



The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.



Global Trade Analysis Project

<https://www.gtap.agecon.purdue.edu/>

This paper is from the
GTAP Annual Conference on Global Economic Analysis
<https://www.gtap.agecon.purdue.edu/events/conferences/default.asp>

UNIVERSITE D'Auvergne

CENTRE D'ETUDE ET DE RECHERCHE SUR LE DEVELOPPEMENT
INTERNATIONAL
(CERDI)

**IMPACT OF THE LIBERALIZATION OF TRADE IN SERVICES
ON AFRICA: CASE OF TELECOMMUNICATIONS SERVICES IN
CAMEROON**

By : CALVIN DJIOFACK ZEBAZE

TABLE DES MATIERES

INTRODUCTION

II. Telecommunications activities and policies in Cameroon

II.1 access to telecommunications services in Cameroon

II.2 Evolution of the legal framework

III. Survey of literature estimating the impact of trade in services on poverty

III.1 CGE and analysis of Trade services impact

III.2 CGE and poverty: microsimulation studies

IV. Model analyzing poverty impact of telecommunications liberalization in Cameroon

IV-1. CGE module

IV.1-1 Production technology:

IV-1-2. mathematical formalization

IV-1-3. Imperfect competition and price setting: pro-competitive effect

IV-1 - 4. Other equations in the model

A. factors Market

B. External Trade

C. Savings and incomes

D. closures relations

IV.2 Poverty module

IV.2-1 Measurement of poverty

IV.2-2 Poverty line

IV.2-3 Sequential Macro-Micro simulation

V. Calibration and simulations results

V.1. Presentation of the Social accounting matrix (SAM)

V.2. Household database and consistency with the CGE model

V.2.-1 Correction of households income : model of Heckman

V.2-2 Adjustment of ECAMII data to those of the SAM

V.3. Estimation of the CGE model parameters

V.3-1 Determination of the level of the markup and their elasticity with respect to the number of firm

V.3-2 Determination of parameters related to the productivity effect: The indicator of telecommunications access and their elasticities with respect to growth.

V.3-3 Elasticities of behavior functions

VI. Simulations and results

VI.1 Specification of scenarios

VI.2 macro economics results

VI.2-1 households' revenue

VI.2-2 Others macroeconomic indicators

VI.3 Sectoral effect

VI.3-1 production effects

VI.3-2 Prices effect

VI.3-3 Wages and capital return

VI.4 Poverty effect

VI.4-1 Poverty effect at national level

VI.4-2 Poverty by category of households

VI.5. results discussion

VI.5-1 Alternative model: modeling the productivity effect through the Pro-variety effect of telecommunications:

VI.5-2 Macroeconomic and factors closures rule

VI.5-3 sensitivity to the parameters

Conclusion

REFERENCES

Annex

Annexe II. SAM and Calibration

Annexe.I CGE and households model results of main model

ANNEXE.III : CGE model

ANNEXE.IV: Presentation of CGE model

Notations

Indices et set

Parameters

exogenous Variables

endogenous Variables

Equations

List of Tables

Table 1. Income elasticity

Table.2 Indicator macroeconomics

Table.3: production

Table.4 Price effect

Table.5 factors' remunerations

Table.6 Poverty effect at national level

Table.7 : poverty indicator per households category(central scenario only)

Table. 8: poverty indicator per households category (central scenario only)

Table.9 Closures rule sensitivity

Table AI-1. Final consumption, investment and intermediate consumptions prices

Table.AI-2 Poverty indicator by category of households

Table.AI-3 Variety effect simulations

Table AI-4. Results of alternatives closures rules (sensitivity analysis)

Table.AII-1 : estimations of microeconomic revenues

Table AII-2 Introduction of new services or new technologies in Cameroonian telecommunications market between 1999 et 2007

TableAII-3 Social Accounting Matrix of Cameroon in 2001

TableAII-4 Correspondences between Sam sectors and ECAM II products nomenclature

List of figures

Figure 1. Evolution of penetration in African and Cameroon

figure.2 : fonction de production multi-niveaux

figure.3 Sensitivity of households income in respect to the parameters values

Figure.AIII-1 Allocations de la consommation et de la production domestique

INTRODUCTION

In the last 80's, Cameroonian government has undertaken a set of reforms in the services sector, leading notably to the privatization and openness to competition of important services, such as telecommunications, electricity, transportations and finances. The last majors acts of this long process have been the submission in 2005 of a pre-commitment list of multilateral liberalization in the framework of GATS (General Agreements on trade in services) at WTO and the publication in 2006 of the privatization offers of the last two important public companies, in transportation sector (Cameroon air lines: CAMAIR) and telecommunications sector (Cameroon Telecommunications CAMTEL).

Among sectors involved in liberalization process, telecommunications which has been partially liberalized with the entry of two private operators in mobile segment (between 1999 and 2001) is undeniably the sector showing the most spectacular transformation, notably with the increase of services varieties, the decrease of prices (Djiofack and Keck. 2006) and the amelioration of penetration; the number of telephone subscribers increasing from 200 000 in 2001 to 2 600 000 in 2006.

If reforms aimed at boosting activity in particularly inefficient and dramatically unbalanced sectors, they were also a means to alleviate commitments of the State (facing an unsustainable debt burden) and are nowadays an entire part of global policy to reduce poverty. In fact, from the statute of an Intermediary income country in 1985, Cameroon is since 2000 ranked among Heavily Indebted Poor Countries (HIPC), with an external debt over 240% of exports in 2000 and the poverty incidence over 41% in 2001 (ECAM II report, 2001).

In a crucial moment where Cameroonian government is about to attribute a private license in fixed telephony segment and a third license in the mobile segment, the aim of this work is to assess, the impact of telecommunications liberalization on poverty using a combined macro-micro simulation model.

The telecommunications services trade liberalization can affect households, either directly through prices or employments, or indirectly via economic growth (Dollar and Kraay, 2001). Even if the direct effect is not very intuitive since telecommunication is traditionally an urban activity in Africa, it seems however, potentially important due to the recent transformations which set the telecommunications as a mass consumption product. The indirect effect is more obvious because of the crucial role that telecommunications services play in the competitiveness and productivity of the economy (as a whole), as an important input in production activities and as an exchange facilitators (Eby Konan et al, 2002).

Number of recent studies evidences the positive effect of services trade liberalization on household welfare (see Warren, 2000; Verikios et al, 2002; Hertel et al, 2000). However, only the study of Rutherford et al (2005) on Russia assessed the impact of services liberalization on poverty. The main innovation of their model is that they account for the foreign direct investment in business services and consider additional varieties of business services that endogenously increase the productivity of sectors using that service through the Dixit-Stiglitz (1997) variety effect.

This paper follows the framework set in Rutherford et al (2005) and Eby Konan et al (2006), by considering the imperfect competition in services sectors and modeling the productivity gain. However, three contributions have to be underlined:

First, instead of modeling productivity gain through the only variety effects, we model the overall productivity gains occurring from trade in services. This is done by introducing the level of penetration, as input of global productivity of factors (GPF). The penetration is based itself on the level of liberalization (number of operators). The two elasticities characterizing these relationships have been estimated in the chapter 2, using a model of simultaneous equations, estimating on the one hand, the effects of penetration on growth and on the other hand, the effects of liberalization on the penetration. Our approach allows capturing other sources of productivity gains than variety effects, which can be substantial in the case of trade in services¹.

Second, instead of modeling the market power (markup) through the Lerner equilibrium (profit maximization), we adopt the Eastman-Stykolt (1960) approach (see Warren (2000) and Eby Konan (2002)). This approach consists for producer, to impose a surplus (representing the markup rate) over the average cost. The markup has been estimated in an econometric model, allowing to determine the market power and its elasticity with respect to the service liberalization indicator (number of operators).

Third, contrary to the studies discussed above, we follow Verikios and al (2002) in assuming the non substitutability of domestic and imported services, for finances and telecommunications sectors, as the domestic suppliers of these services do not directly compete with foreign service suppliers in cross-border trade.

Our results show that the liberalization is successful in reducing poverty, for rural households as well as for urban households, even if the urban categories benefit the most.

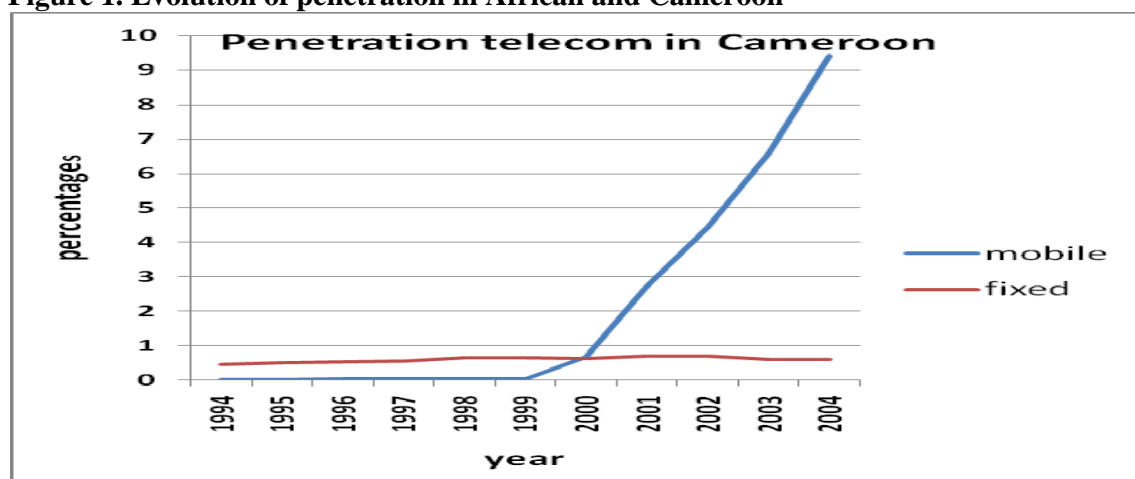
This paper is organized as follows: the next section presents the place of telecommunication and the development of its trade policy in Cameroon. Section III proceeds to review of literature analyzing the poverty effects of liberalization of trade in services. Section IV presents the empirical model to analyze the effects of liberalization of trade in services. The model consists in two steps: first, we use the Cameroonian SAM (social accounting matrix) for 2001 to simulate in a Computable general equilibrium model (CGE) the impact of policy changes on macroeconomic indicators. The second step, relying on the database of households income survey for Cameroon in 2001 (ECAMII), use the output of CGE model to estimate the impact of policy changes at individual level. This step follows the accounting macro-micro simulation approach developed in Chen and Ravallion (2003). Section V proceeds to the calibration of the model while, section VI presents the simulations scenarios and results. The last section provides the conclusions and main recommendations of the study.

¹ These include notably the gain of rationalization, where trade shift production to more efficient firms within an industry and the technical progress that may induce firms to move down their average cost curves.

II. Telecommunications activities and policies in Cameroon

Like in most of African countries, Cameroonian telecommunications sector has benefited from a spectacular development since the year 2000. The contribution of telecommunications to the added value has grown from 2% in 2001 to 3.5% in 2006. In its 2003 economic report, the BEAC (central bank of Cameroon) attributed more than 2% of Cameroonian growth in 2003 to the development of telecommunications services. The services of mobile telephony were the most dynamic (see BEAC, 2003). In fact, the number of subscribers to mobile telephony has increased more than tenfold in just 5 years, moving from 135000 in 2000 to 2.5 million in 2006. This represents a change in penetration rate from 1% to 15% of population (see figure 1).

Figure 1. Evolution of penetration in African and Cameroon



Source: author construction

The development of Internet services has also been substantial, despite the constraints related to access to computers and the mediocrity of the fixed telephone network. While the first Internet connection in the country is very recent (since 1997), there were more than 1 million Internet users in 2006, including 10000 subscribers². This sector has a great potential for jobs both for highly skilled people and for young qualified medium people through Internet coffees (currently estimated at more than 400) that offer a range of services including messaging, information searches, consultations databases, the Net phone, the webcam and other services.

With only 115000 subscribers in 2004, fixed telephony segment remains the weakest link in the chain of Cameroonian telecommunication and shows modest results despite 40 years of public monopoly on all segments of telecommunications (fixed, mobile, fax, telegram). On the eve of liberalization and the introduction of mobile telephony in 1997, the IMF painted a grim situation of fixed sector: only 0.5% of the population had access to telephone lines, only 43% lines installed were in service due to technical problems, the waiting list represented twice the number of lines connected, and the average waiting time to install a new line was five and a half years. This provision has not changed substantially although the competition of mobile segment. Thus, the fix penetration remained under 1% of population between 2001 and 2004 (see figure 1).

² Figures are provided by the « Mission Economique française » in Yaoundé

Evolution of the legal framework

Like in most countries, telecommunications were long considered in Cameroon as a public service area, separated from the commercial sphere. Thus the sector remained until 1998 a public monopoly, on the one hand provided by the International Telecommunication Company of Cameroon (INTELCAM), which was in charge of international telecommunications network, and on other hand by the Department of Telecommunications of the Ministry of Posts and Telecommunications, which had responsibility for the national network.

The diagnostic of deficiencies in public management (as noted above) and ambition to benefit from the development of new technology in the field of telecommunications at the international level have spurred a broad sector reform in the context of structural adjustment plans. The reform, brought by the law of July 1998, aimed primarily at liberalizing the sector through privatization of the public entity and the opening to competition. It also helped on the one hand to merge activities of international and domestic telecommunications within a new structure, CAMTEL, and on other hand to the establishment of a regulatory body, the Agency for Telecommunications Regulatory Board (ART) to ensure the proper functioning of the sector and competition among operators.

Although the company of fixed telephony, CAMTEL, has still not found a taker, liberalization has nevertheless allowed the entry of two private mobile phone companies: Mobile Telecom Cameroon (MTN), subsidiary of the South African of the same name (license obtained in January 2000), and Cameroon Orange, a subsidiary of France Telecom / Orange (license obtained in June 1999).

While telephony field seems a little competitive with a public monopoly (CAMTEL company) on the network of fixed and duopoly on the Mobile Network (MTN and Orange companies), the opposite is true for the distribution segment of the Internet, which is very competitive with more than 400 Internet coffees mainly in the cities of Yaoundé and Douala (but rising sharply in other provincial cities).

However, the privatization of CAMTEL and the granting of a new license in mobile telephony announced by the government may improve competitiveness in the telephone market and above all improve national coverage. In 2006, the operators were covering only nearly 2.5 million subscribers (fixed and mobile) in a total potential estimated at 5 million in the mobile market alone³.

Like in most African countries, the development of telecommunications policies in Cameroon traditionally takes place away from the sphere of multilateralism of GATS; international aspects of the regulations in the domestic telecommunications services (interconnection issues of standards, and Tariff) being discussed under an international advisory committees of the ITU or bilateral agreements between international service providers (Sekou, Falil Doumbouya, 2004). Thus, the country has not commitment in the framework of GATS to date. However, a “proposal of offer” (or pre-commitment) has been submitted at WTO in 2004, in the perspective of an agreement on Doha round negotiations.

³ These figures are from the « Mission Economique française »

Despite liberalization, the State is still very present in the area, maintaining a monopoly on fixed telephony and especially retaining the prerogative policy guidance and regulation of the sector, through the regulatory body (ART) on which he has total control.

III. Survey of literature estimating the impact of trade in services on poverty

Our analysis relies on two domains of literature: the literature of trade in services liberalization modeling in CGE and the literature of impact analysis in poverty.

III.1 CGE and analysis of Trade services impact

The literature on trade in services liberalization can be differentiated by (i) the type of trade restriction considered; (ii) the number of countries considered; (iii) and the way to introduce the assumptions of imperfect competition into the CGE model.

As mentioned above, the GATS distinguish four modes of supply of services. For each mode, it distinguishes between two types of trade barriers: market access and national treatment. There are therefore eight types of protections possible for each service. However, most CGE models study liberalization of services, either through mode 1 (cross-border trade) or solely through the mode 3 (commercial presence: FDI) or mode 4 (temporary movement of natural persons).

The pioneering study by Brown et al. (1996) adopts a multi-regional approach, which allows to account for the interaction among regions and countries. Based on the Michigan data base, these authors simulate the effects of a 25% reduction in ad valorem tariff equivalent of trade barriers on cross-border trade (mode 1). They conclude that liberalization promotes trade for all countries. This approach, also used by Hertel (1999), focuses on cross-border trade and does not account for FDI in services (mode 3) which is one of the key vehicles by which services are traded internationally⁴.

Dee and Hanslow (2000) addressed this shortcoming by assessing separately the cross-border trade (mode 1) and the investments flows mode (3)⁵. They also modeled the effects of product variety, expressing consumer welfare as a positive function of services varieties. Therefore, the global gains from removing barriers to trade in services come from four sources: improvements in the allocation of resources, increased returns to the world stock of capital, increased product variety, and terms of trade variation. However, their models containing only three sectors, including a single aggregate service sector, are rather stylized.

Verikios and Zhang (2001) extend Dee and Hanslow (2000) model to focus on two individual sectors: telecommunications and financial services. Trade liberalizing in telecommunications is estimated to increase world GNP by 0.1 per cent (roughly \$US 24 billion)⁶.

⁴ Other studies focusing only on mode 1 are from Chadha (2000), Chadha et al. (2001), Benjamin et Diao (2000), The Australian Department of Foreign Affairs (1999), Robinson et al. (1999), Francois et al (2002) and World Bank (2002)

⁵ Other studies modelling the mode 3 are from Brown and Stern (2001), Eby Konan and Maskus (2002), Tarr, Markusen (2002) and Jensen et al (2004 and 2005).

⁶ The above studies relying in multi-regional CGE have many inconvenient. The quality of data at worldwide could be doubtful, particularly for developing countries. In addition, the worldwide framework imposes the same assumptions to all countries in market structure (see Hertel, 1999).

Recent studies provide a more detailed model at the level of single countries to assess the impact of trade in services liberalization. The more representative are from Jensen et al, (2002, 2004), Rutherford, et al (2005) based on Russia, and Eby Konan (2006) based on Tunisia. Like Verikios and Zhang (2001), Rutherford et al (2005) modeled separately mode 1 and mode 3, and then introduce the gains of varieties. However, their variety gains (following Dixit and Stiglitz, 1977) is modeled through a production function, rather than consumer's welfare. The authors assumed that openness to FDI in services sector increased the varieties of services, which in turn enhanced the productivity in sectors using business services as input. In the case of Russia, they find that the main gain is provided by the productivity effect allowed by the FDI liberalization. The mean welfare gain to Russia from its WTO accession, averaged over all households amounts to 7.3 percent of Russian consumption when the productivity effect is included, and would be only about 1.2 percent otherwise.

But this approach limits the productivity gains occurring from liberalization to the gain of variety, ignoring other productivity sources such as rationalization gains, where trade shift production to more efficient firms within an industry and the technical progress that may induce firms to move down their average cost curves. In this study, we try to account for the full productivity gain by estimating it from an econometric model. The model is explained in the next section.

Other limitation of Rutherford et al (2005) study is that their model adopted a pricing approach assuming the Chamberlain "monopolistic competition" before and after liberalization⁷. This approach relies on the assumption of free entry and exit of firms, which seem particularly inappropriate for telecommunications services, where liberalization always consisted either of the transformation of public capital into private capital, or of the introduction of competition by allowing limited licenses (Konan et al, 2006).⁸.

Konan et al (2006) circumvent this limitation in the case of Tunisia and derived the lerner markup condition by considering alternative market structures (monopoly, oligopoly, cartel and monopolistic competition) in order to determine the impact of telecommunications liberalization under each market structure. The consideration of alternative market structures allows the authors to highlight the role of regulation on the impact of telecommunications liberalization in Tunisia. The Tunisia gain from the attribution of a supplementary license in telecommunication would be 0.65 per cent of welfare gain if there is a strong pro-competitive environment that permits the constitution of a Cournot duopoly. Otherwise, the two firms would collude (yielding to a cartel) and the economy would face a loss of 0.25 per cent of welfare. However, Eby Konan et al's results suffer an important drawback, as the level of initial markup, which deeply influences the amplitude of effects in this kind of model (see Jeffrey J. Reimer 2002), is assumed subjectively. Our study corrects this shortcoming by estimating the markup through an econometric model.

⁷ They model a situation where each company within an industry is supposed to offer a differentiated product from those of rivals, and where no company have enough power to be able to control the prices of others. In this context, firms characterized by increasing returns to scale will maximize their profits by equalizing the marginal revenue and the marginal income, while considering the assumption of zero profit

⁸ The choice of monopolistic competition relies much more on ease of modeling than on its realism (see P. R. Krugman and M. Obstfeld, 2003). Indeed, the assumption of zero profit exonerate from having to derive the elasticities, a necessity to determine the level of markup Associated (under alternative market structure).

Alongside the choice of an appropriate market structure, the maximization approach also suffers from the complexity of computing income elasticity for consumers and sectors using goods as an indicator of intermediate consumption. Therefore, many studies prefer a more practical approach known as Eastman-Stykolt (1960) (see Warren (2000) and Eby Konan (2002)). It consists of imposing an extra price (markup) over the average cost. The surplus is determined outside the model. This margin may represent the difference between the domestic price and the international price of the service, it may also be estimated through econometric techniques, giving price elasticities over trade policy. This approach is the one used in the present study.

III.2 CGE and poverty: microsimulation studies

In the perspective of poverty analysis, the conventional Computable General Equilibrium (CGE) model is not sufficient. It only provides the income effect for the representative households group specified in the SAM.

To circumvent this limitation, the CGE pioneering studies assumed a functional form of the distribution of revenue for each category of household specified in the model (see De Melo and Robinson (1982); De Janvry et al (1991); and Decaluwé et al (1999 and 2005)). The reliability of this approach, however, is based on the type of distribution function considered even though the literature does not relieve the indisputable selection criteria (see Reimer, 2002; Boccanfuso et al, 2003). Furthermore as highlighted by Cockburn (2001), regardless of the functional form used, this approach follows the assumption that the first time is fixed and not affected by the impact analyzed, an unrealistic assumption given the heterogeneity of households in terms of resource endowments and consumption habits.

Therefore, it is necessary to model directly the impact of a macroeconomic shock at individual households level. This approach is called macro-micro simulation. The only study analyzing the impact of trade liberalization in services on poverty through the micro-simulation is that of Rotherford et al (2005) studying the impact of Russia's entry to WTO. Rather than considering the representative household groups as in the standard CGE models, the authors incorporate all 55,000 households from the Russian Household Budget Survey (HBS) as "real" households in the model. The poverty indicators are directly computed from the change in welfare of individual households observed in the CGE model. This approach of macro-micro simulation is say "integrated"⁹.

The main limitation of integrated macro-micro simulation is the difficulty in the implementation, as stressed Boccanfuso and Savard (2006). The problem resides on the establishment of a correspondence between the aggregated accounts of the SAM and the survey data at the level of individual households, but also on the numerical resolution of the model (see Chen and Ravallion 2003.).

A more practical approach of macro-micro simulation say "sequential" is provided by Chen and Ravallion (2003). to assess the household welfare impacts of China's accession to WTO.

⁹ An application of this method on Cameroon is provided by the study of Emini et al (2005), who estimated the impact of the potential agreements from the Doha negotiations on poverty. They used the 2001 Cameroonian SAM, to which they add the 52000 households of the ECAMII. Their result shows a positive contribution to poverty reduction of 1.5% on average. However, their study does not integrate any scenario on services liberalization. Other applications of integrated micro-simulation are provided by Annabi et al, (2005) based on Senegal and Cockburn et al (2004) on Nepal.

It is a two-step analysis. As a first step, the GTAP model is used to estimate changes in the prices and wages due to WTO accession. Then the changes in prices and wages are passed on survey data from the 1999 Urban Household Survey (67900 households) and the 1999 Rural Household Survey (16900 households) to estimate corresponding changes in income and consumption¹⁰. Finally the FGT indexes are calculated at individual level to analyze poverty. This approach of macro-micro simulation say "accounting" has the disadvantage, however, of not taking household behavior at micro level into account. As highlighted by Cogneau, et al (2003), this approach assumes that the households do not respond to changes in the pricing system, and therefore considers that households' shares of factors are fixed and that only profitability could change. For the sake of simplification of the resolution, we choose in this study to follow the approach of Chen and Ravallion (2003).¹¹.

IV. Model analyzing poverty impact of telecommunications liberalization in Cameroon

IV-1. CGE module

Under the framework of trade in goods analysis, the modeling of a liberalization policy generally consists of increasing the prices of imported goods by the tariff to customs or the tariff equivalent of a non-tariff protection (See De Melo and Tarr, 1992 and Lofren and all, 1999).

This approach based on the neo-classical framework (constant returns to scale and perfect competition) is inadequate for the analysis of trade in services, as highlighted by the following facts. First, unlike trade in goods, which is essentially cross-border, the GATS distinguish four modes of supply for services¹². In addition, trade restrictions on goods targeted primarily foreign producers, while barriers on trade in services could include both foreign and local firms. For each mode of service, there are two types of restrictions: barriers to market access which restrict the establishment and ongoing operations of all firms in a sector, and limitations on national treatment (discriminatory barrier) which hamper the establishment and ongoing operations of foreign firms in a sector. Finally, while the use of imperfect competition has always been an exception in the models of goods liberalization, it becomes the rule in the case of services because services production is characterized by low competitive structure while facing increasing economies of scale, especially in small economies.

These peculiarities of trade in services involved additional effects, compared to the classic liberalization of goods, which is explicitly modeled in this study. These include, on the one hand productivity gains related to the entry of FDIs, economies of scale and increased variety of services, and on the other hand, the pro-competitive gains arising from the decrease in prices as a result of competition.

¹⁰ This approach excludes de facto any feedback effect of income distribution among households on the macroeconomic model (CGE).

¹¹ The only application to an African country is that of Boccanfuso and L. Savard (2006), which is based on Malian households' expenditure survey (2001) to study the impact of cotton subsidies on poverty.

¹² The **mode 1** is the cross-border delivering, the **mode 2** is the consumption abroad, the **mode 3** is the commercial presence (FDI), and the **mode 4** is the presence of natural person. A detailed definition of the four modes is provided in introductive chapter o this thesis

The CGE model used in this analysis is based mainly on the structure and assumptions of standard CGE models (see De Melo and Tarr, 1992; Lofren, 2001; and Decaluwé and Savard, 1999). Our main contribution to the model is based on the introduction of productivity effects and markup as explained in what follows.

The Productivity effect is captured in the CGE model by introducing the level of penetration, as input of global productivity of factors (GPF). The penetration is based itself on the level of liberalization, expressed here by the number of operators. The two elasticities characterizing these relationships have been estimated in the Chapter 2, using a model of simultaneous equations, estimating on the one hand, the effects of penetration on growth and on the other hand, the effects of liberalization on the penetration.

The Pro-competitive effects arise from the introduction of imperfect competition effect in the services sector. It will be modeled by assuming that consumer price is equal to the average cost plus a markup. The markup is ultimately modeled as a function of the level of liberalization. The level of markup and its elasticity with respect to the level of liberalization (number of operators) have been estimated in chapter 1, through a market power model.

While the first effect is modeled through the production function, the second is captured via the pricing equation.

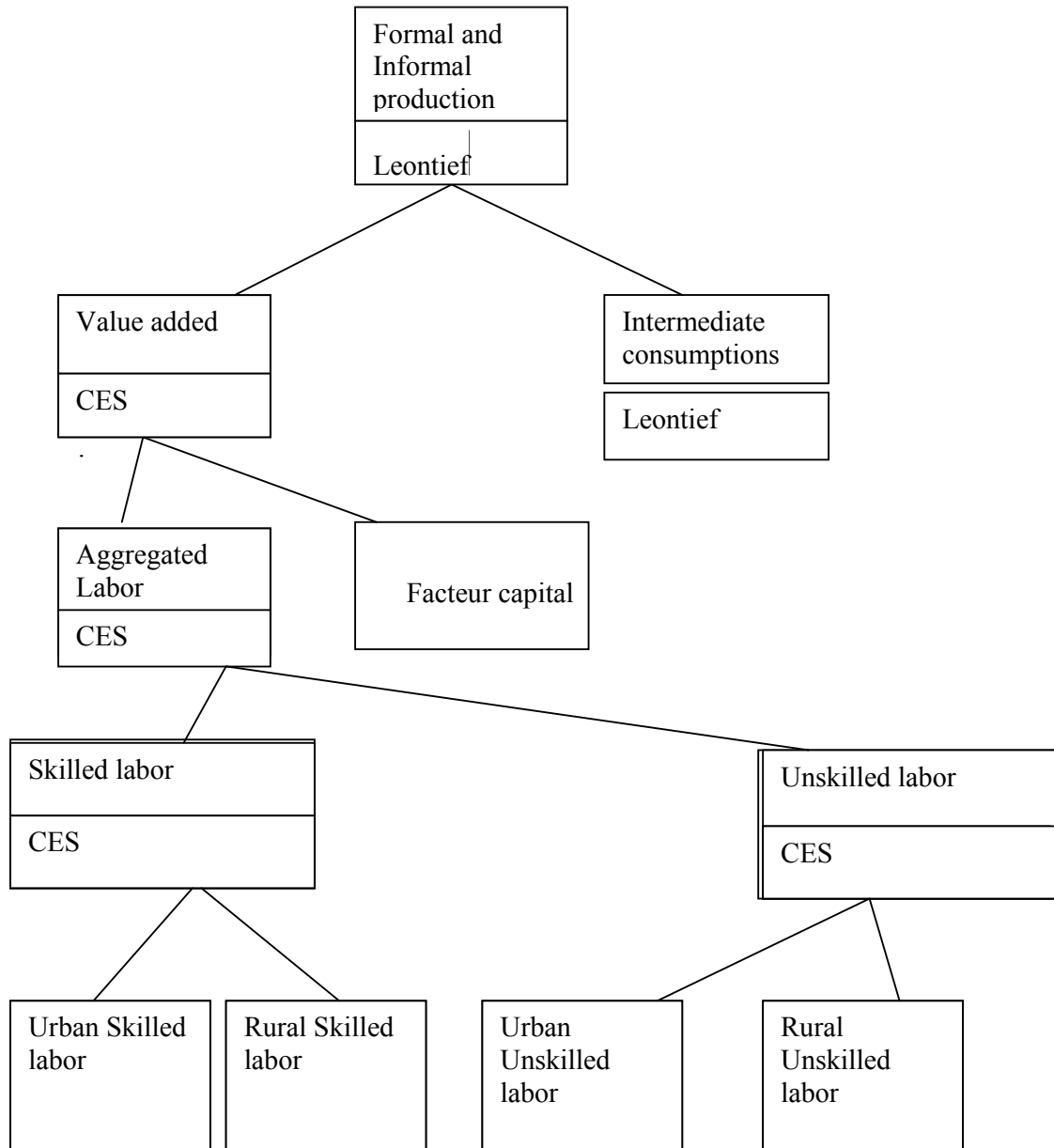
IV.1-1 Production technology:

The model covers an economy with 7 branches. All sectors have a branch in formal and informal sectors except telecommunications and finance, which have only the formal component.

All sectors, except those of the telecommunications and finances, are assumed to produce produced under conditions of constants returns to scale and perfect competition, implying that prices equal marginal cost of output. The telecommunications and finances are characterized by increasing returns to scale and imperfect competition. Although we have no study that shows the formal existence of economies of scale in these areas, this hypothesis considered in almost every study modeling the impact of trade in services (see. Jensen et al, 2004 and Konan, 2006) seems particularly appropriate given the low size of Cameroonian market. The producers maximize their profits by minimizing their cost under the constraint of a multi-level production function, whose structure is given in Figure.2 below.

At the first step, the production function, in each sub-sector (formal and informal), is a combination (fixed coefficients, or "Leontief function") of added value and intermediate consumption. Then, the added value is approximated with Constant elasticity Function (CES), using the capital and the aggregated labor. The aggregated labor is approximated with a CES technology, using skilled and unskilled workers. At the last stage, the demand for skilled labor or unskilled labor is operated by arbitrating between rural and urban workers with a CES function. The model distinguishes therefore 8 segments of labor.

Figure.2 : Multi-level production function



IV-1-2. Mathematical formalization

➤ Production function

For all sectors, production, QA_a , is defined as follow:

$$QA_a = \frac{QVA_a}{\mu_a} \quad a \in A \quad (0.1)$$

$$QCI_a = \theta_a \cdot QA_a \quad a \in A \quad (0.2)$$

Where: (A) is the set of activities branches

QCI_a is the aggregate intermediate consumption of activity (a). It is a Leontief function of disaggregated inputs (QCI_{ca}).

QCI_{ca} , is defined as follows:

$$QCI_{ca} = ci_{ca} \cdot QCI_a \quad c \in C, \quad a \in A \quad (0.3)$$

Where: (C) is the set of traded product from offer the activities from A. as all products in this model is traded, (C) is equal to (A).

ci_{ca} is the technique coefficient, representing the share of intermediate consumption from (C) in the production of (A).

➤ Added value

The value added is a CES function combining the global capital (KT) and global labor (LT). We also integrate the quality of services (QS_a) in order to model the productivity effect. The value added is then given by:

$$QVA_a = [QS_a \cdot B_a] \left[\delta_a K_a^{\rho_a} + (1 - \delta_a) LT_a^{\rho_a} \right]^{1/\rho_a} \quad (0.4)$$

Where QS_a represents the supplementary productive efficiency of the activity (a) generated by the liberalization of services. It is defined as the level of telecommunications services accessibility (IS) raised to the power of the elasticity of GDP growth with respect to the penetration (γ). The formulation is as follow:

$$QS_a = IS^{(\gamma)} \quad a \in A \quad (0.5)$$

IS in turn is a function of the number of operators (N). They are linked by an elasticity determined in the structural model in chapter 2. It is defined as follows:

$$IS = \beta \cdot N^{ELAST_{acces}} \quad (0.6)$$

Where, β indicates a constant, and $ELAST_{acces}$, the elasticity of penetration with respect to the number of operator.

IV-1-3. Imperfect competition and price setting: pro-competitive effect

The CGE literature does not relieve on any unanimous method of modeling the behavior of firms in imperfect competition with increasing returns to scale. The main difference resides on the choice of the rule of pricing in perfect competition to replace the marginal cost pricing rule (used in perfect competition). Numerous studies adopted the profit-maximizing approach, allowing expressing the Lerner relationship as follow:

$$\frac{P_v - Cm_v}{P_v} = \frac{\Omega_v}{N\varepsilon_v} \quad (0.7)$$

Ω_v is the conjecture with respect to the change in industry output. It represents the change in industry output as the result of the change of one unit in output of the variety (v).

ε_v is the elasticity of demand.

N is the number of firms.

P_v is the price of a variety (v)

Cm_v indicates the marginal cost

$$P_v = Cm_v \frac{1}{\left(1 - \frac{\Omega_v}{N\varepsilon_v}\right)} \quad (0.8)$$

$$P_v = Cm_v \left[1 + \left(\frac{1}{\left(1 - \frac{\Omega_v}{N\varepsilon_v}\right)} - 1 \right) \right] \quad (0.9)$$

$$P_v = Cm_v (1 + r_v) \quad (0.10)$$

$$P_v = (r_v + 1) Cm_v \quad (0.11)$$

r_v is equal to zero in the case of perfect competition.

We define $r_v = \left(\frac{1}{\left(1 - \frac{\Omega_v}{N\varepsilon_v}\right)} - 1 \right)$ as the percentage markup of price over marginal cost.

This expression rise additional issues about the determination of the conjectures and the elasticity of demand: Firstly, the selection of the conjecture is arbitrary¹³; secondly this approach suffers from the complexity of computing the demand elasticity for consumers and sectors using the good as intermediate consumption.

We have avoided these issues by estimating the markup (r_v) through an econometric model in chapter 1. This is on line with the so-call “Eastman-Stykolt (1960) approach”¹⁴. However, in opposite of the studies following this approach (see Warren (2000) and Eby Konan (2002)), we consider the markup (r_v) in our model as an endogenous variable. Relying on the elasticity determined in the econometric model, we express the markup as a linear function of the number of operators (N). The formulation is given below:

$$\frac{r - r_0}{r_0} = -ELAST. \left(\frac{N - N_0}{N_0} \right) \quad (0.12)$$

¹³ See De Melo and Tar (1992) for a comprehensive analysis of alternatives assumptions about the conjecture.

¹⁴ It consists to impose an extra price (markup) over the average cost. The surplus is determined outside the model. This margin may represent the difference between the domestic price and the international price of the service, or be estimated through econometric techniques.

Where r_0 indicates the initial markup.

In our model, the simulation of the liberalization will consist to in changing the number of operators (N).

ELAST is the elasticity of markup with respect to the number of operators.

IV-1 - 4. Other equations of the model

After defining the two effects of liberalization, we will introduce them in a general equilibrium model, considering successively the labor market, the foreign market and major macro-economic closures. The equations in the following paragraphs are common to all standard CGE models.

A. Factors' market

The factors' markets are supposed to be in perfect competition. For each segment, the labor is supposed mobile between the different sectors of production, which involves a uniform salary across all sectors. The wage is flexible to allow equality between the supply and demand of labor in each segment.

The capital factor is fixed for each sector, and its remuneration is specific for each sector.

B. External trade

For all sectors of goods and services, other than the telecommunications and finances, the allocation of domestic consumption follows the Armington (1969) approach assuming an imperfect substitutability between domestic goods and those imported (through a constant elasticity of substitution (CES) function).

Aggregated domestic output is allocated between exports and domestic sales on the assumption that suppliers maximize sales revenue for any given aggregate output level, subject to imperfect transformability between exports and domestic sales, expressed by a constant-elasticity-of-transformation (CET) function.

For finances and telecommunications, we assume the non substitutability of domestic and imported services, as the domestic suppliers of these services do not directly compete with foreign services suppliers in cross-border trade. This assumption is developed in Verikios et al (2002), who point to the fact that the cross-border telecommunication services, for instance, cannot be directly consumed by domestic users. They rather, constitute complementary services to domestic telecommunication services to provide international telephone calls, which is the service that final users actually purchase.

C. Savings and incomes

Households

Households receive incomes and transfers from other institutions, including the profits made by companies in which they control a share of the capital. The transfers from the rest of the

world are fixed in foreign currency. Households use their earnings for direct taxes, consumption, savings and transfers to other institutions. The direct tax and the share of savings are constant shares of household income.

Consumption

The consumption (CM_{hc}) of product (c) by a household (h) is determined by the utility function of linear expenditures system (LES) of Stone and Geary (1954). This function allows expressing the consumption of a given product in two components: incompressible consumptions and discretionary consumption. Its formula is given by:

$$CM_{hc} \cdot PQ_c = PQ_c \cdot \pi_{hc} + \chi_{hc}^m \left(CM_h - \sum_{c'} \pi_{hc'} \cdot PQ_{c'} \right) \quad h \in H; \quad c \in C \quad (0.13)$$

Where: π_{hc} is the share of subsistence consumption of product (C) by the household (h).

χ_{hc}^m is the marginal share of consumption of product (C) by the household (h).

The product $PQ_c \cdot \pi_{hc}$ represents the incompressible consumption of the product (c).

D. Closures relations

In the standard CGE model, the macroeconomic closures describe how equilibrium is achieved in the balances for the government, the rest of the world, and the savings-investment account. We consider three standard closures: saving-investments balance, fixed current account balance and the government balance.

For the government balance, the closure is that government consumptions and all tax rates are fixed. This implies that government savings is a flexible so as to assure the fiscal deficit is constant.

For the savings-investment balance, we assume a savings-driven closure: this implies that all nongovernment institutions (households and firms) savings rates are fixed, whereas the investment is flexible so as to assure that the investment cost will be equal to the savings value.

For the external balance, the closure is that the real exchange rate is flexible, while foreign savings (the current account deficit) is fixed. In fact to maintain the current account constant, while maintaining the international price fixed, the real exchange rate variation adjusts the domestic prices, so as to generate appropriate change in volumes of imports and exports.

IV.2 Poverty module

Poverty status in a given society characterizes the situation of households or individuals who are unable to acquire a living standard equivalent to a minimum acceptable by the society norms, called poverty line.

The literature distinguishes monetary poverty (or material) and non-monetary poverty. The latter is linked to aspects of social deprivation such as social exclusion or political rights abuse. Without underestimating the non-monetary component, we will deal in this work with the monetary aspect of poverty, which is more accessible to the economic analysis (notably due to data availability). The welfare indicator widely used in this context is household

expenditure. It is generally perceived by the consumption of private and public, the income only being used as a proxy for consumption (Lachaud, 2000).

IV.2-1 Measurement of poverty

To measure poverty, we opt for the indexes proposed by Foster, Greer and Thorbecke, (1984) said FGT index. It is expressed as the sum of individual differences between the poverty line and the income of those below it raised to the power of the degree of sensitivity (α), then this sum is expressed as a fraction of poverty line itself.

$$P_{\alpha}^h = \frac{1}{n_h m_h} \sum \left(\frac{SP - YM_h}{SP} \right)^{\alpha} \quad (0.14)$$

Where: m_h is the number of people from the category of households (h), below the poverty line

n_h is the total number of individuals in the category of households (h)

YM_h is the income of a household from category (h).

SP is the poverty line ;

α is the coefficient of sensitivity or aversion to poverty ($\alpha > 0$) ;

P_{α}^h is the FGT index corresponding to the class of poverty aversion (α) ,for the households from the category (h)

For $\alpha = 0$, P_{α}^h represents the index of poverty incidence (or poverty rate). Its primary utility is counting people, which are located under a poverty line.

For $\alpha = 1$, P_{α}^h represents the index of poverty depth, and estimate the average gap between the poor and the poverty line.

for $\alpha = 2$, P_{α}^h represents the severity of poverty. It takes into account both the distance to the poverty line and the degree of inequality among the poor

IV.2-2 Poverty line

The choice of the poverty line is crucial to determine the level of poverty indexes. We rely in this study on the official poverty line of Cameroon, estimated at 255000FCFA. However, we will assume that this threshold is endogenous and depends on the general trend of consumer prices¹⁵.

$$\text{So } SP = \overline{SP}_o \cdot (1 + \Delta(IPC)) \quad (0.15)$$

IV.2-3 Sequential macro-micro simulation

As noted above, our micro module is a reduced form of macro-micro simulation presented in Chen and Ravallion (2003). called "accounting micro simulation". Unlike the most advanced

¹⁵ This definition has the disadvantage of confusing the evolution of prices in the official minimum basket, to the general price level (global basket).

sequential micro simulation (see Robillard and Bourguignon, 2004), the accounting approach does not endogenize the allocation of factors, or the consumer at the micro level. Only prices and wages are expected to vary depending on the output of the CGE model. The impact on the welfare of a given household is then measured by a simple accounting relation, expressing the difference between income, earned from its offer of factors (labor and capital), and its expenditures.

$$g^h = \sum_c \left(w_c LS_c^h \right) \Delta w_c + \sum_c \left(r_c K_c^h \right) \Delta r_c - \sum_c \left(PD_c QD_c^h \right) \Delta PD_c \quad (0.16)$$

Where: h indicates the households and c the product of consumption.

LS_c^h , K_c^h and QD_c^h indicate, the labor supply, the supply of capital and the consumption of household h of a product (c), respectively.

Δw_c , Δr_c and ΔPD_c indicate the percentage of variation in wages, return on capital and the price, Respectively

The post-simulation poverty indicators are computed by adding the change in the welfare (g^h) of the previous formula to the initial income of households.

V. Calibration and simulations results

This section presents the data and parameters used in our CGE model.

V.1. Presentation of the social accounting matrix (SAM)

The SAM used in this study represents the Cameroonian economy of 2000/2001 fiscal year. It is adapted from a SAM built by a World Bank team and C. Emini (2004). The authors used the input output matrix of Cameroon for fiscal year 2000/2001 and the Cameroonian households' survey of 2001 (ECAMII). To create branches of interest to our analysis, we have made some changes to the original matrix, using the Cameroonian household survey of 2001 (ECAMII). The main changes are described as follow:

- The initial 42 branches were aggregated into 8 new branches; 6 out to 8 branches were further divided into informal and formal sub-branches¹⁶.
- Using the households' survey, the two original categories of labors (skilled and unskilled) in the original SAM were separated according to geography (urban and rural) and status of the activity (formal and informal) criteria.

¹⁶ The separation of the branches into formal and informal sub-branches has been operated from the original SAM following the steps: (1) To share factors remunerations between formal and informal components, the Cameroonian input-output matrix of 2001 provides for each of the 42 initial branches, the distinction between the formal activities' value added and informal activities; (2) **In addition The DSF ("déclarations statistiques et fiscales") give exactly** the payroll for each formal sub-branch, which allows to determine the shares of labor and capital in the formal sub-branch; (3) The corresponding shares in the informal sub-branch are determined according to that obtained in the formal sub-branch. To do this, we follow the Cameroon's accounting system which assumes that the share of the remuneration of labor in the informal sector equals that in the corresponding formal, increased by 50% of the share of capital in formal value added. This increase of 50% is subjective, and attempts to take into consideration the fact that informal activities are more labor-intensive compared to the formal activities (see Emini, 2004).

- The rebalancing of the matrix was made by the entropy method, developed in Robinson (2001). This consisted of solving a program minimizing the sum of the squares of the differences between the new values and the former values of the SAM (LSO principle), under the constraints of balancing between the expenditures and the resources. The final SAM is presented in [annex II; Table.AII-3](#).

V.2. Household database and consistency with the CGE model

The SAM and the households survey database used in this study have many convergence points, as the former has been build on the basis of the latter. This link is indispensable to translate the variation in price and wages of the CGE model to individual households. TableAII-4 in annex II, shows the correspondence between the 8 sectors of the SAM and the 37 sectors of the ECAM II.

V.2.-1 Correction of households income : Heckman model

To introduce the wage effect into the households' database, there is clearly a need that each individual in ECAM II declared his income. However, ECAM II Database provides exact information on income for only 41% of workers surveyed. The remaining workers surveyed are people who have either reported incomes in a given interval (56%), or declared a wage equal to zero (3%). Then the following procedure has been opted: (i) individuals who reported not to be working in ECAM II (54% of the population) have no benefited from any change in their income. Their incomes are set to zero. (ii) for those who declared being working (46%), the variation of their income is calculated on the basis of a corrected income, estimated through econometric techniques.

Following labor economics literature, and by concerns of consistency with the treatment method of wages used in the construction of the SAM, we estimated workers revenues using the model of Heckman. This consists in a first step of estimating a model of wage relying on the sample of individuals who have correctly declared their income. The control variables are individual (sector and industry, age, gender, education level, marital status) and households (size, place of residence characteristics. The model estimation, in turn, has been used to predict the income of people who have not declared their income correctly, considering their individual characteristics and those of the households to which they belong. TableAII-1 in Annex II shows the estimations

V.2-2 Adjustment of ECAMII data to those of the SAM

There is a major source of inconsistency between the SAM and the base ECAM II, related to the fact that the amounts of totals revenue and expenditure in the SAM 2001 have been collected from macroeconomic sources (TEE, 2001), whereas the source is micro data for ECAMII.

We proceed to a readjustment in order to allow each source of welfare (salary, capital and consumptions) in households' database to have the same total as in the SAM. The new values at individual level are obtained by correcting each variable of interest (salary, capital and consumptions), proportionally to its initial level (i.e. value declared).

$$VAL_{ECAM,h}^a = \left(\frac{VAL_{ECAM,h}^0}{\sum_{h=1}^{10992} VAL_{ECAM,h}^0} \right) \times VALTOT_{SAM} \quad (0.17)$$

Where, $VAL_{ECAM,h}^0$, indicates the value declared by the respondent in the ECAMII database. It refers to the wages, capital or consumption of a household.

$VAL_{ECAM,h}^a$, indicates the value after adjustment; and

$VALTOT_{SAM}$ indicates the total amount for the variable in the SAM. For example in the case of wages, this value indicates the total payroll in the SAM.

V.3. Estimation of the CGE model parameters

V.3-1 Determination of the markup level, and its elasticity with respect to the number of firm

As mentioned above, the markup level and markup elasticity with respect to the number of firms is determined in Chapter I using a model of market power.

The level of market power predicted in our model is 22% of telecommunications producer price in Cameroon. The elasticity of market power with respect to the number of firms is -15% in mobile telephony and -48% in fixed telephony.

V.3-2 Determination of parameters related to the productivity effect: indicator of telecommunications access and its elasticity with respect to growth.

The productivity effect is based on three parameters:

- the level of telecommunications services access (penetration), provided by the ITU database which stands at about 5% for 2001.
- the elasticity of penetration with respect to the number of operators which is estimated in the structural model of chapter2 determining simultaneously the growth and penetration. Its value is 1.2%. A 1% change in the number of operators leads to the improvement of 1.2% in the level of penetration of telecommunications.
- the elasticity of productivity with respect to the penetration. It is also estimated in the structural model of chapter2, determining simultaneously the growth and penetration. Its value is 0.12%.

V.3-3 Elasticities of behavior functions

- **Income elasticity for the consumption function**

Income elasticities are estimated econometrically using data of successive Cameroonian input-output matrix from 1994 to 2005.¹⁷ The results are reported in the table 1. Giving the low number of observations used in the regression (only 15), a sensitivity analysis would be made on the values of these parameters while interpreting our results.

Table 1. Income elasticity

	Income Elasticity
var.	Simul1
Other business Services	0.78
Food Agriculture	0.23
Agriculture of exportations	0.4
Industry	1.51
Publics and social services	0.43
Transportations	0.78
Telecommunications	1.18
Finances	1.29

Source: author's estimation

➤ Elasticities of production and trade behavior

The elasticities of CES functions of value added, the allocation of labor, the allocation of consumption and CET allocation function of local production are provided by the study of Devarajan and Rodrik (1989) in Cameroon. However, we need to perform a sensitivity analysis on these parameters.

VI. Simulations and results

This section present results, their interpretations and discuss about their validity (thought the consideration of alternatives model assumptions, parameters and closures)

VI.1 Specification of scenarios

We examine and compare the potential impact of the increase in number of telecommunications operators in Cameroon. All simulations are based on the scenario of the attribution of one license for a mobile telecommunications operator. This constitutes the policy more likely to be followed by the Cameroonian government in the next step of telecommunications reforms.

Since liberalization is modeled through the productivity and mark-up effects, our simulations are built to distinguish the main gains occurring from each of these channels. Moreover, as the mark-up effect is modeled using the elasticity determined in an econometric estimation with a sample of African countries, this elasticity is therefore of an archetype African country. Our simulations will

¹⁷ The regression is performed for each of the 42 sectors constituting the original SAM. The dependant variable is the logarithmic of consumption and the independent variable is the log of household income (allocated to the total consumption).

assume alternatives values of elasticities in order to examine the role of pro-competitive regulation on liberalization effects. Three scenarios are considered:

- the central scenario includes the both productivity and markup effects, and relies on the regulation policy of an archetype African country. Hence the markup of telecommunications is modeled using the estimated elasticity (-15%) from our econometric analysis.
- the second simulation performs the liberalization effect only through the markup effect. The elasticity of markup is the same as in the first simulation.
- the third simulation assumes the absence of a pro-competitive regulation, and therefore a total collusion among the operators. In this case the elasticity of markup is -0%. Hence the liberalization effect is reduced to the productivity effect.
- the fourth simulation like the first one includes the two liberalization effects channels. However, it relies on the best pro-competitive policy allowing the total cancelling of markup. In this case the elasticity of market power (or markup) is set to -100%.

Our analysis will focus on the first simulation, before making the comparison with others simulations. Moreover, before presenting the poverty impact, we focus first on the macroeconomic and sectoral effects, particularly on variables used as input in the households module of our model.

VI.2 macro economics results

Macroeconomics variables considered here are households' revenue, and others including: government and firms revenue, Investment and GDP.

VI.2-1 households' revenue

The table.2 below, presents the macroeconomic effects resulting from liberalization of telecommunications, for all simulations. The first scenario (column simul1) reveals an increase of household's revenue of around 3.2%. This increase is attributable to a combination of rising in wages and the return on capital, in all sectors¹⁸.

As far as others simulations are concerned, the simulation 2 (column simul2) and 3 (column simul3) also show the increase in households revenue of 0.22% and 3.02%, respectively. It appears therefore that the main gain for households occur from the productivity effect captured in simul3, the markup channel showing relatively slight effect.

Moreover, for the simulation 4 (column simul4), which represents the situation where the liberalization is accomplished beside a strong pro-competitive regulation (elasticity of markup -100%), i.e. policy allowing a full competition, with the cancellation of the all markup, the gain of households would change slightly from 3.21% to 4.03%. This result, contrary to our expectation, seems to suggest that, there is a very low potential gain to be expected from a pro-competitive effect. However, the implications of this result should be relativized, as the

¹⁸ The factors remunerations will be analyzed below.

pro-competitive effect is unambiguously underestimated in our model, due to the very low level of telecommunication weight in the consumer's expenses in 2001 (the reference year of our analysis). The boom of telecommunication which took place since that date, has moved the telecommunication from a luscious product (190.000 consumers in 2000), to a product of mass consumptions nowadays (3 million of consumers in 2006). The introduction of a new telecommunication operator, leading the price reduction in the current context, would therefore have a higher impact than in our model.

Table 2: Macroeconomics indicator

		Productivity +Markup	Markup	Productivity	Productivity +Markup with strong regulation
Variable	Baseline	Simulation 1	Simulation 2	Simulation 3	Simulation 4
Household income	5241688.79	3.21	0.22	3.01	4.03
Enterprise saving	560380.00	3.51	-0.15	3.67	2.65
Government saving	243372.00	22.45	-0.36	22.82	20.40
Enterprise revenue	1946772.00	3.51	-0.15	3.67	2.65
Government revenue	1509982.00	3.62	-0.06	3.68	3.29
IPC	1.03	0.12	-0.06	0.18	-0.15
GDP	6349348.10	3.02	0.00	3.02	2.90
Investments	1110701.00	7.69	-0.14	7.84	6.86
RECETTE	528146.00	3.77	-0.04	3.81	3.56

Source: Author's construction

VI.2-2 Others macroeconomic indicators

Table 2 also reports the evolution of government and business revenues, as well as investment and GDP for all scenarios. For the scenario 1, it appears that government and firms's income grow in the same way as those of households. This increase in income is reflected in government and firms' savings, which increase up to 22.45% and 3.51% respectively, leading to a raise in investments by nearly 8%. This evolution ultimately generates a GDP growth of 3.02%.

When observing other simulations, it appears that the change in GDP induced by the markup effect is zero (see simulation 2). Indeed, under the assumption of the fixity of factors supply (labor and capital), a change of GDP growth in our model can only be the result of a change in productivity.

In addition, the hypothesis of a strong pro-competitive regulatory policy (simulation 4) reveals lower GDP growth than what observed in the first simulation (2.90% vs. 3.02%). In fact, the total cancellation of the markup deprives firms of the share of their profits that would have been allocated to savings. This results into a relative decline of investments (7.68% for the first scenario compared to 6.8% for the fourth).

VI.3 Sectoral effect

In this section we analyze some interesting sectoral variables, in view of the following poverty analysis. Four variables are considered here: production, market prices, wages, and rental rate of capital. The last three variables constitute the key variables affecting households' welfare.

VI.3-1 Production effects

Table 3 below presents the changes in production resulting from the liberalization of telecommunications for all our scenarios.

Table 3: Production effect

		productivity +markup	markup	productivity	productivity +markup with strong regulator
Sectors	Baseline.	Simulation 1	Simulation 2	Simulation 3	Simulation 4
Other business Services	3139768.00	4.14	0.00	4.14	4.12
Food Agriculture	2934049.00	2.82	-0.04	2.86	2.63
Agriculture of exportations	463327.00	3.63	-0.03	3.66	3.45
Industry	3915240.00	3.45	-0.03	3.48	3.29
Publics and social services	906059.00	2.90	-0.04	2.63	2.38
Transportations	572331.00	2.92	0.07	2.85	3.27
Telecommunications	103020.09	5.04	1.81	3.21	15.17
Finances	114205.58	4.73	0.07	4.65	5.03

Source: Author's construction

The first scenario shows that liberalization contributes to an increase in production for all sectors. This increase ranges from 2.8% in food and agriculture sector to 5.04% in telecommunications sector. As underlined before, the change in production is the result of two factors: the productivity effect (see column simulation 3) and the markup effect (see column simulation 2).

The markup effect (Simulation 2) is the results of the decrease in telecommunication price. It encourages the demand for telecommunications and the production of goods and services using them intensively as inputs. It is the case for finance, transportations and social services. Moreover, given that the labor supply is fixed in the model, the supplementary labor needed for this change in production is provided by others sectors which could experience a fall in their production. This is the case for food agriculture. However, except the telecommunication sector, the markup effect on production is not significant for any other sectors, as it ranges from -0.04% in food Agriculture to 0.07% in financial sector (change in telecommunication is 1.6%).

The change in production is therefore mainly occurring from productivity effect (Simulation 3), which allows a better production with the same amount of inputs. In fact, the productivity effect is introduced uniformly in all sectors of our model, through the efficiency coefficient of the production function. The difference in magnitude of its effects among sectors is therefore due to the second round effect. This can happen notably through the increase in final demand, resulting from the raise in household's revenue, which is determined by the income elasticity of each good or service. Hence finance and other business services that have the most important production effects turn out to be the sectors with the most important income elasticity. On the contrary, the food agriculture sector that has the least important elasticity in our model is also the sector where the output grows the least.

Concerning the fourth simulation (where the markup effect is maximum), the main observation is the important change in telecommunications production compared to other sectors. In fact, the production of others sectors remains relatively stable compared to simulation 1. This confirms the lack of influence of change in telecommunications price (markup effect) on the whole economy. The main reason is the relatively low size of this sector in Cameroonian economy in 2001, where it represented only 2.9% of the GDP. Therefore, the main telecommunications effects on economy rely on the qualitative effect (increase of productivity) rather than on price effect¹⁹.

VI.3-2 Prices effect

In Table.4 below, we present the changes in consumer prices and price trends in each sector for the four simulations. In the central scenario (simulation 1), liberalization leads to an overall increase in prices, consumer price index rising by 0.12%. If the markup effect (simulation 2) contributes to a decrease by 0.08%, the productivity effect rather contributes to an increase by 0.19%.

Table.4 Price effect

		Productivity +Markup	Markup	Productivity	productivity +markup with strong regulator
sectors	Baseline	Simulation 1	Simulation 2.	Simulation 3	Simulation 4
Other business Services	1.01	0.36	-0.01	0.37	0.33
Food Agriculture	1.01	0.13	0.02	0.12	0.21
Agriculture of exportations	1.01	0.55	-0.02	0.57	0.43
Industry	1.06	0.26	0.01	0.26	0.30
Publics and social services	1.01	-0.04	0.04	-0.09	0.22
Transportations	1.06	-0.03	-0.01	-0.03	-0.03
Telecommunications	1.44	-3.01	-2.95	-0.05	-16.52
Finances	1.14	-0.03	-0.14	0.11	-0.63
IPC	1.03	0.12	-0.08	0.19	-0.15

Source : author's construction

¹⁹ This price effect is nowadays unambiguously more important as the number of telecommunications move from 190.000 in 2000 to 3 million in 2007.

At the sectoral level, price effects are mixed. The results in the Table 5 below show for the first scenario that the price has increased in four out of eight sectors. In fact, two opposite movements influence the evolution of prices in our model. First, the increase in final demand and investment, outlined above contribute to the increase in price. Secondly, the lowering of input prices, caused by the lower prices of telecommunications contributes to the decrease in prices. Hence the results for the first scenario point to the decline in prices for sectors consuming intensively telecommunications (financial services, transportation and social services) and the increase for others (industry, food agriculture and agriculture of exportations).

VI.3-3 Wages and capital return

The wages and return on capital are key inputs for the households' module of our model. In fact, the CGE model assumes a neoclassical closure of the labor market where labor supply is fixed for each of the eight segments considered. Similarly, as the model is in comparative static, it is assumed that capital is fixed within each sector, with the variation in return allowing adjustments. Hence, household's income is mainly determined by the return on capital and wages, which in turn follows the evolution of production.

Table.5 : Factors' remunerations

			Productivity +Markup	Markup	Productivity	Productivity +Markup with strong regulator
Factors		Baseline.	Simulation 1	Simulation 2.	Simulation 3	Simulation 4
	Other business Services	4.00	4.45	0.10	4.34	4.95
	Food Agriculture	4.00	3.11	0.04	3.06	3.31
	Agriculture of exportations	4.00	3.98	0.03	3.95	4.08
	Industry	4.00	3.67	0.02	3.65	3.76
	Publics and social services	4.00	2.90	0.12	2.78	3.52
	Transportations	4.00	3.06	0.18	2.88	3.97
	Telecommunications	4.00	6.24	3.19	3.00	23.72
	Finances	4.00	4.19	0.19	3.99	5.14
Formal capital						
	Other business Services	3.00	4.30	0.05	4.25	4.53
	Food Agriculture	3.00	3.22	0.02	3.20	3.27
	Agriculture of exportations	3.00	3.90	0.02	3.89	3.94
	Industry	3.00	3.67	0.02	3.65	3.74
	Publics and social services	3.00	2.98	0.09	2.89	3.43
	Transportations	3.00	3.17	0.13	3.03	3.86
	Telecommunications	3.00	0.00	0.00	0.00	0.00
	Finances	3.00	0.00	0.00	0.00	0.00
Informal capital						
	Rural not qualified formal	1.80	3.62	0.15	3.37	4.41
	Rural qualified formal	1.83	3.51	0.15	3.35	4.30
	Urban not qualified formal	2.35	3.62	0.15	3.47	4.41
	Urban qualified formal	3.16	3.67	0.15	3.63	4.30
Formal labor						
	Rural not qualified informal	0.50	2.07	0.03	2.63	2.81
	Rural qualified informal	1.25	3.07	0.03	3.02	3.81
Informal labor						

urban not qualified informal	1.50	2.67	0.03	2.63	2.81
Urban qualified informal	2.50	3.51	0.03	3.35	3.81

Source : author's construction

Table 5 shows the evolution of the remuneration of factors in each sector and for all of our simulations. Scenario 1 (simulation 1) points to an increase of wages and return of capital in all sectors. This trend is logical since the prices of factors are increasing functions of production. Thus regarding the capital factor, the sectors which have seen their production increased the most are also those with the best raise in return on capital. This is the case for telecommunications services, finances, and other business services.

As far as the wages are concerned, the labor segments in which wages are growing the most are those used intensively in the sectors growing the most. Thus, the formal sectors (telecommunications, business services and finance), where production has increased the most, explained the highest change in wage observed in formal labor segments (whether the location or the qualification considered)²⁰.

VI.4 Poverty effect

We consider successively the analysis at national and individuals' level.

VI.4-1 Poverty effect at national level

This sub-section performs the poverty impact analysis at the national level and on population sub-groups by comparing the results of the four simulations. The impact's analysis on poverty is based on the households' survey of ECAM II. It covers 10952 households and 54821 individuals representative of Cameroon's total population.

As underlined in introduction, in 2001, 41% of the population lived below the poverty line in Cameroon. However, the situation of poverty in Cameroon is characterized by several disparities, related notably to education level and residential area. While more than 50% of the non-educated are poor, only 13% of people with upper secondary education and 6.2% of those who have tertiary education share the same fate. In rural areas, the incidence of poverty is 52% (84% of the poor in the country). The figure in urban areas is only 18%. Poverty in Cameroon is also linked to the status of the activity. Thus the incidence of poor is 25% among those who practice an activity in the formal sector, whereas it represents 54% in the informal activity.

Table 6 below gives the poverty impact of telecommunications' liberalization at the national level. Poverty impact is analyzed through the indicators, FGT-0, FGT-1 and FGT-2, describing the indexes of FGT (Foster, Greer and Thorbecke (1984)) when α takes the values 0, 1 and 2, respectively.

Regarding the incidence of poverty FGT-0, scenario 1 shows that liberalization has contributed to a decline of 2% in poverty at national level. This decline is essentially due to the productivity effect (Simulation 3), as the markup effect has not showed a significant change (Simulation 2). However, it should be noted that liberalization accompanied by strong

²⁰ Finance and telecommunication's services branches are assumed to be exclusively formal in this study.

pro-competitive regulation, that would allow the total cancellation of markup, generates a supplementary point of decline in poverty (simulation 4)²¹.

It is also interesting to analyze poverty depth and severity, which generally grant more importance to the poorest. In term of poverty depth (FGT-1), the effect of liberalization is more important than in scenario 1, FGT-1 index declining by nearly 4% nationally. Similarly, in terms of severity, the impact of liberalization is more important, compared to the indicator of incidence, FGT-2 index decreasing by 5%. These results suggest that liberalization allows a decrease of the gap between the poor's incomes and the poverty line, as well as a decline in inequality among the poor.

Table6: Poverty effect at national level

Indicators	Status	Productivity +Markup	Markup	Productivity	Productivity +Markup with strong regulator
		Simulation 1	Simulation 2	Simulation 3	Simulation 4
FGT-0	Baseline	0.41	0.41	0.41	0.41
	Change	1.76	0.06	1.72	3.03
FGT-1	Baseline	0.13	0.13	0.13	0.13
	Change	5.62	0.23	5.46	6.38
FGT-2	Baseline	0.06	0.06	0.06	0.06
	Change	6.50	0.17	6.17	7.33

Source: author's construction

VI.4-2 Poverty by category of households

Given the distribution of poverty sets described in the previous paragraph, our analysis is based on the following 10 categories of households (distinguished by the criteria of qualification, location and level of activity): urban unskilled in formal sector, rural qualified in formal sector, urban qualified in formal sector, rural non qualified in formal sector, urban unskilled in informal, rural qualifies in informal sector, urban qualifies in informal, rural non qualifies in informal sector, rural inactive and urban inactive.

Table 7 presents the effects of the central scenario (simulation 1) on poverty incidence for each category of households. As above, poverty is measured by the variations of FGT indexes, for $\alpha = 0, 1$ and 2 respectively. In the baseline scenario reported in column (1), the incidence of poverty (FGT-0) indicates that the poorest category is that of rural unskilled and occupied in the informal sector, with a poverty rate of 60%, while the richest category is the urban skilled engaged in the formal sector with a poverty rate of only 7%.

²¹ As underlined above, the gains related to markup are underestimated in this model, given the low level of telecommunications penetration at the beginning of our period of study (2000).

Column (2), which reports the poverty incidence effect reveals that all households groups experience a decrease in poverty. However, the magnitude of this effect is differentiated for the specific categories of households because of their heterogeneous factors endowment, the structure of their expenditures, and the differentiated initial level of poverty between household groups.

Hence, the group gaining the most in terms of poverty incidence, is urban unskilled labor operating in the informal sector, which benefits from a decrease of 2.9 point in poverty. This decrease can be explained by the fact that products benefiting the most from lower prices are those consumed more intensively in urban areas (telecommunications services finance and utilities). Furthermore this category of households has the highest initial poverty rate among urban groups.

Table 7 : Poverty indicator per households category(central scenario only)

		Households categories	FGT-0		FGT-1		FGT-2	
			(1)	(2)	(3)	(4)	(5)	(6)
			Baseline	Change	Baseline	Change	Baseline	Change
Simul1	Formal	Rural not qualified formal	0.40	2.63	0.16	5.00	0.08	5.25
		Urban not qualified formal	0.28	1.89	0.08	10.25	0.03	12.67
		rural qualified formal	0.22	1.74	0.06	6.83	0.02	8.50
		Urban qualified formal	0.07	1.48	0.01	19.00	0.00	0.05
	Informal	Rural not qualified informal	0.60	2.07	0.20	5.35	0.09	6.67
		Urban not qualified informal	0.37	2.92	0.10	12.40	0.04	16.00
		rural qualified informal	0.51	1.35	0.17	3.76	0.08	4.63
		Urban qualified informal	0.17	1.96	0.04	13.00	0.01	20.00
	Inactive	Rural inactive	0.51	1.95	0.17	2.94	0.08	3.25
		Urban inactive	0.21	0.07	0.05	4.60	0.02	5.00

Source: Author's calculation

Except the group of inactive, the group gaining the least in terms of the poverty incidence is the rural qualified and occupied in informal sector. This gain is justified by the fact that the prices of factors in the informal segments have progressed less than those in the formal segments (see Table 5).

Generally, it might be expected that the formal groups benefit the most in term of poverty decline - as wages in formal factors have increased the most -, and that the products whose price declined the most are those intensively consumed by households working in formal sectors (telecommunications finance and social services). This is the case for households in rural areas, where for equivalent qualifications, households benefiting the most from liberalization are those whose activities are in the formal sector.

However, the opposite pattern is observed in urban households; for equivalent qualifications, the groups of households benefiting the most from liberalization are those whose activities are in the informal sector. This result is explained, at least partly by the fact that informal households have an initial level of poverty higher than households from the formal sector.

The analysis of poverty depth should be more informative as it is more sensitive than the poverty incidence (Buccanfosso, 2006). The depth of poverty (FGT-1), reported in Column 4 confirms the downward trend observed in incidence, but reveals more disparity in the amplitudes throughout household groups. Hence it clearly appears that urban groups are those benefiting the most; for the same qualification and the same status of activity (formal or informal), the groups residing in urban area have better gains in terms of reduced poor's

income gap with the poverty line. This result suggests that the poorest people in urban areas benefit more from liberalization than their counterparts in rural areas.

The index of poverty severity (Column 6) reveals exactly the same trend as the depth. All the effects are positive and urban households enjoy better gains than their rural counterparts. This result suggests that beyond the decline in the average income gap with the poverty line, telecommunications liberalization contribute to reduce inequality among the poor, in each of the ten categories of households considered. However, the groups of urban households seem to benefit the most from this trend compared to rural households.

VI.5. Results and discussion

We consider here alternatives model assumptions, parameters and macroeconomics closures.

VI.5-1 Alternative model: modeling the productivity effect trough the pro-variety effect of telecommunications

One of the main limitations of our model is related to the uniform introduction of productivity effect in the different sectors. If this does not affect our results on average, as the elasticities used are those estimated on the economy on average, it could dissimulate the distribution effects of liberalization. As underlined above, the recent literature modeling the impact of trade in services have used to proxy the productivity gain, by pro-variety effects (Rotherford and Tarr, 2000, 2002 and 2004, and Rotherford et al, 2005). If this approach ignore others components of productivity gains, its main advantage compared to the model developed above is that productivity gains are introduced in the sectors with respect to the weight of telecommunications in the total intermediate consumptions of the considered sector. The approach therefore takes better consideration of the distributive effect of telecommunications liberalization.

As a robustness test of the distributive effect of our model, we perform our central scenario using the pro-variety effect as a proxy of productivity effects²². Following the recent literature (Rotherford and Tarr, 2000, 2002 and 2004, and Rotherford et al, 2005), we consider the effects of varieties relying on the Dixit and Stiglitz's model (1977). This model assumes that the firms in the services sector to be liberalized produce differentiated services, and that, consumers and other sectors using these services have a preference for products variety. The main changes in the model remain on two points: (i) first, the production function of the services branch is a constant elasticity of substitution (CES) function of different varieties:

$$Y_{az} = \left(\sum_{v=1}^N z_v^\varphi \right)^{\frac{1}{\varphi}} \quad (0.18)$$

Where z_v indicates the production of the variety v .

²² This assumption is relevant to a large extent in the case of Cameroon where liberalization has been characterized by an impressive increase of services varieties. The table AII-2 in annex II shows the evolution of new telecommunications products in Cameroonian market from 1999, the year of the first liberalization, and 2007. During this period, the two liberalized segments, internet and mobile telephone, have benefited from the introduction of 16 and 14 new services or technology innovations respectively. The fixed segment, still under the public monopoly, has only benefited from one major technological innovation with the introduction of CDMA technology in 2005.

As for the other sectors, the production function of a service variety is approximated by a Leontief function of total value added and composite intermediate consumption.

The elasticity of substitution between each variety is $\sigma = \frac{1}{1-\varphi}$

As the second change in the model, the services producing differentiated varieties are assumed to impact positively the production function of sectors using them as intermediate good. This is modeled by assuming that telecommunications is an imperfect substitute to value added in the sector using them as input

$$QVATOT_a = \left[\theta_a QVA_a^{\lambda_a} + (1-\theta_a) Y_{za}^{\lambda_a} \right]^{1/\lambda_a} \quad (0.19)$$

Where: QVA_a is the ordinary value added (function of labor and capital)

$QVATOT_a$ is the new value added,

θ_a is the share of telecommunications in the new value added

$\varepsilon_a = \frac{1}{1-\lambda_a}$ is the constant elasticity of substitution between the value added and the producer services (telecommunications).

Table.AI-3 in annex I presents the macroeconomic impact of liberalization. Under our first scenario including the productivity and the markup effect, the results point to an increase of 0.67% in households' income. This result is close to the 0.79 % of Eby Konan et al (2006) who used the same approach in the case of Tunisia. However, this result represent an important gap with the outcome of the main model (including all productivity effects), as. it represent less than the half of its impact (1.4%). However, the importance of this gap has no consequence for our macroeconomic finding in main model, as the variety effect is only a part of the productivity effect captured in our model.

Table 8: Poverty indicator per households category (central scenario only)

	Households categories	FGT-0		FGT-1		FGT-2	
		Reference	change	Reference	change	Reference	change
	(0)	(1)	(2)	(3)	(4)	(5)	(6)
Formal	Rural not qualified formal	0.40	0.38	0.163	1.15	0.082	1.19
	Urban not qualified formal	0.28	0.00	0.076	1.96	0.028	2.74
	rural qualified formal	0.22	0.09	0.060	1.83	0.023	1.76
	Urban qualified formal	0.07	0.39	0.012	4.89	0.003	4.41
Informal	Rural not qualified informal	0.60	0.51	0.203	1.68	0.090	2.22
	Urban not qualified informal	0.37	0.85	0.102	3.97	0.041	5.11
	rural qualified informal	0.51	0.86	0.167	1.37	0.075	1.75
	Urban qualified informal	0.17	0.86	0.035	5.07	0.012	6.03
Inactive	Rural inactive	0.51	0.63	0.170	1.24	0.077	1.51
	Urban inactive	0.21	0.03	0.053	1.88	0.021	2.06
Total	Total	0.41	0.55	0.131	1.81	0.057	2.25

Source: Author calculation

More interesting is the impact of this distribution effect throughout our ten households categories. Table 8 below presents the results of the poverty effect for each households group.

On average the poverty incidence decrease by 0.55%. The incidence of poverty (Column 2) ranks from 0 to 0.86% and the changes in FGT-1 (Column 4) and FGT-2 (Column 6) are all positives. This is a support to our previous finding, that all of the households groups are to be benefiting from the liberalization, whatever the poverty indicator considered.

VI.5-2 Macroeconomic and factors closures rule²³

The results of CGE simulations are dependent to the parameters values and to macroeconomic and factors closures rules.

Table 9 below presents the results of central scenario, including the productivity and the markup effect, under alternatives macroeconomic closures.

This paper adopted the neoclassic closure approach which supposes endogenous investments. This implies that investment is adjusted endogenously to be equal to the sum of savings of all economic institutions (households, firms, government and the rest of the world). But this assumption is not always realistic in developing countries, where the objectives of investments are more likely to be fixed by government (Decaluwe, 2001), instead of being determined by the market.

Thus we will consider as alternative a so-call “Johanson economy” that assumes fixed investments. This implies that savings of domestic institutions adjust endogenously to balance the exogenous investments. Two cases are considered here: (i) the adjustment is operated through government savings, implying that the government consumption become flexible to allow the necessary adjustment of government savings (see Table.8 Column 2); (ii) the adjustment is operated through foreign aid, implying that foreign savings adjust endogenously to balance the exogenous investments (Column 3). The latter case is more relevant to the Cameroonian context, where the government massively receives international aid.

As far as labor market is concerned, the neoclassic closure assumes that labor supply is fixed, implying that wages adjust endogenously to allow the equality between the demand and the exogenous offer of labor in each segment. We will consider as alternative a more realistic economy with unemployment, where there is no restriction on labor supply (Column 4).

Table9 : Closures rule sensitivity

	Baseline	current account endogenous and investment exogenous	government Consumption endogenous and government saving exogenous	Labor supply endogenous and wage exogenous	capital endogenous and capital price exogenous	IPC exogenous and TCN endogenous
	(1)	(2)	(3)	(4)	(5)	(6)
CGOVT	660749	0.0	8.7	0.0	0.0	0.0
YM	5237311	3.3	3.3	5.8	9.1	3.2
BC	-23037	213.5	0.0	0.0	0.0	0.0
IPC	1	-1.5	0.4	-0.7	1.7	0.0
GDP	6345194	3.4	3.4	6.2	10.1	3.4

Source : Author's construction

²³ Decaluwe et al (2001), and Harris and Robinson (2002) offer a complete overview of macroeconomic closures for a CGE model.

Concerning the capital, the model assumes a fixed and specific capital for each sector. We consider as alternative a flexible and unrestricted capital in the economy (Column 5). Many authors have pointed out the sensitivity of CGE model to the choice of numeraire (Hoffmann, 1999; Lofren and al 1999). The numeraire in the main model is exchange rate; we consider as alternative the consumer price index (Column 6).

Two observations emerge from the results of sensitivity simulations. First, the closures considering the fixation of the number of quantity of factors (closure2, closure3 and closure6) produces quite the same amplitude of gains as the reference scenario (closure1), in terms of households' incomes, as well as in terms of GDP growth.

As the second observation, the scenario allowing the flexibility of factors supply produce, as expected significantly more important output in terms of household income and GDP change; the more profitable scenario being the one allowing the flexibility of the stock of capital.

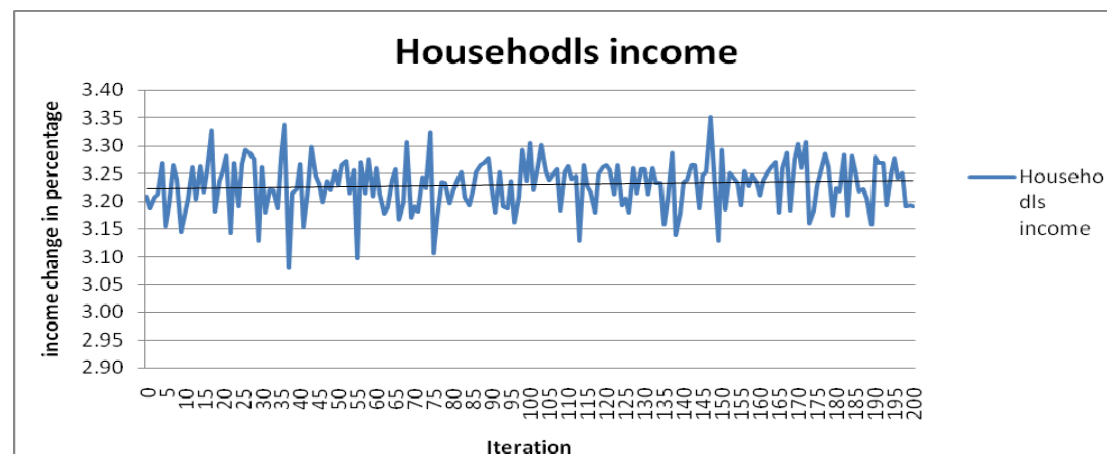
The two observations suggest that our results, which rely on fixed supply closures are globally stable and constitute the low bound effects result.

VI.5-3 Sensitivity to the parameters

The behavior functions parameters (production and trade functions) used in this paper have been adopted from the CGE model of Devaradjan for Cameroon in 1988, instead of relying on econometric estimates. We suppose here alternatives values for each parameter of trade and production functions in the interval $[0.01, 4]$, which is the interval of parameters estimated in GTAP model (See Koffi et al 2005). Using the Monte Carlo approach, we have introduced 200 random sets of parameters in the model in order to simulate our central scenario²⁴.

The results of simulations performed for 200 set of parameters, are presented in the following Figure focusing on the value of households income.

Figure 3: Sensitivity of households income in respect to the parameters values



²⁴ This implies a random choice of: (1) $4 \times (200 \times 8)$ values for production function of informal sectors; (2) $+3 \times (200 \times 6)$ parameters values for production function of formal sector; (3) $+(200 \times 7)$ parameters values for imports functions ; (4) $+(200 \times 7)$ parameters values for exports functions

It appears from Figure 3 that the values of households' income are concentrated in the interval [3.08 to 3.35%] with an average to 3.22%. This output strongly supports the high stability of our results with respect to the behavioral parameters.

Conclusion

This study's aim was to analyze the impact of telecommunications liberalization on poverty in Cameroon, using the macro-micro simulation approach, linking the output of CGE model simulations to households database, in order to compute poverty indicators. Our CGE model, build on imperfect competition assumptions, considers two channels of liberalization effects: the productivity effect and the markup effect. The two effects are introduced in the CGE model using elasticities estimated in the econometric analyses of chapter 1 and 2 respectively. The micro module of the analysis use the Cameroonian households income survey data of 2001 (ECAM II), and is based on the accounting micro simulation approach developed in Chen and Ravallion (2003).

Our results show that liberalization contributes to reduce poverty in Cameroon. The attribution of a supplementary license in the mobile segment of telecommunications would lead to a decrease of poverty incidence by 2% on average. It appears, as in Rotherford et al (2005) and Eby Konan et al (2006), that the main gain procured by services liberalization are generated by productivity effects, even if the markup effect remain positive.

Our study suffers from some limitations: first our basis of analysis is the social accounting matrix of 2001. This period has the advantage to be the starting point of the liberalization process, then offering a credible counterfactual. However given the important increase in the number of telecommunications users since 2001 (200.000 compared to 3 millions nowadays), it is obvious that the consideration of a more recent data would have allowed to find a more significant markup effect on households welfare. The second limitation of this study is the uniform introduction of productivity effect throughout all the sectors of the model. An estimation of the differentiated productivities elasticities for each main sector would allow to better capture the distributive effect linked to services liberalization.

Despite these weaknesses, some interesting policy recommendations can be drawn from our study. More specifically, reforms in telecommunications sector should be a full part of a national strategy of fight against poverty. Our results advocate for the attribution of a third mobile license in Cameroonian telecommunications market. A strong pro-competitive telecommunications regulation will be in the long term the main means to realize supplementary gains from telecommunications. This advocates for the strengthening of national regulatory operator in order to follow the best regulatory practice at international level.

REFERENCES

- Alan V. Deardorff, Robert M. Stern, Drusilla K. Brown (1995): "Modelling Multilateral Trade Liberalization in Services". Ann Arbor: University of Michigan
- Alan V. Deardorff, 2000: "International Provision of Trade Services, Trade, and Fragmentation"; The University of Michigan Ann Arbor, MI 48109-1220 Disponible sur: <http://www.econ.lsa.umich.edu/~alandear/>
- B. Delcauwé, Patry, savard, et Thorbecke. (1999). "Poverty Analysis Within A General Equilibrium Framework." CREFA Working paper 9909. Université Laval, Quebec. Disponible sur : <http://www.crefa.ecn.ulaval.ca/cahier/liste99.html>.
- B. Décaluwé, André Martens et Luc Savard « La politique économique du développement et les modèles d'équilibre général calculable », les presses de l'université de Montréal (2001).
- Benjamin, N. et Diao, X. (2000), "Liberalising Services Trade in APEC: A General Equilibrium Analysis with Imperfect Competition", Pacific Economic Review
- Broda, Christian and David Weinstein, 2004. "Globalization and the Gains from Variety," NBER Working Paper number 10314. www.nber.org/papers/w10314.
- Brown, D. et Stern, R. (2001), "Measurement and Modelling of the Economic Effects of Trade and Investment Barriers in Services", Review of International Economics, vol.9 n°2.
- Brown, D., Deardorff, A. et Stern, R. (1996), "Modelling Multilateral Liberalisation in Services", Asia-Pacific Economic Review 2,
- Brown, D., Deardorff, A. et Stern, R. (2000), "CGE Modelling and an Analysis of Multilateral and Regional Negotiating Options", document établi pour la conférence donnée sur les problèmes et options concernant les politiques commerciales des États-Unis et du Japon à l'échelle multilatérale, régionale et bilatérale, University of Michigan, Gerard R. Ford School of Public Policy and Japan Economy Program, Department of Economics, 5 et 6 octobre.
- Chadha, R. (2000), "GATS and the Developing Countries: A Case Study of India", à paraître dans Robert M. Stern (éd.), Services in the International Economy: Measurement and Modeling, Sectoral and Country Studies, and Issues in the WTO Services Negotiations, University of Michigan Press, Ann Arbor, Michigan.
- Chadha, R., Brown, D., Deardorff, A. et Stern, R. (2000), "Computational Analysis of the Impact on India of the Uruguay Round and the Forthcoming WTO Trade Negotiations", Document de réflexion n°459, School of Public Policy, University of Michigan. Ann Arbor, Michigan.
- Chen, Z. et Schembri, L., (2002), « Mesure des obstacles au commerce des services : études et méthodes », Ministère des Affaires étrangères et du Commerce international, Canada.
- Chen, Shaohua and Ravallion, Martin, "Household Welfare Impacts of China's Accession to the World Trade Organization" (May 2003). World Bank Policy Research Working Paper No. 3040. Available at SSRN: <http://ssrn.com>

- Claessens S., Demirgüç-Kunt A. et Huizinga, H. (2001), "How does Foreign Entry Affect Domestic Banking Markets?" *Journal of Banking and Finance* 25, pp. 891-911.
- Claessens, S. et Glaessner, T. (1998), "Internationalization of Financial Services in Asia", *Banque mondiale*.
- Colecchia, A. (2001), "Measuring barriers to market access for services: A pilot study on accountancy services", in Findlay, C. et Warren, T. (éds.), *Impediments to Trade in Services: Measurement and Policy Implication*. New York: Routledge.
- Cogneau, Denis, and Anne Sophie Robilliard. 2000. "Growth, Distribution and Poverty in Madagascar: Learning from a Microsimulation Model in a General Equilibrium Framework." IFPRI TMD Discussion Paper 61
- Denise Eby Konan, Keith E. Markus and The World Bank (2002).: "Quantifying the impact of service liberalization in a developing" university of Hawaii, Honolulu;. Disponible sur: [http://www.erf.org.eg/9th%20annual%20conf/9th%20PDF%](http://www.erf.org.eg/9th%20annual%20conf/9th%20PDF%20)
- Denise Eby Konan and Ari Van Assche (2006) "Regulation Market Structure and Service Trade Liberalization"; CIRANO; Scientific Series, Montreal September 2006
- Drusilla K. Brown and Robert M. Stern. (2000). "Measurement and Modelling of the Economic Effects of Trade and Investment Barriers in Services" RSIE Discision paper 453. University of Michigan. Disponible sur: <http://www.spp.unich.edu/rsie/workingpapers/wp.html>
- Devarajan, Shantayanan, and Dominique van der Mensbrugghe. 2000. "Trade Reform in South Africa: Impacts on Households." Stockholm, October, 2000.
- Deardoff, A. (2001), "International Provision of trade Services, Trade and Fragmentation", *Review of International Economics*, 9(2), pp.233-248.
- Deardorff, A. et Stern, R. (1998), "Measurement of Nontariff Barriers", Ann Arbor: University of Michigan Press
- Dee, P. et Hanslow, K. (2000), "Multilateral Liberalisation of Services Trade", Productivity Commission Staff Research Paper, Ausinfo, Canberra.
- Dollar, David and Aart Kraay. 2000. "Growth is Good for the Poor." World Bank Policy Research Working Paper 2587.
- Dollar, David and Aart Kraay. 2001. "Trade, Growth, and Poverty." World Bank Policy Research Working Paper 2615.
- Emini, Christian , Cockburn, John and Decaluwe, Bernard, "The Poverty Impacts of the Doha Round in Cameroon: The Role of Tax Policy" (October 2005). World Bank Policy Research Working Paper No. 3746 Available at SSRN: <http://ssrn.com>
- Emini, Christian , (2004), « Note technique sur la Matrice de Comptabilité Sociale du Cameroun de 2001", mimeo
- Findlay, C. et Warren, T. (2000), "Impediments to Trade in Services: Measurement and Policy Implication", New York: Routledge.

- Fink, C., Mattoo, A., et Neagu, I. (2001), "Trade in International Maritime Services: How Much Does Policy Matter?", Banque mondiale.
- Fink, C., Mattoo, A., et Rathindran, R.(2002), Liberalizing Basic Telecommunications: Evidence from Developing Countries, document présenté à la réunion des experts en services de l'OCDE et de la Banque mondiale qui s'est tenue à Paris les 4 et 5 mars 2002
- Feenstra, Robert C. and Hiau Looi Kee, 2004. "On the Measurement of Product Variety in Trade," *American Economic Review*, 94(2), 145-149.
- Francois, J. et Hoekman, B. (1999), "Market Access in the Service Sectors", manuscrit, Tinbergen Institute.
- Francois, J., Van Meijl, H. et van Tongeren, F. (2002), "Economic Benefits of the Doha round for the Netherlands", polycopié.
- Fofack, Hippolyte, Célestin Monga, and Hasan Tuluy. 2001. "Household Welfare and Poverty Dynamics in Burkina Faso: Empirical Evidence from Household Surveys." World Bank policy Research Paper 2590.
- Global Dialogue. The EU-South Africa Trade Deal: Implications for Southern Africa; 1999. available at http://WWW.igd.org.za/g-dialogue/Special_feature/trade.html
- Hardin, A. et Holmes, L. (1997), "Services Trade and Foreign Direct Investment, Staff Research Paper, Industry Commission. Canberra: Services de publication du gouvernement australien.
- Hertel, Thomas W., ed. 1997. Global Trade Analysis: Modeling and Applications. New York:Cambridge University Press.
- Hoekman, Bernard. 1995. "Assessing the General Agreement on Trade in Services," in Will martin and L. Alan Winter (eds) The Uruguay Round and the developing Economies, World Bank Discussion paper No. 307. Washington, D.C.
- Jensen, J., Rutherford, T. et Tarr, D. (2002), "Economy-Wide Effects of Russia's Accession to the WTO", document élaboré pour la conférence ASDI-CEFIR sur les négociations relatives à l'accession de la Russie à l'OMC, juin 2002.
- Johnson, M., Gregan, T., Gentle, G. et Belin, P. (2000), "Modelling the benefits of increasing competition in international air services" in Findlay, C et Warren, T (eds.), Impediments to Trade in Services: Measurement and Policy Implication, New York: Routledge.
- Jomini, P., Verikios, G. et Zhang, X. (2002), "Quantifying the Effects of Liberalizing Services: the Experience of the Australian Productivity Commission", réunion des experts en services de l'OCDE et de la Banque mondiale, Paris (4 et 5 mars 2002).
- Kalirajan, K. (2000), "Restrictions on Trade in Distribution Services", Productivity Commission Staff Research Paper, Ausinfo, Canberra.
- Kalirajan, K., McGuire, G., Nguyen-Hong, D. et Shuele, M. (2000), "Restrictiveness of International Trade in Banking Services", in Findlay, C. et Warren, T. (eds.),

- Impediments to Trade in Services: Measurement and Policy Implication, New York: Routledge.
- Kang, J. (2000), "Price Impact of Restrictions on Maritime Transport Services", in Findlay, C. et Warren, T. (eds.), *Impediments to Trade in Services: Measurement and Policy Implication*. New York: Routledge.
- Kemp, S. (2000), "Trade in Education Services and the Impacts of Barriers to Trade", in Findlay C. et Warren T. (eds.), *Impediments to Trade in Services: Measurement and Policy Implication*. New York: Routledge.
- P. Krugman, (1981), "Intraindustry Specialization and the Gains From Trade", *Journal of political Economy*, 73, 557-573.
- P. Krugman et Helpman, E (1989), "Trade policy and market structure" MIT Press
- Hoekman, Bernard. 2000. "The Next Round of Services Negotiations: Identifying Priorities and Options." *Federal Reserve Bank at St. Louis Review*, July/August 2000
- Jaime De Melo, Dervis kemal and Sherman Robinson (1982): "General Equilibrium Models for development policy" Cambridge university press.
- Jaime de Melo – Jean-Marie Grether: "Commerce international, Théories et applications," De Boeck Université., 1997.
- Jaime de Melo and David G. Tarr (1992), *A General Equilibrium Analysis of US Foreign Trade Policy*, MIT Press, Cambridge Mass.
- Jeffrey J. Reimer (2002).: "Estimating the Poverty Impacts of Trade Liberalization" Purdue University.
- Mattoo Aaditya, ramdeep et Arvind.(2001). "Measuring services trade Liberalization and Its Impacts on Economic Growth: an illustration" World bank research program on trade in service.
- Mattoo Aaditya, (1998) "Financial Services and the World trade Organization: liberalization Commitments of the Developing and Transitional Economies," policy reseach program No. 2184 development research group, world Bank, Septembre 1999
- Marko, M. (1998), "An Evaluation of the Basic Telecommunications Service Agreement", Policy Discussion Paper No. 98/09, Centre for International Economic Studies, University of Adelaide, Australie.
- Markusen, J. et Rutherford T. (2002), "Developing domestic entrepreneurship and growth through imported expertise", CEBR Discussion paper No 2002-12.
- Markusen, J., T. Rutherford et D. Tarr (2000), "Foreign Direct Investment in Services and the Domestic Market for Expertise", Policy Research Paper No. 2413, Banque mondiale, Washington DC, août.
- McGuire G. (2002), "How Important are Restrictions on Trade in Services?", document de référence présenté à la réunion des experts en services de l'OCDE et de la Banque mondiale, OCDE, Paris (4 et 5 mars 2002).

- Nguyen-Hong, D. (2000), "Restrictions on Trade in Professional Services," Productivity Commission Staff Research Paper, Ausinfo, Canberra.
- Zhiqi Chen and Lawrence Schembri (2001); "Measuring the Barriers to Trade in Services: Literature and Methodologies"
- Löfgren, Hans. 1999. "Trade Reform and the Poor in Morocco: A Rural-Urban General Equilibrium Analysis of Reduced Protection." IFPRI TMD Discussion Paper 38.
- Hans Löfgren Rebecca Lee Harris Sherman Robinson, 2001 "A STANDARD COMPUTABLE GENERAL EQUILIBRIUM (CGE) MODEL IN GAMS" IFPRI TMD DISCUSSION PAPER 75 Washington, D.C. 20006, U.S.A. May 2001
- Ravallion, Martin. 1990. "Rural Welfare Effects of Food Price Changes Under Induced Wage Responses: Theory and Evidence for Bangladesh." Oxford Economic Papers 42: 574-585.
- Robilliard, Anne-Sophie, Francois Bourguignon, and Sherman Robinson. 2001. "Crisis and Income Distribution: A Micro-Macro Model for Indonesia." Nottingham University, Octobre, 2001.
- Rodrik, Dani. 2000. Comments on "Trade, Growth, and Poverty," by David Dollar and Aart Kraay. Dispible sur: <http://ksghome.harvard.edu/~drodrik.academic.ksg/papers.html>.
- Robinson, S., Wang, Z et Martin, W. (1999), "Capturing the Implications of Services Trade Liberalisation", document présenté lors de la deuxième conférence annuelle sur le thème "Global Economic Analysis", Ebberuk, Danemark, 20-22 juin.
- Sadoulet, Elisabeth and Alain de Janvry. 1992. "Agricultural Trade Liberalization and Low Income Countries: A General Equilibrium-Multimarket Approach." American Journal of Agricultural Economics
- South African Institute of International Affairs (2000), "The EU-SA Trade, Development, And Co-Operation Agreement – A Sectoral Analysis of its Implications on Small, Medium And Micro Enterprises (SMMES) In South Africa."
- Thomas Rutherford, David Tarr, Oleksandr Shepotylo, Chapter 16 in *Poverty and the WTO: Impacts of the Doha Development Agenda*, Thomas W. Hertel and L. Alan Winters (eds.) from the World Bank, Washington, DC. World Bank Policy Research Working Paper 3725, October 2005
- Verikios, G. et Zhang, X. (2000), "Sectoral Impact of Liberalising Trade in Services", document présenté à la troisième conférence organisée sur le thème "Global Economic Analysis", Melbourne, 27-30 juin., Disponible sur: www.monash.edu.au/policy/conf/53Verikios.pdf
- Verikios, G. and Zhang, X-G. 2001, Global Gains from Liberalising Trade in Telecommunications and Financial Services, Productivity Commission Staff Research Paper, AusInfo, Canberra, October.
- Winters, L. Alan. 2000. "Trade, Trade Policy, and Poverty: What are the Links?" Centre for Economic Policy Research Paper No. 2382.
- Warren, T. (2000), "The Impact on Output of Impediments to Trade and Investment in Telecommunications Services," in Findlay, C. et Warren, T. (eds), Impediments to Trade in Services: Measurement and Policy Implications, New York: Routledge

Annex. I CGE and households model results of main model

Table AI-1. Final consumption investment and intermediate consumptions prices

		Base line	Marku p effect: (elast 15)	Productivity effect: (elast 15)	Productivity + markup effect: elast 15	Markup effectet (elast 100)	productivit y + markup effect (elast 100)
var.	sectors	Base line	change	change	change	change	change
Formal sector Intermediate prices	Other business Services	1.06	-0.14	0.21	0.07	-0.76	-0.55
	Food Agriculture	1.02	-0.01	0.22	0.21	-0.02	0.20
	Agriculture of exportations	1.04	-0.06	0.34	0.28	-0.31	0.03
	Industry	1.04	-0.01	0.28	0.27	-0.07	0.22
	Publics and social services	1.06	-0.16	0.25	0.09	-0.88	-0.63
	Transportations	1.07	-0.20	0.23	0.03	-1.11	-0.89
	Telecommunications	1.07	-0.36	0.28	-0.08	-1.97	-1.70
	Finances	1.11	-0.26	0.17	-0.09	-1.42	-1.25
Informal sector Intermediate prices	Other business Services	1.05	-0.14	0.20	0.06	-0.79	-0.59
	Food Agriculture	1.02	-0.01	0.22	0.21	-0.02	0.20
	Agriculture of exportations	1.04	-0.06	0.34	0.28	-0.31	0.03
	Industry	1.03	-0.01	0.29	0.28	-0.06	0.23
	Publics and social services	1.06	-0.16	0.25	0.09	-0.88	-0.63
	Transportations	1.07	-0.20	0.23	0.03	-1.11	-0.89
	Telecommunications	0.00	0.00	0.00	0.00	0.00	0.00
	Finances	0.00	0.00	0.00	0.00	0.00	0.00
Investments	Other business Services	343711.00	-0.14	7.84	7.69	-0.94	6.86
	Food Agriculture	479598.00	-0.14	7.84	7.69	-0.94	6.86
	Agriculture of exportations	73365.00	-0.14	7.84	7.69	-0.94	6.86
	Industry	597833.00	-0.14	7.84	7.69	-0.94	6.86
	Publics and social services	-145333.00	-0.14	7.84	7.69	-0.94	6.86
	Transportations	-219757.00	-0.14	7.84	7.69	-0.94	6.86
	Telecommunications	-46898.00	-0.14	7.84	7.69	-0.94	6.86
	Finances	28182.00	-0.14	7.84	7.69	-0.94	6.86
Final consumption	Other business Services	1000544.85	0.04	4.59	4.63	0.21	4.82
	Food Agriculture	1608992.91	0.00	1.13	1.13	0.00	1.13
	Agriculture of exportations	54728.81	0.02	1.06	1.07	0.09	1.15
	Industry	1286060.96	0.01	2.06	2.06	0.04	2.09
	Publics and social services	376334.50	-0.08	9.07	8.99	-0.57	8.49
	Transportations	381768.01	0.04	5.24	5.28	0.16	5.41
	Telecommunications	56315.54	4.82	5.27	10.29	31.20	37.72
	Finances	5249.51	0.24	5.02	5.28	1.30	6.38

Source: Author estimations

Table.AI-2 Poverty indicator by category of households

			FGT-0		FGT-1		FGT-2	
		(0)	(1)	(2)	(3)	(4)	(5)	(6)
			Reference	change	Reference	change	Reference	change
Simul1	Formal	Rural not qualified formal	0.40	2.63	0.16	5.00	0.08	5.25
		Urban not qualified formal	0.28	1.89	0.08	10.25	0.03	12.67
		rural qualified formal	0.22	1.74	0.06	6.83	0.02	8.50
		Urban qualified formal	0.07	1.48	0.01	19.00	0.00	0.05
	Informal	Rural not qualified informal	0.60	2.07	0.20	5.35	0.09	6.67
		Urban not qualified informal	0.37	2.92	0.10	12.40	0.04	16.00
		rural qualified informal	0.51	1.35	0.17	3.76	0.08	4.63
		Urban qualified informal	0.17	1.96	0.04	13.00	0.01	20.00
	Inactive	Rural inactive	0.51	1.95	0.17	2.94	0.08	3.25
		Urban inactive	0.21	0.07	0.05	4.60	0.02	5.00
Simul2	Formal	Rural not qualified formal	0.40	0.19	0.16	0.38	0.08	0.38
		Urban not qualified formal	0.28	0.00	0.08	0.50	0.03	0.67
		rural qualified formal	0.22	0.00	0.06	0.50	0.02	0.50
		Urban qualified formal	0.07	0.16	0.01	2.00	0.00	0.01
	Informal	Rural not qualified informal	0.60	0.06	0.20	0.20	0.09	0.22
		Urban not qualified informal	0.37	0.02	0.10	0.30	0.04	0.50
		rural qualified informal	0.51	0.11	0.17	0.18	0.08	0.13
		Urban qualified informal	0.17	0.00	0.04	0.50	0.01	1.00
	Inactive	Rural inactive	0.51	0.00	0.17	0.18	0.08	0.25
		Urban inactive	0.21	0.00	0.05	0.20	0.02	0.50
Simul3	Formal	Rural not qualified formal	0.40	2.63	0.16	4.81	0.08	5.00
		Urban not qualified formal	0.28	1.89	0.08	9.75	0.03	12.00
		rural qualified formal	0.22	1.74	0.06	6.50	0.02	8.50
		Urban qualified formal	0.07	1.48	0.01	19.00	0.00	0.05
	Informal	Rural not qualified informal	0.60	2.03	0.20	5.15	0.09	6.56
		Urban not qualified informal	0.37	2.92	0.10	12.10	0.04	15.75
		rural qualified informal	0.51	1.37	0.17	3.65	0.08	4.38
		Urban qualified informal	0.17	1.75	0.04	12.50	0.01	20.00
	Inactive	Rural inactive	0.51	1.56	0.17	2.82	0.08	3.00
		Urban inactive	0.21	0.05	0.05	4.20	0.02	4.50
Simul4	formal	Rural not qualified formal	0.40	2.63	0.16	6.00	0.08	6.50
		Urban not qualified formal	0.28	1.93	0.08	12.38	0.03	14.67
		rural qualified formal	0.22	1.92	0.06	8.50	0.02	11.00
		Urban qualified formal	0.07	1.78	0.01	23.00	0.00	0.06
	Informal	Rural not qualified informal	0.60	2.34	0.20	6.05	0.09	7.56
		Urban not qualified informal	0.37	3.33	0.10	13.50	0.04	17.50
		rural qualified informal	0.51	1.59	0.17	4.41	0.08	5.38
		Urban qualified informal	0.17	2.08	0.04	14.25	0.01	22.00
	Inactive	Rural inactive	0.51	2.55	0.17	3.59	0.08	4.00
		Urban inactive	0.21	0.32	0.05	5.60	0.02	6.00

Source: Author estimations

Table.AI-3 Variety effect simulations

variables		Baseline	Variety effect without markup	Variety effect with markup 15%	Variety effect without markup 100%
Macro indicators	Households	5329957.02	0.63	0.63	0.65
	Firm revenue	1946772.00	-0.07	-0.08	-0.13
	Gov revenu	1509982.00	-0.12	-0.12	-0.14
	CPI	1.02	-0.15	-0.15	-0.14
	GDP	6259528.00	0.17	0.17	0.17
Production	Other business Services	3139768.00	0.11	0.11	0.11
	Food Agriculture	2934049.00	0.22	0.22	0.22
	Agriculture of exportations	463327.00	0.10	0.09	0.08
	Industry	3915240.00	0.01	0.01	0.00
	Publics and social services	906059.00	0.69	0.69	0.69
	Transportations	572331.00	0.55	0.56	0.57
	Telecommunications	367000.39	3.49	3.54	3.82
	Finances	114205.58	2.11	2.12	2.19
Composite prices	Other business Services	1.01	-0.12	-0.12	-0.11
	Food Agriculture	1.01	0.45	0.46	0.49
	Agriculture of exportations	1.01	-0.01	-0.01	0.01
	Industry	1.06	0.17	0.18	0.20
	Publics and social services	1.01	-0.28	-0.28	-0.26
	Transportations	1.06	-0.63	-0.63	-0.63
	Telecommunications	0.41	-36.55	-36.78	-38.09
Formal sectors wages	Wage of rural non qualified in formal activity	1.80	0.36	0.37	0.42
	Wage of rural qualified in formal activity	1.83	0.33	0.34	0.39
	Wage of urban non qualified in formal activity	2.35	0.36	0.37	0.42
	Wage of urban qualified in formal activity	3.16	0.33	0.34	0.39
Informal sector wages	Wage of rural non qualified in informal activity	0.50	0.92	0.93	0.97
	Wage of rural qualified in informal activity	1.25	0.92	0.93	0.97
	Wage of urban non qualified in informal activity	1.50	0.92	0.93	0.97
	Wage of urban qualified in informal activity	2.50	0.92	0.93	0.97
Formal sector capital return	Other business Services	4.00	1.00	1.01	1.07
	Food Agriculture	4.00	0.89	0.90	0.95
	Agriculture of exportations	4.00	0.80	0.80	0.82
	Industry	4.00	0.53	0.53	0.55
	Publics and social services	4.00	0.84	0.85	0.90
	Transportations	4.00	1.06	1.07	1.14
	Telecommunications	4.00	-9.91	-9.85	-9.52
Informal sector capital return	Finances	4.00	1.34	1.35	1.44
	Other business Services	3.00	0.77	0.78	0.82
	Food Agriculture	3.00	1.03	1.04	1.08
	Agriculture of exportations	3.00	0.90	0.91	0.94
	Industry	3.00	0.84	0.85	0.88
	Publics and social services	3.00	0.97	0.98	1.03
	Transportations	3.00	1.15	1.16	1.22
Informal sector capital return	Telecommunications	3.00	0.00	0.00	0.00
	Finances	3.00	0.00	0.00	0.00

Source: Author estimations

Table AI-4. Results of alternatives closures rules (sensitivity analysis)

		Baseline	current account endogenous and investment exogenous	government Consumption endogenous and government saving exogenous	Labor supply endogenous and wage exogenous	capital endogenous and capital price exogenous	IPC exogenous and TCN endogenous
		(1)	(2)	(3)	(4)	(5)	(6)
Macro indicators	Households income	5237311	3.3	3.3	5.8	9.1	3.2
	IPC	1	-1.5	0.4	-0.7	1.7	0.0
	GDP	6345194	3.4	3.4	6.2	10.1	3.4
	Firms revenue	1946772	2.1	3.8	5.4	12.9	3.5
	Gov revenue	1509982	2.1	3.8	5.8	12.8	3.6
production	Other business	3139768	3.9	3.8	7.5	12.9	4.1
	Food Agriculture	2934049	1.9	1.9	5.1	7.3	2.7
	Agriculture of	463327	3.9	2.8	6.2	12.7	3.7
	Industrv	3915240	3.8	3.2	5.7	12.6	3.6
	Publics and social	906059	3.6	5.9	6.2	3.2	2.6
	Transportations	572331	4.9	4.3	5.8	6.4	2.9
	Telecommunications	99399	6.5	6.1	7.5	11.5	5.1
	Finances	113683	3.6	3.1	9.3	12.6	4.8
Prices	Other business	1	-1.4	0.5	-0.3	1.7	0.3
	Food Agriculture	1	-2.0	-0.2	-1.8	3.1	-0.1
	Agriculture of	1	-2.0	-0.1	0.8	1.3	0.5
	Industrv	1	-1.2	0.3	0.7	0.6	0.3
	Publics and social	1	-0.9	2.6	-1.6	2.2	-0.3
	Transportations	1	-0.8	1.3	-1.1	1.6	-0.3
	Telecommunications	1	-3.0	-0.7	-2.9	-4.6	-3.3
	Finances	1	-1.1	1.3	-1.8	2.9	-0.2
Formal sector Wages	WRUNQ1	2	2.6	6.0	0.0	10.0	3.4
	WRUQ1	2	2.7	6.1	0.0	9.5	3.3
	WURNQ1	2	2.6	6.0	0.0	10.0	3.4
	WURQ1	3	2.7	6.1	0.0	9.5	3.3
Informal sector wages	WRUNQ2	1	1.2	3.0	0.0	11.9	3.4
	WRUQ2	1	1.2	3.0	0.0	11.9	3.4
	WURNQ2	2	1.2	3.0	0.0	11.9	3.4
	WURQ2	3	1.2	3.0	0.0	11.9	3.4
Formal sector wages	Other business	4	2.3	4.5	6.4	0.0	4.6
	Food Agriculture	4	-0.4	1.6	2.1	0.0	2.5
	Agriculture of	4	3.0	2.4	7.0	0.0	4.1
	Industrv	4	3.1	3.5	7.4	0.0	4.0
	Publics and social	4	2.8	9.2	3.3	0.0	2.3
	Transportations	4	4.3	6.0	3.7	0.0	2.6
	Telecommunications	4	10.8	13.4	10.7	0.0	7.7
	Finances	4	2.8	5.8	4.7	0.0	4.5
Informal sector wages	Other business	3	2.4	4.5	6.6	0.0	4.5
	Food Agriculture	3	-0.4	1.5	2.0	0.0	2.5
	Agriculture of	3	2.7	2.3	6.1	0.0	4.0
	Industrv	3	2.7	3.1	6.1	0.0	3.9
	Publics and social	3	3.0	9.7	3.4	0.0	2.3
	Transportations	3	4.3	5.9	3.7	0.0	2.6
	Telecommunications	3	0.0	0.0	0.0	0.0	0.0
	Finances	3	0.0	0.0	0.0	0.0	0.0

Source: Author estimations

Annex II. SAM and Calibration

Table.AII-1 : estimations of microeconomic revenues

	(1)	(2)	(3)	(4)
	Qualified wage	No qualified wage	Rent of land	Return on capital
Age	0.025	-0.000	0.021	0.068
	(15.87)***	(0.35)	(11.70)***	(2.45)**
Education	0.087	-0.015	0.156	0.097
	(15.37)***	(1.97)**	(23.23)***	(2.50)**
Jours travail/semaine	0.069	0.063		
	(5.46)***	(4.28)***		
Département	-0.002	0.009	0.012	-0.004
	(1.63)	(5.47)***	(5.69)***	(0.23)
Sexe	-0.286	-0.477	-0.035	0.101
	(9.39)***	(11.13)***	(0.47)	(0.15)
Mauvaise santé	-0.048	-0.000		
	(3.12)***	(0.02)		
Région (ville Vs village)	-0.258	-0.298	-0.599	0.216
	(11.26)***	(10.10)***	(16.90)***	(0.86)
Sct. Parapublic	-0.240	-0.091	-0.313	-2.212
	(3.08)***	(0.46)	(1.30)	(3.02)***
Sct. Privé formel	-0.480	-0.225	0.647	0.844
	(10.87)***	(1.59)	(4.52)***	(2.19)**
Sct. Informel agricole	-1.373	-0.760	0.935	-0.033
	(24.28)***	(5.87)***	(7.68)***	(0.04)
Sct. Informel non agricole	-0.959	-0.684	0.444	-0.853
	(21.99)***	(5.35)***	(3.48)***	(1.54)
Nombre conjoint			0.075	-0.284
			(2.05)**	(0.88)
Tcap				-0.306
				(0.89)
Superficie terre			0.030	
			(3.51)***	
Taille ménage				
Constant	5.415	6.621	1.600	0.354
	(36.36)***	(32.93)***	(7.47)***	(0.23)
Observations	3328	2679	4730	127
R-squared	0.55	0.18	0.25	0.28

Robust t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

Table AII-2 Introduction of new services or new technologies in Cameroonian telecommunications market between 1999 et 2007

Segments		1999	2000	2001	2002	2003	2004	2005	2006	2007	Total
Internet	number	2	4	0	4	1	1	2	0	2	16
	Services or technologies	-Connexion RTC -Liaison câblée	-Connexion -Par Wireless -Téléphonie (VoiceIP) -Net fax -VPN	amélioration des produits existants	-Web Design -Web Hosting -Domain Name -Webcam, VisioConférence	-Connexion V-SAT	-Connexion WIFI	-Connexion U-SAT -ADSL	Amélioration des produits existants	-WAP (Internet sur Cellulaire) - Possibilité de connexion par fibre optique	
fixe telephone	number	0	0	0	1	0	0	1		0	2
	Services or technologies	Téléphonie urbaine et interurbaine	RAS	RAS	Passage du numéro à 7 chiffres	RAS	RAS	arrivée sur le Marché en début décembre du CTPHONE basé sur la technologie CDMA en effet le CTPHONE est à cheval entre le fixe et le mobile en ceci qu'il permet le déplacement dans un rayon de 50 Km à la ronde	RAS	RAS	
mobile telephone	number	0	2	0	2	0	5	3	0	1	14
	Services or technologies	RAS	-appel urbain, interurbain et international -SMS	RAS	-Gestion double appel -Appel en conférence max 5	RAS	-Pay as you GO POP -Pay as you GO PER Second -Pay as you GO GOLD -Business Solutions Flexi -Me2U transfert de crédit	-GPS Localisation -Le Roaming -CSD DATA Link transfert de données	RAS	WAP (Internet sur Cellulaire)	

Sources : collected by the author from different sources including (Cameroonian regulation authority of telecommunication website, cyber coffee, and telephone box owners in Yaoundé)

Note: RAS= no inovation

Table AII-3 Social Accounting Matrix of Cameroon in 2001

		RURTNO	URBTNO	RURTQ	URBTQ	CAP	TER	MNAGE	ENTR	ETAT	RDM	TAXREV	TAXACT	TVA LCX	TAXDOM	TVA IMP	TAXVTE	Tarif	TAX exprt	AGR VRIER	AGRV RIER	AGREXP FOR	AGREXP- INF	IND-FOR	IND-INF	SEVSO-FOR	SEVSO-INF
	Números	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
RURTNO	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3963	226746	663	12509	5594	56183	14851	1460
URBTNO	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7055	403103	1173	22238	9944	99881	26402	2596
RURTQ	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19842	70858	3314	3903	27968	17558	74254	457
URBTQ	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79366	283432	13255	15636	111870	70229	297008	1825
CAP	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	129986	358443	84341	35181	1002977	140574	201991	1247
TER	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6442	17767	8998	3753	0	0	0	0
MNAGE	7	534018	949366	346545	1386179	1023248	36960	0	714386	408514	10400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENTR	8	0	0	0	0	1946772	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ETAT	9	0	0	0	0	172043	0	0	371689	0	0	399718	33507	168663	98805	115478	145200	0	4879	0	0	0	0	0	0	0	0
RDM	10	0	0	0	0	0	0	0	69360	197347	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TAXREV	11	0	0	0	0	0	0	168761	230957	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TAXACT	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	355	1957	376	313	3289	2041	756	10
TVA LCX	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TAXDOM	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TVA IMP	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TAXVTE	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tarif	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TAX exprt	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGRVRIER-FOR	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGRVRIER-INF	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGREXP-FOR	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGREXP-INF	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IND-FOR	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IND-INF	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEVSO-FOR	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEVSO-INF	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANS-FOR	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANS-INF	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TELCOM-FOR	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TELCOM-INF	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FINCE-FOR	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEVTRDE-FOR	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEVTRDE-INF	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGRVRIER-C	34	0	0	0	0	0	0	1616363	0	0	0	0	0	0	0	0	0	0	0	71096	392096	1817	1515	138942	102939	8578	106
AGREXP-C	35	0	0	0	0	0	0	55458	0	0	0	0	0	0	0	0	0	0	0	4143	22845	28462	23744	41206	30534	108	2
IND-C	36	0	0	0	0	0	0	1357395	0	0	0	0	0	0	0	0	0	0	0	20780	114599	50907	42469	726972	293099	131987	1623
SEVSO-C	37	0	0	0	0	0	0	378204	0	660749	0	0	0	0	0	0	0	0	0	68	375	90	76	1757	1185	984	13
TRANS-C	38	0	0	0	0	0	0	402892	0	0	0	0	0	0	0	0	0	0	0	27844	153559	6698	5588	54359	25546	20259	250
TELCOM-C	39	0	0	0	0	0	0	81221	0	0	0	0	0	0	0	0	0	0	0	476	2622	2388	1992	6741	3056	14797	183
FINCE-C	40	0	0	0	0	0	0	5966	0	0	0	0	0	0	0	0	0	0	0	358	1969	766	639	7110	2523	6803	84
SEVTRDE-C	41	0	0	0	0	0	0	1013370	0	0	0	0	0	0	0	0	0	0	0	78927	435289	49727	41485	580582	355911	96994	1197
AGRVRIER	42	0	0	0	0	0	0	0	0	0	0	45837	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGREXP	43	0	0	0	0	0	0	0	0	0	0	201799	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IND	44	0	0	0	0	0	0	0	0	0	1246178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANS	45	0	0	0	0	0	0	0	0	0	0	112268	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TELCOM	46	0	0	0	0	0	0	0	0	0	0	4445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FINCE	47	0	0	0	0	0	0	0	0	0	0	28608	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEVTRDE	48	0	0	0	0	0	0	0	0	0	0	71076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ACCUM	49	0	0	0	0	0	0	329986	560380	243372	-23037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	50	534018	949366	346545	1386179	3142063	36960	5409616	1946772	1509982	1697574	399718	33507	168663	98805	115478	145200	0	4879	450701	2485660	252975	211041	2719311	1201259	895772	11053

		TRANS -FOR	TRANS -INF	TELCOM -FOR	TELCOM -INF	FINCE -FOR	SEVTRDE -FOR	SEVTRDE -INF	AGRVRIER-C	AGREXP-C	IND-C	SEVSO-C	TRANS-C	TELCOM-C	FINCE-C	SEVTRDE-C	AGRVRIER	AGREXP	IND	TRANS	TELCOM	FINCE	SEVTRDE	ACCUM	Total	
	Números	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
RURTNO	1	3184	20202	606	68	1125	13920	172944	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	534018	
URBTNO	2	5659	35914	1077	121	2000	24747	307456	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	949366	
RURTO	3	15916	6313	3028	22	5625	43442	54045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	346545	
URBTO	4	63664	25252	12112	85	22498	173767	216180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1386179	
CAP	5	124956	36303	76032	205	10999	539309	399519	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3142063	
TER	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36960	
MNAGE	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5409616	
ENTR	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1946772	
ETAT	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1509982	
RDM	10	0	0	0	0	0	0	0	153457	21806	1051204	0	58594	5469	34824	105513	0	0	0	0	0	0	0	0	1697574	
TAXREV	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	399718	
TAXACT	12	5497	3194	456	3	0	6375	8885	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33507
IVA LCX	13	0	0	0	0	0	0	0	1804	909	94391	3735	22665	10211	8639	26309	0	0	0	0	0	0	0	0	0	168663
TAXDOM	14	0	0	0	0	0	0	0	6360	0	92445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98805
IVA IMP	15	0	0	0	0	0	0	0	4213	2465	108800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	115478
TAXVTE	16	0	0	0	0	0	0	0	26605	1907	116688	0	0	0	0	0	0	0	0	0	0	0	0	0	0	145200
Tarif	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TAX export	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1775	5	3099	0	0	0	0	0	0	4879
AGRVRIER-FOR	19	0	0	0	0	0	0	0	443938	0	0	0	0	0	0	0	6763	0	0	0	0	0	0	0	0	450701
AGRVRIER-INF	20	0	0	0	0	0	0	0	2448361	0	0	0	0	0	0	0	37299	0	0	0	0	0	0	0	0	2485660
AGREXP-FOR	21	0	0	0	0	0	0	0	0	142960	0	0	0	0	0	0	0	110015	0	0	0	0	0	0	0	252975
AGREXP-INF	22	0	0	0	0	0	0	0	0	119262	0	0	0	0	0	0	0	91779	0	0	0	0	0	0	0	211041
IND-FOR	23	0	0	0	0	0	0	0	0	1656459	0	0	0	0	0	0	0	0	1062852	0	0	0	0	0	0	2719311
IND-INF	24	0	0	0	0	0	0	0	0	1021032	0	0	0	0	0	0	0	0	180227	0	0	0	0	0	0	1201259
SEVSO-FOR	25	0	0	0	0	0	0	0	0	0	895772	0	0	0	0	0	0	0	0	0	0	0	0	0	0	895772
SEVSO-INF	26	0	0	0	0	0	0	0	0	0	11053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11053
TRANS-FOR	27	0	0	0	0	0	0	0	0	0	0	0	296484	0	0	0	0	0	0	71009	0	0	0	0	0	367493
TRANS-INF	28	0	0	0	0	0	0	0	0	0	0	0	172270	0	0	0	0	0	0	41259	0	0	0	0	0	213529
TELCOM-FOR	29	0	0	0	0	0	0	0	0	0	0	0	0	134229	0	0	0	0	0	0	4421	0	0	0	0	138650
TELCOM-INF	30	0	0	0	0	0	0	0	0	0	0	0	0	722	0	0	0	0	0	0	24	0	0	0	0	746
FINCE-FOR	31	0	0	0	0	0	0	0	0	0	0	0	0	0	96008	0	0	0	0	0	0	28608	0	0	0	124616
SEVTRDE-FOR	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1359177	0	0	0	0	0	0	65535	0	0	1424712
SEVTRDE-INF	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1724775	0	0	0	0	0	0	5541	0	0	1730316
AGRVRIER-C	34	37	22	0	0	10	99841	171778	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	479598
AGREXP-C	35	0	0	0	0	0	2864	6578	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73365
IND-C	36	82690	48047	11322	61	4418	369916	286901	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	597833
SEVSO-C	37	2358	1364	52	1	138	3948	4531	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4141019
TRANS-C	38	4536	2638	1395	8	2572	41636	19990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-145333
TELCOM-C	39	9434	5482	5370	29	4908	30041	28789	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	910560
FINCE-C	40	17994	10456	879	5	48708	3659	3370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-219757
SEVTRDE-C	41	31568	18342	26321	138	21615	71247	49350	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	550013
AGRVRIER	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46898
AGREXP	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	201799
IND	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1246178
TRANS	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	112268
TELCOM	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4445
FINCE	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28608
SEVTRDE	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71076
ACCUM	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1110701
Total	50	367493	213529	138650	746	124616	1424712	1730316	3084738	289309	4141019	910560	550013	150631	139471	3215774	45837	201799	1246178	112268	4445	28608	71076	1110701	0	

Source: Author construction from original SAM provided by Emini (2004)

TableAII-4 Correspondences between Sam sectors and ECAM II products nomenclature

Tableau de correspondance des activités entre la SAM et ECAM

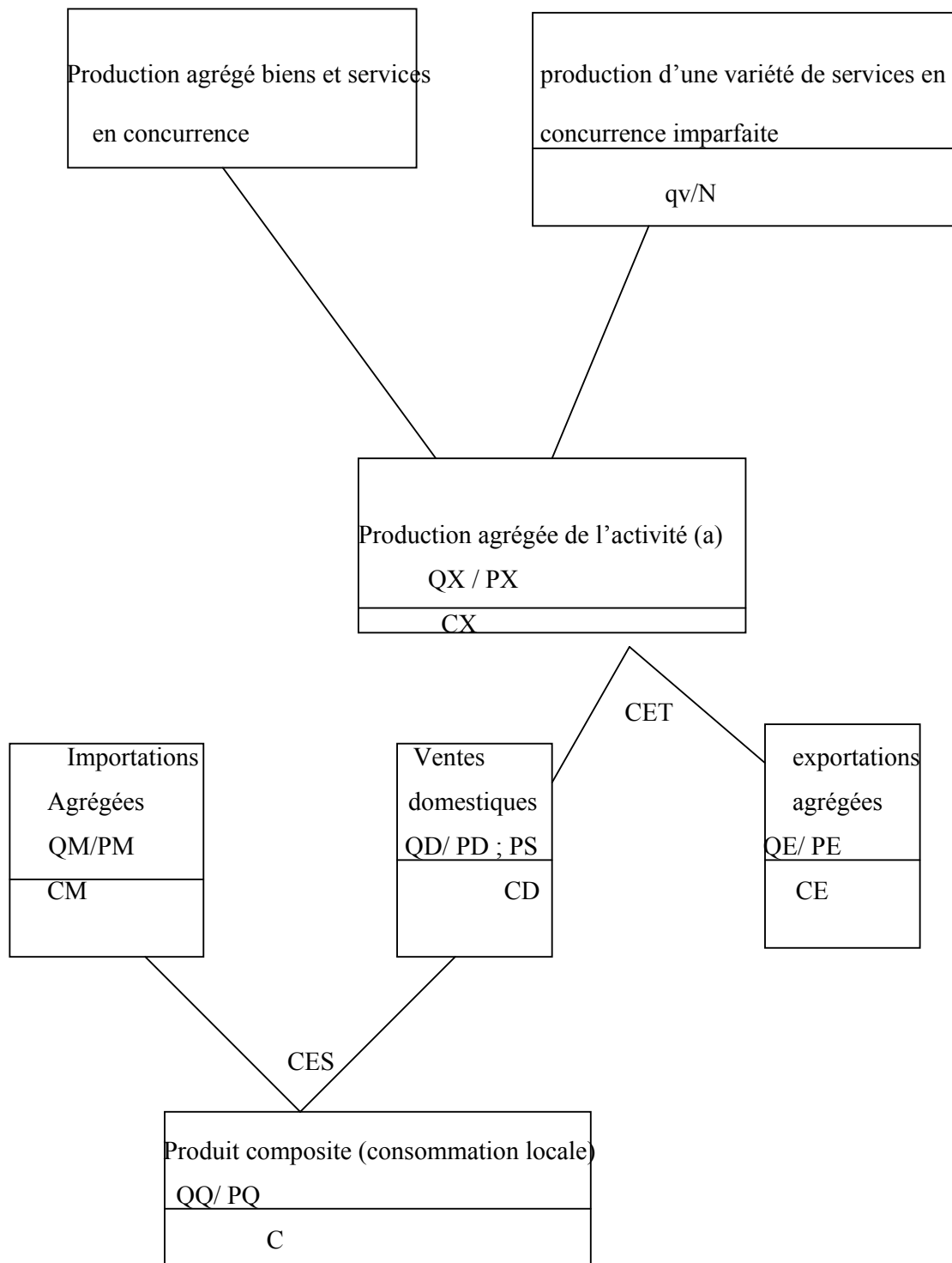
Activités dans la SAM	Activités dans l'ECAM
Agriculture vivrière	Agri/Pêche/Chasse
	Elevage
Agriculture Exportation	Agri/Pêche/Chasse
	Elevage
Industrie	Mines et Minerais
	Energie/Gaz/Eau
	Industrie Agro Ali
	Industrie Textile
	Industrie de Bois
	Industrie Chimique
	Ind. Matériaux de Construction
	Métaux Mécanique et Réparation
finance	Banque / Assurance
télécommunications	Transport et communication
Services commerciaux	BTP
	Commerce Général
	Commerce Alimentaire Spécialisé
	Autre Commerce
	Hôtellerie et Restauration
Services publics	Services Publiques
	Autres Services sociaux

Tableau de correspondance des activités de la SAM et Dépenses correspondantes dans l'ECAM

Activités dans la SAM	Prix dans l'ECAM
Agriculture vivrière	Dépenses d'alimentation, autoconsommation, boisson et tabacs
Agriculture Exportation	Dépenses d'alimentation, autoconsommation, boisson et tabacs
Industrie	Dépenses logements, eau, électricité, gaz et autres combustibles
	Dépenses d'habillement, équipements de maison, hôtels
Services commerciaux	Dépenses de transport et communication
finance	Dépenses de transport et communication
télécommunications	Dépenses de transport et communication
Services publics	Dépenses d'éducation, santé, loisir, spectacles et culture

ANNEX.III : CGE model

Figure. AIII-1 Allocations de la consommation et de la production domestique



ANNEX. IV: Presentation of CGE model

Notations

Indices et ensembles

(a) indique une activité de production définie par l'ensemble A
(c) indique un produit ou une marchandise défini par l'ensemble C
(s) indique un service défini par l'ensemble S
AS est l'ensemble des activités de production de services
AST' est l'ensemble des activités de production de services commerciaux
CST est l'ensemble des produits de services commerciaux
CS est l'ensemble des produits de services
CM est l'ensemble des produits importés
CE est l'ensemble des produits exportés
CD est l'ensemble des produits produit et consommés localement
CTR désigne l'ensemble des produits dont la commercialisation nécessite des coûts de transactions
 CX est l'ensemble de la production domestique marchande.

Paramètres

A_{mc} est le coefficient d'efficience lié à la CES d'allocation de la consommation
B est le facteur d'efficience dans la fonction CES de la valeur ajoutée de l'activité (a)
 D_a est le facteur d'efficience dans la fonction CES d'allocation du facteur travail.
 cic_{cc} est la consommation intermédiaire des services commerciaux nécessaire à l'exportation d'une unité de (c).
 cin_{cc} est la consommation intermédiaire des services commerciaux nécessaire à une unité de (c) produit et vendu localement.
 ci_{ca} C'est la part de l'input (c) dans le total de la consommation intermédiaire de (a).
 ct_{nc} est le coût de transactions nécessaires à la vente d'une unité de bien non échangeable(c).
 cim_{cc} est la consommation intermédiaire des services commerciaux nécessaire à une unité d'importations.
 ct_{mc} est le coût de transactions liés aux importations de (c).
 d_a est la densité en service de l'activité (a)
 f_a est l'exposant dans la fonction CES d'allocation du facteur travail.
 pms_h est la propension marginale à épargner des ménages
 r est le taux de rente pratiqué par les producteurs.
 tm_c est le taux de taxation sur les importations
 tq_c est la taxe sur la vente de la marchandise (c)
 te_c est le taux de taxation sur les exportations

$trev_h$ est l'impôt sur le revenu
 tp_a taux de taxation de la production
 μ_a est la part du travail non qualifié dans le travail total de l'activité (a) impliqué dans la fonction CES d'allocation du facteur travail,
 ν_a est la part constante des inputs dans la production de l'activité a
 χ_{hc}^m est la part marginale de la consommation du produit (c) par le ménage.
 χ_c^g est la part de la consommation du produit (c) par le gouvernement
 χ_c^i est la part de la consommation du produit (c) par les investissements.
 ϕP_c est le poids du produit (c) dans l'indice du prix à la production
 ϕC_c est le poids du produit (c) dans l'indice de prix.
 π_{hc} est la part de la consommation de subsistance du produit (c) par le ménage.
 λ_h^{nq} , représente la part de l'offre du ménage dans l'offre du travail non qualifié,
 λ_h^q représente la part de l'offre du ménage dans l'offre du travail qualifié
 λ_h^k représente la part de l'offre du ménage dans l'offre du capital.
 λ_{wm} est l'exposant lié à la fonction CES d'allocation de la consommation
 σ est l'élasticité de substitution dans la fonction CES de la valeur ajoutée
 ε est l'élasticité de substitution dans la fonction CES d'allocation du facteur travail
 θ_a est la part constante de la valeur ajoutée dans la production de l'activité (a).
 ρ_a est l'exposant dans la fonction CES de la valeur ajoutée de l'activité (a)
 δ_a est la part du facteur capital dans la valeur ajoutée de l'activité (a),
 γ_s est la pondération du facteur de la libéralisation et représente l'élasticité de la croissance par rapport à l'indicateur de libéralisation.
 α : coefficient de sensibilité ou d'aversion à la pauvreté(>0) ;
 m_h : nombre d'individus de la catégorie de ménages h, pour qui $\overline{YM}_h < YM_h < SP$
 n_h : nombre total des individus de la catégorie de ménages h.
le terme
 N_c est le nombre d'entreprise dans la branche produisant (c).
 sd_c est l'équivalent tarifaire de la protection des services transfrontalier

Variables

Variables exogènes

\overline{CGouv} consommation du gouvernement
 \overline{KST} Offre total de capital

\overline{TGM}_h est le transfert exogène de l'état vers les ménages

\overline{BC} Balance commerciale

\overline{LSNQ} Offre de travail non qualifié

\overline{LSQ} offre de travail qualifié

\overline{IS}_s Indicateur de la libéralisation du service (s).

Variables endogènes

IPC est l'indice de prix à la consommation

IPP l'indice de prix à la production

CM_h consommation des ménages

$KT(A)$ capital global (capital plus la terre)

$LT(A)$ travail global

$PK(A)$ prix du capital composite (terre incluse)

PX_c prix aux producteurs du produit composite (marché domestique et exportations) (c).

PD_c prix de la demande du produit (c) offert par les producteurs locaux

PS_c prix d'offre du produit (c) sur le marché domestique et représente le prix effectivement perçu par les fournisseurs.

PX_a prix de chaque activité de production (a)

PCI_a prix de la consommation intermédiaire agrégé

PVA_a prix de la valeur ajoutée

PWE_c est le prix mondial de la marchandise (c) exporté .

PWM_c est le prix mondial de la marchandise (c) importé .

PM_c prix aux consommateurs d'importations du produit (c).

PQ_c composite de la marchandise (c) incluant le coût de transaction et les taxes.

QS_a est le facteur de la libéralisation et représente l'efficiance productive de l'activité (a) engendré par la libéralisation des services.

QX_a quantité de production de l'activité (a) définit par une technologie de production Leontief

QVA_a valeur ajoutée agrégée de l'activité (a)

QCI_a consommation intermédiaire agrégée de l'activité (a)

QCI_{ca} consommation intermédiaire désagrégée du produit (marchandise) (c) par l'activité (a).

QQ_c quantité totale de la marchandise (c) vendu sur le marché domestique.

QD_c quantité de la demande de marchandise (c) offert par les producteurs locaux.
 QX_c QX (C) quantité commercialisable du produit (c)
 QM_c (quantité de la demande d'importations du produit (c)).
 QE_c est la quantité exportée du produit (c)
 QX_{ca} quantité de produits (c) issue de l'activité (a).
 QX_a production totale de l'activité (a)
 CM_{hc} consommation du produit (c) par un ménage (h)
 QQ_c est le produit composite (d'importation et de production locale) sur le marché domestique.
 QTR_c consommation intermédiaire des coûts de transactions nécessaire à la commercialisation du produit (c).
 TCN taux de change nominal
 TCX_c taxe sur les exportations
 TIM_c taxe sur les importations
 w_a salaire moyen de l'activité (a).
 w_{nq} salaires des travailleurs non qualifiés.
 w_q indique les salaires des travailleurs qualifiés.
 YM_h est le revenu des ménages
 YMD_h est le revenu disponible des ménages
 $YENT$ revenu des entreprises
 SM_h épargne de ménages
 $SENT$ épargne des firmes
 $SGouv$ épargne du gouvernement
 $YGouv$ revenu du gouvernement
 CT_c demande de consommation totale du produit (c).
 QTr_c Consommation Totale des services de transactions
 $INVG$ Investissement du Gouvernement
 $INVH_h$ Investissement des ménages
 $CINV_c$ Consommation d'investissement
 $INVT$ Investissement de base
 Cm_{ac}^e coût marginal du l'activité (a) produisant (c)) destiné à l'exportations
 Cm_{ac}^d coût marginal de destiné au marché local
 ε_c^d est l'élasticité de substitution prix de la demande domestique
 Δ_{ac} **Le profit de l'entreprise**

r_{ac} taux de rente du producteur sur le produit (c) de l'activité (a)
 CM_a coût moyen
 Cm_a coût marginal de l'activité (a)
 YM_h est le revenu du ménage (h)
 DIV_h est le bénéfice du ménage sur la rente des firmes oligopolistiques

Paramètres et variables liés à la modélisation de la pauvreté

SP : seuil de pauvreté
 P_{α}^h : classe d'indice de pauvreté FGT pour la catégorie de ménages h ;
 YM_h : revenu de l'individu ou du ménage de la catégorie h ;
 \overline{YM}_h : revenu minimal du ménage de la catégorie h ;
 $\overline{\overline{YM}}_h$: revenu maximal du ménage de la catégorie h ;
 \overline{TGM}_h est le transfert au profit du ménage (h)
 a_h, b_h : paramètres de $f(YM_h; a_h, b_h)$ (> -1).

Equations

I. Secteur de production
 La technologie de production Leontief :

Demande de valeur ajoutée

$$QVA_a = q_a \cdot QA_a \quad a \in A \quad (0.20)$$

Demande de consommation intermédiaire

$$QCI_a = v_a \cdot QA_a \quad a \in A \quad (0.21)$$

Demande des inputs désagrégés (fonction Leontief des différents inputs)

$$QCI_{ca} = ci_{ca} \cdot QCI_a \quad a \in A \quad (0.22)$$

Valeur ajoutée fonction CES du capital global (KT) et du travail global (LT) et la qualité des services de(QS) ;

$$QVA_a = [QS_a \cdot B_a] [\delta_a KT_a^{\rho_a} + (1 - \delta_a) LT_a^{\rho_a}]^{1/\rho_a} \quad a \in A \quad (0.23)$$

Facteur de la libéralisation

$$QS_a = e^{(d_a)} \prod_{s \in S} IS_s^{(\gamma_s)} \quad a \in A$$

(0.24)

le Coût total

$$CT_a = PK_a \cdot K_a + W_a \cdot L_a + PCI_a \cdot QCI_a + KF_a \quad a \in A$$

(0.25)

Demande de travail total dérivé de la minimisation de la fonction du coût sous contrainte de la valeur ajoutée.

$$LT_a = \left(\frac{QVA_a}{QS_a B_a} \right) \left[(1-d_a) + d_a \left[\frac{d_a W_a}{(1-d_a) PK_a} \right]^{d_a-1} \right]^{\frac{1}{r_a}} \quad a \in A$$

(0.26)

La distribution CES du travail entre les qualifiés et les non qualifiés

$$LT_a = D_a \left[\mu_a LNQ_a^{-f_a} + [1-\mu_a] LQ_a^{-f_a} \right]^{\frac{1}{f_a}} \quad a \in A$$

(0.27)

La demande de travail qualifié LQ_a dérivé de la fonction d'allocation du travail

$$LQ_a = \left(\frac{LT_a}{D_a} \right) \left[(1-m_a) + m_a \left[\frac{m_a W_q}{(1-m_a) W_{nq}} \right]^{f_a-1} \right]^{\frac{1}{f_a}} \quad a \in A$$

(0.28)

Prix des facteurs

$$PK_a = \frac{PVA_a \cdot QVA_a - W_a LT_a}{K_a} \quad a \in A$$

(0.29)

$$W_a = \frac{w_{nq} LNQ_a + w_q LQ_a}{LT_a}$$

(0.30)

Coûts variables

$$CV_a = PK_a \cdot K_a + W_a \cdot L_a + PCI_a \cdot QCI_a$$

(0.31)

Coût fixe

$$CF_a = PK_a \cdot KF_a$$

(0.32)

II. Equations de prix

Prix de la demande domestiques

$$PD_c = \frac{PS_c}{(1-tq_c)} + ct_{nc} \quad c \in CD \quad (0.33)$$

Prix à l'importation

$$PM_c = \frac{PWM_c \cdot (1+sd_c)(1+t_{mc})TCN}{(1-tq_c)} + ct_{mc} \quad (0.34)$$

Prix à l'exportation

$$PE_c = PWE_c (1-t_{ec})TCN - ct_{ec} \quad c \in CE \subset C \quad (0.35)$$

Prix agrégé des inputs intermédiaires

$$PCI_a = \sum_{c \subset C} PQ_c \cdot ci_{ca} \quad a \in A ; c \in C \quad (0.36)$$

Valeur de la production Domestique marchande

$$PX_c \cdot QX_c = PS_c \cdot QD_c + PE_c \cdot QE_c \quad c \in CX \quad (0.37)$$

Equation de l'absorption

$$PQ_c \cdot QQ_c = PD_c \cdot QD_c + PM_c \cdot QM_c \quad c \in (CD \cup CM) \quad (0.38)$$

Indice de prix du consommateur

$$\overline{IPC} = \sum_{c \in C} PQ_c \cdot \phi C_c \quad c \in C \quad (0.39)$$

L'indice de prix de la production

$$IPP = \sum_{c \in C} PS_c \cdot \phi P_c \quad (0.40)$$

III. Commerce extérieur

Fonction CET entre le marché national et le marché extérieur

$$QX_c = A_{ec} \left[\eta_{ec} QE_c^{\lambda_{ec}} + (1-\eta_{ec}) QD_c^{\lambda_{ec}} \right]^{1/\lambda_{ec}} \quad c \in (CE \cap CD) \quad (0.41)$$

La ration de l'offre d'exportation sur l'offre domestique.

$$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PD_c} \cdot \frac{(1-\eta_{ec})}{\eta_{ec}} \right)^{\frac{1}{\lambda_{ec}-1}} \quad c \in (CE \cap CD) \quad (0.42)$$

Fonction CES entre les biens produits localement et les biens importés

$$QQ_c = A_{mc} \left[\eta_{mc} QM_c^{-\lambda_{mc}} + (1-\eta_{mc}) QD_c^{-\lambda_{mc}} \right]^{-1/\lambda_{mc}} \quad c \in (CM \cap CD) \quad (0.43)$$

Demande de biens importés dérivé de (28).

$$\frac{QM_c}{QD_c} = \left(\frac{PM_c}{PD_c} \cdot \frac{\eta_{mc}}{1-\eta_{mc}} \right)^{\frac{1}{1+\lambda_{mc}}} \quad c \in (CE \cap CD) \quad (0.44)$$

La demande des services de transactions (commerciales)

$$QTr_c = QM_c \cdot \overline{cim_{cc}} + QE_c \cdot \overline{cie_{cc}} + QD_c \cdot \overline{cin_{cc}} \quad c \in CTR \quad (0.45)$$

IV. Epargne et revenu

Revenu des ménages

$$\begin{aligned} YM_h = & Wnq \lambda_h^{nq} \sum_{a \in A} LNQ_a + Wq \lambda_h^q \sum_{a \in A} LQ_a \\ & + \lambda_h^k \sum_{a \in A} PK_a K_a + \overline{TGM}_h + DIV_h \quad h \in H \end{aligned} \quad (0.46)$$

Le revenu disponible des ménages

$$YMD_h = YM_h (1 - trev_h) \quad h \in H \quad (0.47)$$

Le revenu des entreprises

$$YENT = \left(1 - \sum_{h \in H} \lambda_h^k \right) \sum_{a \in A} PK_a K_a \quad (0.48)$$

Le revenu de l'état

$$YGouv = \sum_h trev_h YM_h + \sum_{c \in C} TCX_c + \sum_{c \in CM \subset C} TIM_c + \sum_{a \in A} TPR_a \quad (0.49)$$

Taxe sur la production

$$TPR_a = tp_a \cdot PA_a \cdot QA_a \quad (0.50)$$

Taxe sur les ventes

$$TCX_c = tq_c \cdot PQ_c \cdot QQ_c \quad c \in C \quad (0.51)$$

Taxe sur les importations

$$TIM_c = \overline{TCN} \cdot \overline{tm_c} \cdot \overline{PWM_c} \cdot QM_c \quad c \in CM \subset C \quad (0.52)$$

Epargne des ménages

$$SM_h = YDM_h \cdot pms_h \quad h \in H \quad (0.53)$$

L'épargne des firmes

$$SENT = YENT \quad (0.54)$$

L'épargne du gouvernement

$$SGouv = YGouv - \sum_h \overline{TGM}_h - \overline{CGouv} \quad (0.55)$$

Demande des produits

Consommation des ménages

$$CM_h = YDM_h - SM_h \quad h \in H \quad (0.56)$$

consommation du produit (c) par un ménage (h)

$$CM_{hc} \cdot PQ_c = PQ_c \cdot \pi_{hc} + \chi_{hc}^m \left(CM_h - \sum_{c'} \pi_{hc'} \cdot PQ_{c'} \right) \quad h \in H; \quad c \in C \quad (0.57)$$

La demande de consommation totale du produit (c) est

$$CT_c = \sum_h CM_{hc} + \frac{\chi_c^g \overline{CGouv}}{PQ_c} \quad c \in C \quad (0.58)$$

Les dépenses d'investissements sur le produit (c) sont :

$$CINV_c = \frac{\chi_c^i INVT}{PQ_c} \quad c \in C \quad (0.59)$$

Balance de paiement (épargne étrangère)

$$\overline{SROW} = \overline{TCN} \left[\sum_{c \in CM} \overline{PWM}_c \cdot QM_c - \sum_{c \in CE} \overline{PWE}_c \cdot QE_c \right] \quad (0.60)$$

V. Equations d'équilibres

$$\begin{array}{l} \text{Équilibre sur le marché du travail qualifié} \\ \overline{LSQ} = \sum_{a \in A} LQ_a \end{array} \quad (0.61)$$

$$\begin{array}{l} \text{Équilibre sur le marché du travail non qualifié} \\ \overline{LSNQ} = \sum_{a \in A} LNQ_a \end{array} \quad (0.62)$$

$$\begin{array}{l} \text{Équilibre sur le marché du capital} \\ \overline{KST} = \sum_{a \in A} K_a \end{array} \quad (0.63)$$

$$\begin{array}{l} \text{Équilibre entre les investissements et l'épargne} \\ \overline{INVT} = \overline{SENT} + \sum_{h \in H} SM_h + SGouv + SROW \end{array} \quad (0.64)$$

$$\begin{array}{l} \text{Équilibre entre la demande et l'offre des produits domestique} \\ \overline{QQ_c} = \sum_a QCI_{ca} + \sum_h CM_{ch} + CGouv_c + CINV_c + QTr_c \quad c \in C \end{array} \quad (0.65)$$

