsic Impacts of various shocks on Poverty and Gini Indices

Poverty (*) and Inequality Indices per category of households		Level of the indices in 2001	Variations (in % points for poverty indices)			
			Technological Changes	Devaluation	Fiscal Reforms	Public Infrastructures
Cameroon	FGT0	40.22	-6.50	-0.36	0.71	-1.87
	FGT1	13.76	-3.21	-7.72	-0.19	-1.43
	FGT2	6.38	-1.87	-8.53	-0.30	-0.92
	Gini Index	0.4575	0.0028	-0.1110	-0.0111	-0.0046
Urban households	FGT0	17.97	-8.69	2.20	1.69	-1.39
	FGT1	4.56	-3.43	-3.32	0.30	-0.73
	FGT2	1.75	-1.75	-3.36	0.05	-0.39
	Gini Index	0.4538	-0.0118	-0.0656	-0.0066	-0.0027
Rural households	FGT0	52.17	-5.33	-1.74	0.18	-2.13
	FGT1	18.70	-3.10	-10.08	-0.45	-1.80
	FGT2	8.86	-1.94	-11.32	-0.50	-1.21
	Gini Index	0.3906	0.0027	-0.1083	-0.0071	-0.0029
Male-headed households	FGT0	40.54	-7.15	-2.07	0.55	-2.00
	FGT1	14.01	-3.49	-9.22	-0.32	-1.53
	FGT2	6.51	-2.06	-9.73	-0.38	-0.99
	Gini Index	0.4615	0.0031	-0.1136	-0.0114	-0.0046
Female-headed households	FGT0	39.18	-4.43	5.08	1.23	-1.45
	FGT1	12.95	-2.35	-2.89	0.24	-1.11
	FGT2	5.97	-1.28	-4.68	-0.02	-0.70
	Gini Index	0.4443	0.0017	-0.0992	-0.0099	-0.0042
Poverty Headcount (FGT0): Households categorized on the basis of the Household Head main sector of activity	Agriculture, fishing, hunting,	57.05	-3.12	-3.79	-0.97	-2.26
	Stockbreeding,	51.02	-4.73	-16.71	0.34	-3.05
	Mining	24.31	0.00	-27.47	6.65	0.00
	Food Industry	20.54	-28.58	-19.48	-16.05	-6.92
	Textile Industry	29.20	-16.19	-9.66	-3.75	-1.86
	Wood Industry	22.19	-15.01	-1.88	5.56	-0.41
	Chemical Industry	13.19	-19.38	-3.25	-2.89	-2.89
	Construction materials	11.71	-3.22	-3.59	-1.05	-0.12
	Metal and mechanical repair works	26.10	-13.40	-8.20	0.76	-2.33
	Energy, gas, water	19.68	-5.14	-3.64	2.07	-2.80
	Construction and public works	30.59	-10.89	4.18	5.10	-1.33
	Transport	19.61	-10.93	-1.40	3.61	-0.21
	General Trade	18.44	-11.64	1.03	4.94	-1.48
	Foodstuff Trade	22.64	-12.90	7.50	4.35	-1.99
	Other forms of trade	29.28	-8.58	6.16	3.13	-1.03
	Hotels and Restaurants	25.09	-5.14	-0.84	2.82	0.00
	Banking and Insurance	1.93	-3.76	-1.18	2.02	0.00
	Public services	13.45	-14.56	4.18	1.28	-1.27
	Other services	24.67	-10.29	-1.63	1.94	-2.74
	Unclassified	28.36	-3.53	12.01	2.88	-1.23

Source: Construction made by the authors on the basis of the findings of simulations.
 (*) FGT0: Poverty Headcount ratio; FGT1: Poverty Gap; FGT2: Poverty Severity.

Table 11: Contribution of each scenario to the changes in Poverty Headcount Ratio (FGT0) witnessed between years 1993 and 2001

Households Categories	FGT0 Level in 2001 (in %)	Changes witnessed between 1993 and 2001 (in percentage points)	Contribution relating to the shocks (in %)			
			Technological Changes	Devaluation	Fiscal Reforms	Public Infrastructures
Cameroon	40.22	-20.96	31.01	1.72	-3.39	8.92
Urban households	17.97	-30.88	28.11	-7.12	-5.47	4.53
Rural households	52.17	-15.84	33.65	10.98	-1.14	13.45
Male-headed households	40.54	-21.76	32.86	9.51	-2.53	9.24
Female-led households	39.18	-11.36	39.00	-44.81	-10.83	12.76

Source: Construction made by the authors on the basis of the findings following simulations.

Table 12: Growth Effects versus Redistribution Effects within Changes in Poverty Headcount Ratio (FGT0)

Groupes de ménages	FGT0 Level in 2001 (in %)	Contribution of Growth and Redistribution to the change of FGT0 (in percentage points)		
		Growth Effects	Redistribution Effects	Overall Effect
Technological Changes				
Cameroon	40.22	-6.53	0.03	-6.50
Urban households	17.97	-6.93	-1.76	-8.69
Rural households	52.17	-5.41	0.08	-5.33
Male-headed households	40.54	-6.93	-0.22	-7.15
Female-led households	39.18	-4.66	0.23	-4.43
Devaluation				
Cameroon	40.22	6.68	-7.04	-0.36
Urban households	17.97	11.10	-8.90	2.20
Rural households	52.17	-2.11	0.37	-1.74
Male-headed households	40.54	4.61	-6.68	-2.07
Female-led households	39.18	13.46	-8.38	5.08
Tax Reform				
Cameroon	40.22	1.71	-1.00	0.71
Urban households	17.97	2.74	-1.05	1.69
Rural households	52.17	0.37	-0.19	0.18
Male-headed households	40.54	1.29	-0.75	0.55
Female-led households	39.18	2.34	-1.11	1.23
Rehabilitation of Basic Infrastructures				
Cameroon	40.22	-1.79	-0.08	-1.87
Urban households	17.97	-1.08	-0.31	-1.39
Rural households	52.17	-2.15	0.02	-2.13
Male-headed households	40.54	-2.08	0.08	-2.00
Female-led households	39.18	-1.22	-0.23	-1.45

Source: Construction made by the authors on the basis of the findings following simulations.

Table 13a: Effects on Prices and Volumes by Production Sector

Production sectors	Changes in domestic prices							Changes in volumes					
	Production	Exports	Imports	Prod. For local market (Tax and duty-free)	Prod. for local market (tax included)	Composite products	Households consumption	Production	Exports	Imports	Production for local market	Demand for composite products	Households consumption
Technological Changes													
Food crops agric.	3.16	0.00	0.44	3.19	3.19	3.16	3.15	4.71	0.65	0.00	4.74	4.70	4.84
Cash crops agric.	-47.39	0.00	0.00	-81.80	-81.80	-81.75	-81.72	42.87	68.96	0.00	23.92	23.91	15.31
Forestry	7.03	0.00	0.20	7.47	7.47	7.43	7.39	15.97	-20.50	0.00	18.28	18.18	4.79
Crude oil	0.09	0.00	0.00	5.30	5.30	0.27	0.00	-44.58	-45.18	15.81	-10.55	14.48	0.00
Food industries	-1.61	0.00	0.05	-1.73	-1.73	-1.51	-1.52	12.58	19.32	3.96	12.08	11.08	12.40
Processed wood	-3.62	0.00	0.08	-5.69	-5.66	-5.65	-5.69	22.00	35.14	0.00	14.45	14.42	12.77
Refined oil	-1.62	0.00	-0.09	-2.27	-2.33	-2.09	-2.03	17.72	23.15	7.31	15.56	14.68	11.25
Other industries	-4.23	0.00	0.28	-4.67	-4.62	-3.20	-3.97	19.99	35.05	-3.70	18.39	11.97	13.57
Services	-7.02	0.00	0.00	-7.38	-7.38	-7.04	-6.90	18.17	36.84	-8.52	17.21	16.03	14.82
Public utilities	27.93	0.00	0.00	27.93	27.93	27.93	0.00	-2.77	0.00	0.00	-2.77	-2.77	0.00
All sectors	-2.60	0.00	0.16	-3.03	-3.02	-2.64	-3.07	12.05	0.21	0.25	13.98	12.33	12.06
Devaluation													
Food crops agric.	49.77	50.00	49.43	49.76	49.76	49.76	49.76	11.68	8.91	0.00	11.71	11.59	-7.64
Cash crops agric.	75.64	50.00	50.00	94.26	94.25	94.22	94.22	7.21	2.72	0.00	10.48	10.46	-4.54
Forestry	43.72	50.00	50.26	43.32	43.32	43.36	43.39	-7.55	21.78	0.00	-9.41	-9.35	-10.25
Crude oil	49.95	50.00	50.00	47.11	47.11	49.85	0.00	0.14	0.19	-4.22	-2.67	-4.14	0.00
Food industries	49.68	50.00	49.80	49.65	49.64	49.66	49.77	-0.37	8.14	-11.45	-1.00	-2.29	-18.18
Processed wood	50.54	50.00	49.60	50.85	50.68	50.68	50.86	5.26	11.87	0.00	1.47	1.47	-14.98
Refined oil	48.36	50.00	50.13	47.71	47.80	48.05	48.06	-5.43	10.24	-46.12	-11.68	-15.37	-16.01
Other industries	51.50	50.00	48.55	51.66	51.37	50.55	51.77	5.55	7.98	10.60	5.30	6.84	-20.57
Services	50.42	50.00	50.00	50.44	50.41	50.39	50.51	-6.78	8.04	-39.77	-7.54	-9.03	-20.63
Public utilities	34.80	0.00	0.00	34.80	34.80	34.80	0.00	5.65	0.00	0.00	5.65	5.65	0.00
All sectors	49.78	50.00	49.27	49.75	49.68	49.63	50.15	0.22	4.99	-3.34	-0.56	-0.89	-17.49

Source: Construction made by the authors on the basis of the findings following simulations.

Tableau 13b: Effects on Prices and Volumes by Production Sector

Sectors of production	Changes in domestic prices							Changes in volumes					
	Production	Exports	Imports	Prod. For local market (Tax and duty-free)	Prod.for local market (tax included)	Composite products	Households consumption	Production	Exports	Imports	Production for local market	Demand for composite products	Households consumption
Tax Reform													
Food crops agric.	5.81	0.00	11.05	5.85	5.80	5.86	5.90	1.55	-6.56	0.00	1.63	1.61	-7.64
Cash crops agric.	10.65	0.00	-48.90	18.39	-13.21	-13.23	18.54	9.29	1.71	0.00	14.81	14.79	-4.54
Forestry	2.96	0.00	17.17	3.15	1.38	1.46	3.28	-5.23	-29.29	0.00	-3.72	-3.69	-10.25
Crude oil	0.06	0.00	2.58	3.20	-2.10	2.34	0.00	-0.35	-0.65	-6.35	17.04	-5.17	0.00
Food industries	6.83	0.00	9.00	7.33	3.18	3.90	7.11	3.81	-28.35	-26.06	6.19	2.21	-18.18
Processed wood	2.22	0.00	5.91	3.49	6.53	6.53	17.63	-3.73	-11.31	0.00	0.63	0.63	-14.98
Refined oil	-1.19	0.00	18.23	-1.66	9.31	10.26	9.38	-3.58	0.58	-60.74	-5.23	-11.17	-16.01
Other industries	6.34	0.00	9.80	7.01	6.63	7.55	15.11	4.98	-18.49	-10.25	7.48	2.33	-20.57
Services	4.25	0.00	-0.36	4.47	5.07	4.82	6.55	-1.48	-11.92	18.45	-0.94	-0.05	-20.63
Public utilities	3.18	0.00	0.00	3.18	3.18	3.18	0.00	0.66	0.00	0.00	0.66	0.66	0.00
All sectors	4.73	0.00	7.70	5.51	5.13	5.43	8.17	0.75	-7.08	-8.47	2.01	0.76	-3.17
Rehabilitation of basic Infrastructures													
Food crops agric.	0.34	0.00	-0.09	0.34	0.34	0.34	0.33	4.05	3.79	0.00	4.06	4.02	2.16
Cash crops agric.	0.49	0.00	0.00	0.86	0.85	0.85	0.85	2.61	1.26	0.00	3.60	3.60	1.18
Forestry	-0.27	0.00	0.07	-0.29	-0.29	-0.29	-0.29	2.13	4.72	0.00	1.96	1.95	2.04
Crude oil	0.00	0.00	0.00	-0.04	-0.04	0.00	0.00	5.23	5.26	2.64	3.73	2.69	0.00
Food industries	0.20	0.00	-0.02	0.21	0.21	0.18	0.19	3.43	2.39	4.92	3.51	3.68	2.91
Processed wood	-0.06	0.00	-0.06	-0.10	-0.13	-0.10	-0.10	3.06	2.74	0.00	3.24	3.24	2.24
Refined oil	-0.38	0.00	0.04	-0.53	-0.51	-0.43	-0.48	2.46	3.48	0.22	2.05	1.85	2.38
Other industries	0.13	0.00	-0.16	0.15	0.12	0.01	0.14	3.31	2.28	5.65	3.42	4.07	2.68
Services	-0.20	0.00	0.00	-0.21	-0.21	-0.20	-0.19	2.49	2.35	2.51	2.50	2.50	2.50
Public utilities	1.27	0.00	0.00	1.27	1.27	1.27	0.00	0.63	0.00	0.00	0.63	0.63	0.00
All sectors	0.12	0.00	-0.09	0.14	0.13	0.09	0.05	3.06	3.68	4.40	2.96	3.14	2.54

Source: Construction made by the authors on the basis of the findings following simulations.