

Long Run Vs Short Run Effects of a Value Added Tax: A Computable General Equilibrium Assessment for Cameroon *

by

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Abstract

This paper examines the gap that would exist between short run effects of implementing a value added tax and long run ones. These effects are captured using a CGE model applied to the Cameroon case. The short run is assumed to be a period when only labor is mobile across production sectors while the long run is set as a time horizon at which the capital becomes also mobile. The paper focuses on the analysis of welfare effects and some resource allocation considerations. Results from simulations denote that, even if an imperfect VAT could be welfare improving in the short run, this improvement would tend to turn into welfare deterioration in the long run. On the contrary, if the VAT implemented is a pure one, the transitional welfare improvement of the short run widens in the long run; in the same line of a pure VAT, a short time welfare worsening, if any, tends to disappear or to turn into gains in the long run. To promote a sustainable welfare improvement from VAT implementation, this study then encourages countries, and particularly Cameroon, to gradually liken their VAT to a pure one; without overleaping VAT administration constraints, and some pro-socioeconomic policies which could be taken with the aim to preclude tax regressivity undesirable effects.

INTRODUCTION

Accordingly to the positive theory of taxation, the economic incidence of an indirect tax can differ whether one considers a short run or a long run time horizon. The level of mobility of all production factors across sectors is one of the main arguments which explain this difference. Indeed, it is assumed that in the short run, for financial and technological constraints, some production factors, *e.g.* the capital, remain fixed and specific to each economic sector. In the long run, on the contrary, it is admitted that all factors become variable and mobile throughout economic sectors. Thus, the shifts in relative prices induced in the short run due to a tax reform can differ from those generated in the long run.

The central question addressed in this study is to assess the gap that would exist between short-term and long-term effects of a VAT (value-added tax) implementation in an economy. In order to bring some answers to this query, we study here the case of the VAT gradually introduced in Cameroon since 1994. We use, in this respect, a computable general equilibrium (CGE) model and consider successively three VAT scenarios, which nearly reflect some steps of the gradual introduction of a VAT to Cameroon. We simulate moreover a fourth scenario, which represents the ultimate stage that portrays a pure VAT. Each VAT scenario is simulated in a dualistic way : on the one hand, we use a short term version of the model and, on the other hand, a long term version of the same model. Incidences of these scenarios are mainly measured on households' welfare, while passing by resources reallocation analysis.

In the literature, CGE models used for VAT incidence analysis are of two kinds, with respect to resource mobility. On the one hand, there are CGE models with capital fixed and specific for each sector, which are better fitted to capture transitional effects of implementing taxes of VAT type (*e.g.* Clarete (1991); Emini (2000)). On the other hand, there are CGEs which are suitable to explore long run effects, all production factors being variable and inter-sectorally mobile (*e.g.* Serra-Puche (1984); Ballard *et. al.* (1985) ; Fehr *et. al.* (1993) and van der Mensbrugghe (1994)). Although tax incidence analysis is enlightening in each case, it would be worth to pinpoint the direction and to gauge the width taken by the impacts from one time horizon to another; in particular from the transitional period to the period at which companies can adjust the level of each of their factors. The

analytical specificity of this study lays consequently on its comparative approach for the Cameroonian VAT case.

The remainder of this paper is split up into five sections. In the first one, we present some heuristic assumptions about the incidence of VAT implementation on the payment and reallocation of production factors. The second section is devoted to a thumbnail sketch of some salient characteristics of the VAT performed in Cameroon, whereas the CGE model applied here is presented in the third section. The fourth focuses on the definition of the VAT scenarios and the analysis of results from aforesaid scenarios' simulations. In the last section, we make some concluding comments.

I. AN HEURISTIC ANALYSIS OF THE VAT INCIDENCE ON RESOURCE ALLOCATION

It is generally argued that, thanks to its economic neutrality, the VAT allows a more efficient resource allocation compared to the other sale taxes. With regard to the production apparatus, this neutrality rests in particular on the deductibility of the VAT paid by companies on the purchases of their intermediate consumption and other inputs. Thus, by adopting the VAT in substitution of a tax which is not deductible on inputs (*i.e.* taxes with cascade), that induces a resource reallocation more beneficial to sectors whose tax burden on inputs was heavier in the system with cascade, and conversely for sectors for which this burden was relatively light. Capturing the direct impact that the VAT neutrality generates on the factor payments supports this presumption here. In CGE modelling, the total payment of the whole of primary factors for a branch i is generally stated by the means of the value added price (PVA_i), which is the remuneration of each unit of value added produced:

$$PVA_i = \frac{PX_i \cdot X_i - \sum_j (PQ_j^{ht} + tx_j) \cdot CIJ_{j,i}}{VA_i} \quad I$$

where PX_i is the price of the production at factor cost, in the sector i ; X_i , the volume of production ; PQ_j^{ht} , the market composite price of goods j , net of all taxes ; tx_j , the average rate of all taxes collected on the sales of goods j ; $CIJ_{j,i}$, intermediate consumption of branch i in goods j ;

and VA_i , the value added of the sector. However, equation 1 represents a situation where taxes on intermediate consumption are not refundable. On the contrary, in a VAT system, where companies ultimately discharge their input purchases at prices excluding VAT, PVA is determined such as with equation 2:

$$PVA_i = \frac{PX_i \cdot X_i - \sum_j PQ_j^{ht} \cdot CIJ_{j,i}}{VA_i} \quad 2$$

The shift from taxes with cascade to VAT would then lead to a production cost reduction, equal to $\mathfrak{T}_i$ (amount of the input tax burden in the cascade tax system):

$$\mathfrak{T}_i = \sum_j tx_j \cdot CIJ_{j,i} \quad 3$$

Ceteris paribus, the cancellation of $\mathfrak{T}_i$ (due to VAT refunds) implies an increase of PVA_i , if the relation $tx_j > 0$ is verified for at least one intermediate consumption j used by branch i . The increase “ ΔPVA_i ” is as higher as the ex ante tax burden $\mathfrak{T}_i$ was heavier. In other words, set *HBS* a branch with heavy tax burden in the system with cascade, and *LBS* a branch with relatively light tax burden in the same system; replacing this cascade system by the VAT, one has then:

$$\Delta PVA_{HBS} > \Delta PVA_{LBS} \quad 4$$

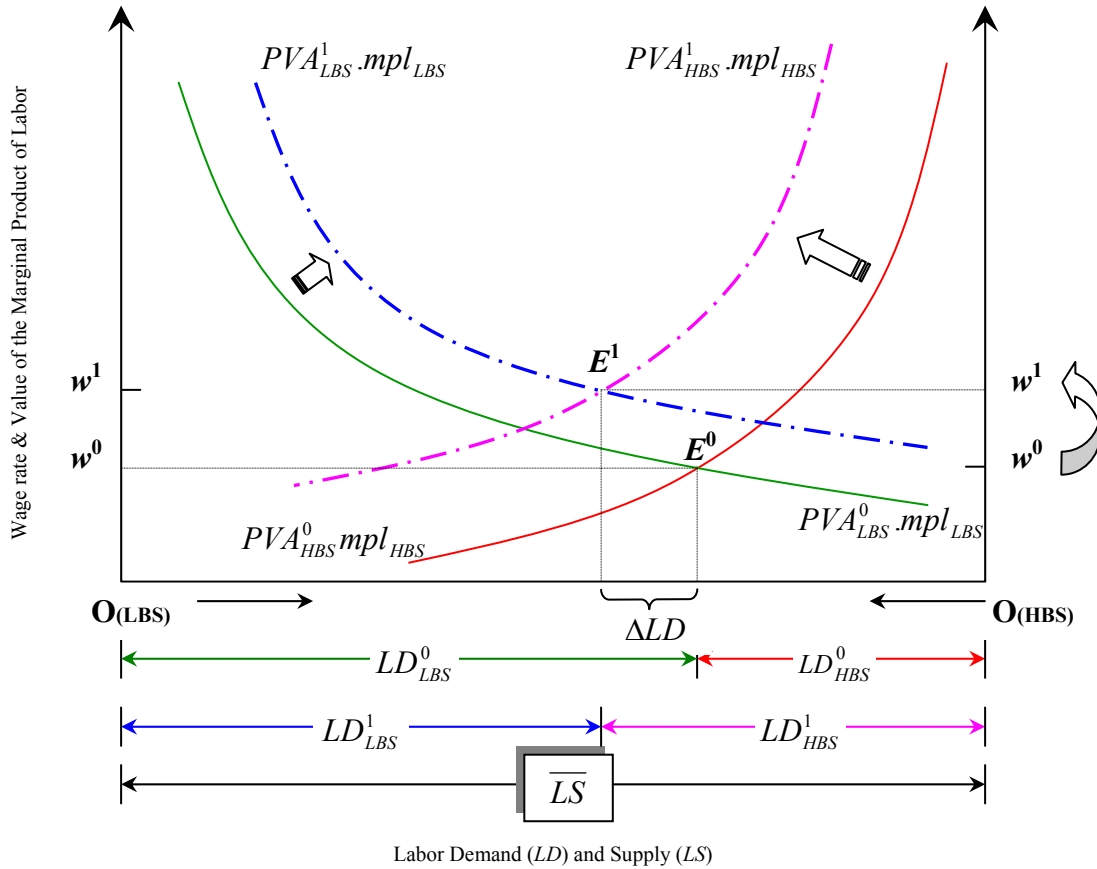
1.1 - An outline of VAT effects on resource reallocation: a two sectors economy case, with one mobile production factor

Considering a short run time horizon, the VAT allocative effects transmitted by the way of inequation 4 can be depicted through figure 1, which represents a two sectors economy, each using two primary factors: a variable and mobile factor (the labor), and a fixed and specific one (the capital). To maximize its profit, each sector demands labor until the value of marginal product of that factor is equal to its marginal cost (*i.e.* wage rate). For the whole of the economy, the labor offer is shared out over sectors so that, at the equilibrium, the value of marginal product of labor is the same in all sectors and equal to the wage rate:

$$PVA_{LBS} \cdot mpl_{LBS} = PVA_{HBS} \cdot mpl_{HBS} = w \quad 5$$

where mpl_{LBS} , mpl_{HBS} and w are respectively the marginal product of labor (MPL) in the ex ante light burden sector, the MPL in the sector with heavier taxation burden, and the wage rate. Given any level of PVA , the marginal product of labor is decreasing when the volume of labor increases, because of the decreasing returns law.

Figure 1 - The labor reallocation following the replacement of taxes with cascade by the VAT. A two-sector case with sector-specific capital endowment



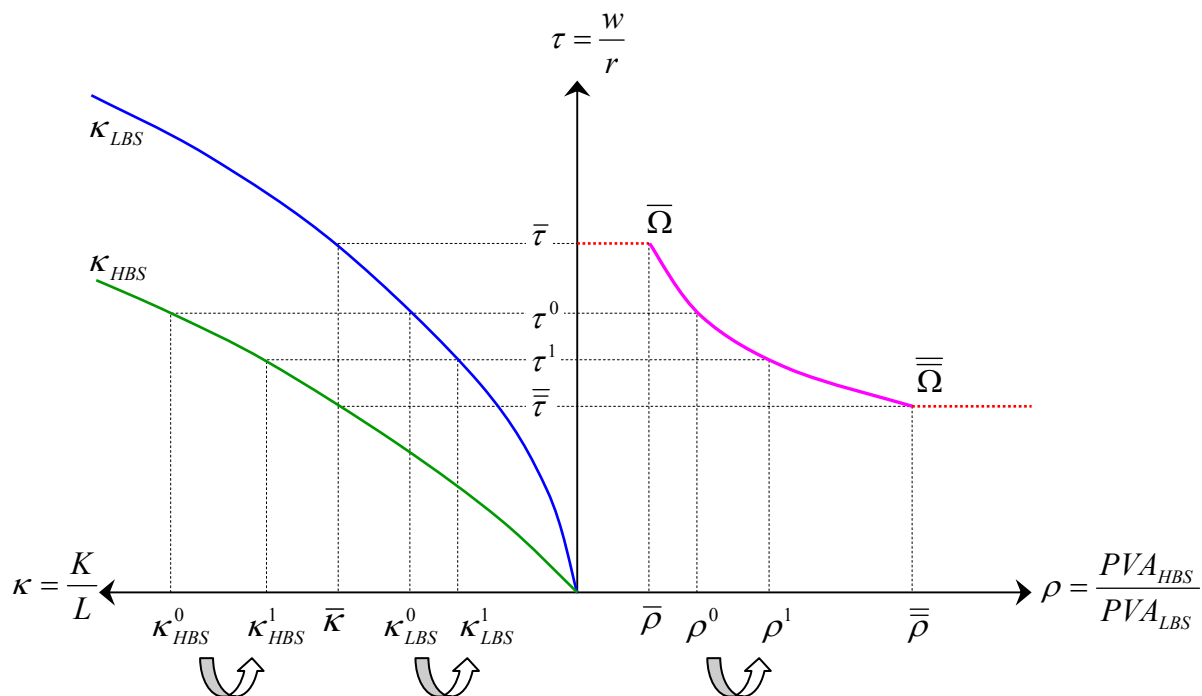
Before the implementation of VAT, the equilibrium point for optimal allocation of labor is E^0 , which corresponds to a wage rate equal to w^0 and labor demands equal to LD^0_{LBS} and LD^0_{HBS} , respectively for sectors LBS and HBS . After replacing the former cascading tax system by VAT, the value added prices increase and shift from PVA^0_{LBS} to PVA^1_{LBS} , and from PVA^0_{HBS} to PVA^1_{HBS} . Given the relation $\Delta PVA_{HBS} > \Delta PVA_{LBS}$, as justified above at the inequation 4, the value of MPL increases

more in the sector with heavy ex ante tax burden than in the sector with light one. The new equilibrium point is then E^1 . The shift from E^0 to E^1 implies a labor demand increase for the ex ante heavy tax burden sector (the change is equal to ΔLD) and, correspondingly, a decrease for LBS .

1.2 - The resource reallocation process generated by VAT: two sectors and two mobile factors case

Given two sectors (HBS and LBS), and two mobile factors (capital and labour), figure 2 depicts on the one hand, the correlation which exists between the shift on sectors' value added relative prices and the change on factors' relative prices. On the other hand, this figure exhibits the relation binding the shift on relative prices of these factors to shift on factor intensities, for each sector. Thereafter figure 3 depicts the incidence of the change in factor intensities on factors reallocation.

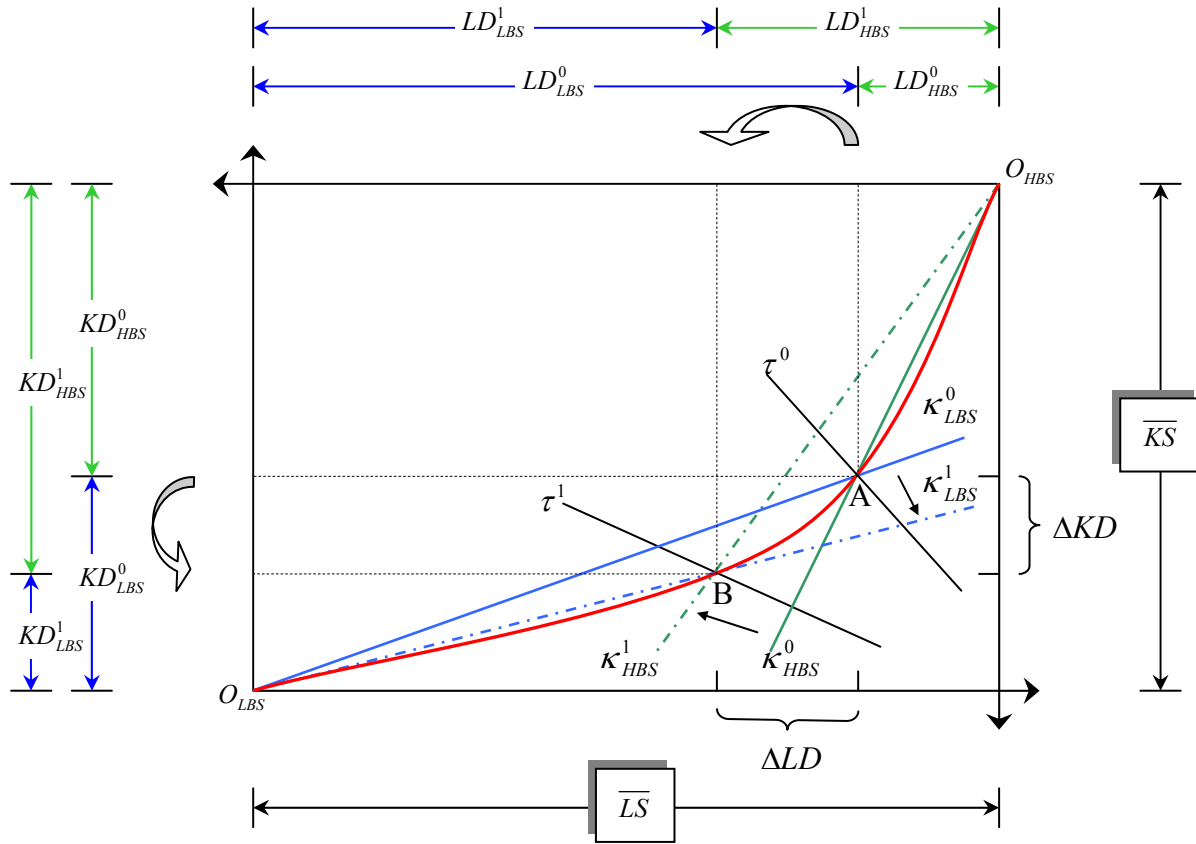
Figure 2 - VAT incidence on factors' relative prices and factors' intensities



Assuming irreversibility of the factor intensities, there is a unique correlation between the relative price (at factor cost) of two goods and the relative price of mobile factors used for their

production: a raise in relative price of a good brings at new equilibrium an increase in relative price of the factor used intensely in the production of this good (de Melo and Grether (1995)). In figures 2 and 3, the production is capital intensive in the sector with heavy ex ante tax burden, whereas it is labor intensive in *LBS*.

Figure 3 – VAT incidence on resource allocation: The effects of a change in factor intensities on capital and labor reallocation between two sectors with opposite factor intensities:



Before the introduction of VAT, the ratio of value added prices is ρ^0 and that of factor prices is τ^0 ; with capital intensities κ_{LBS}^0 and κ_{HBS}^0 . As long as both sectors have each one a non-null production, their respective capital intensities surround the total capital intensity of the whole economy, which is a weighted average of capital intensities of all sectors. Following the VAT implementation and according to inequation 4, the ratio of value added prices of *HBS* and *LBS* rises

and then, shifts from ρ^0 to ρ^1 . Given the fact that *HBS* is a capital-intensive sector, this shift leads consequently to a rise in the capital price (r) compared to the change on wage rate (w). Then, the ratio w/r collapses and shifts from τ^0 to τ^1 . As a consequence, both sectors reduce their capital intensities from κ_{HBS}^0 to κ_{HBS}^1 , and from κ_{LBS}^0 to κ_{LBS}^1 . From figure 3, it arises obviously that this joint reduction of capital intensities implies as well capital reallocation as labor reallocation in favor of the sector with heavy ex ante tax burden. Needless to say, from point *A* in figure 3 to the new equilibrium point *B*, the reallocation gains which fall to *HBS* (ΔKD and ΔLD) represents losses for *LBS*, since the total capital endowment $\overline{KS}$ and manpower $\overline{LS}$ are fixed, with full use of all the productive resources.

From the heuristic analysis presented above, it arises that whatever the temporal horizon considered, the substitution of the VAT to taxes with cascade generates a resource reallocation that is more favorable to the activities that bore heavier tax burden in the system with cascade. However, this analysis remains very limited in several ways. First of all, it does not make it possible to state whether reallocation gains of the *HBS* activities and the reallocation losses of the *LBS* ones are more consistent in the long run or in the short run. Moreover, whatever the time horizon considered, the reallocation scheme, which arises from VAT implementation, doesn't give the direction nor the width of the welfare change. Several other variables and interrelationships must be taken into account for this issue. Hence the formulation of a CGE model, which could involve several features.

II. SOME KEY FEATURES OF VAT IN CAMEROON

The VAT came into force in Cameroon since 1994. It was applied then in an embryonic way, exclusively to the imports, to some large factories and wholesalers. But since then, several marginal tax reforms has been gradually implemented, most of them aiming to shift this VAT from its seminal embryonic form towards a less and less imperfect alternatives. Among these marginal reforms, one can particularly note the broadening of VAT base to some retail trades, services and relatively small size companies; the essential condition to fulfil by these legal taxpayers being to keep at least a minimal accountancy and to realize a turnover beyond a threshold defined according to various kinds of activity. It is also worth to underline the recent measures taken since January

1999, namely: (1) the abolition of the reduced VAT rate and consequently the application of a uniform VAT rate equal to 17% (plus municipal additional taxes of 1.7%), whatever the debtor or the product subject to VAT; (2) the refund *in cash* of VAT credits to particular companies which face structural accumulation of their VAT credits.

However, in spite of these improvements, the VAT in Cameroon remains an imperfect one and is characterized accordingly by partial neutrality with respect to the productive system. Roughly speaking, this partial neutrality is especially due to (1) the one month latency which companies must observe before finally recovering their refundable VAT; (2) the coexistence of two VAT regimes: a normal regime and a simplified regime. Belonging to the last one, on the contrary of the first, does not give the right to companies to claim any VAT credit; so input costs of these companies are permanently gross of VAT. Moreover, the VAT applied to the products subject to simplified regime is not refundable even for the companies belonging to the normal regime. In addition, several activities are still excluded from the VAT base and thus subject to none of the two modes referred to above; either because their turnovers are below the required threshold, or because they operate in the informal sector.

III. THE MODEL

The model applied in this study is a variant of the CGE model used in Emini (2000). In this section, we pass over the presentation of more conventional equations and rather focus on those having concern with (1) short run versus long run resource allocation, (2) the VAT modeling, and (3) with the formulation of welfare indicators.¹ The model involves twenty production sectors among which one distinguishes sectors with heavy ex ante tax burden and those with light ex ante tax burden². Sectors are furthermore differentiated according to taxation regimes applicable to their outputs at the early stage of VAT implementation in Cameroon: products subject to the general VAT rate; products liable to the reduced VAT rate; products liable to excise duty; those subject to non refundable VAT; those liable to the special tax on oil products and those exonerated from VAT. There is an international differentiation of demand and offer, according to the so-called Armington

¹ The entire list of equations is available in Emini (2000) or directly from the author by a simple request.

(1969) assumption; *i.e.* there is an imperfect substitution in goods demand, between imports and imports' local substitutes. The corollary on the offer side implies an imperfect transformation between the production for local market and that for export. Four types of economic agents interact in the model: (1) the households (three classes: the rural households, the semi-urban and the urban ones), (2) companies, (3) the State and (4) the rest of the world. The last two agents do not have an explicit objective function, while companies (through sectors) have a profit maximization behavior and the households an utility maximization one. Models data were processed from Njinkeu *et. al.* (1993), Cogneau and Roubaud (1992), and DSCN (1990). Substitution and transformation elasticities for international differentiation of demand and offer are closed to those in Condon, Dahl and Devarajan (1987). Likewise, the level and the structure of households' income elasticities are based on estimates from Dervis, de Melo and Robinson (1982).

3.1 – Equilibrium demand for production factors : Short run vs. long run equations

For any sector i , production X_i at factor cost is generated by combining through a Leontief function, primary factors (Labor and capital) on the one hand and intermediate consumptions $CIJ_{i,j}$ on the other hand. These last are linked among them by fixed technical coefficients $aij_{i,j}$ and constitute together an aggregate equal to CI_i . Labor LD_i and capital K_i are combined through a Cobb-Douglas function in order to form the value added of the sector. The equilibrium demand for intermediate consumptions depends on equilibrium demand for primary factors, which maximizes the profit of the sector.

$$X_i = \frac{CI_i}{io_i} \quad 6$$

$$CI_i = \frac{io_i}{v_i} . VA_i \quad 7$$

$$CIJ_{i,j} = aij_{i,j} . CI_j \quad 8$$

$$VA_i = AVA_i . LD_i^{\alpha_i} . K_i^{(1-\alpha_i)} \quad 9$$

² *Ex ante* is used here to denote the « before VAT situation ».

In the short term version of the model, as stated above, the capital is fixed and specific to each branch; so that labor is the only variable and mobile factor. For each sector, the profit maximizing demand for labor is given at the equilibrium point where the marginal productivities of labor $\frac{\alpha_i \cdot PVA_i \cdot VA_i}{LD_i}$ for all sectors are equal to the marginal cost of labor w ; hence:

$$LD_i = \frac{\alpha_i \cdot PVA_i \cdot VA_i}{w} \quad 10$$

Given the constant returns of scale and the zero profit assumptions, the payment of the fixed factor, RK_i , is computed as a residue after the provision of labor payment.

$$RK_i = PVA_i \cdot VA_i - w \cdot LD_i \quad 11$$

However in the long term version of the model, demand for capital becomes also endogenous and determined, as for labor, on an extent such that the marginal productivities of capital $\frac{(1-\alpha_i) \cdot PVA_i \cdot VA_i}{K_i}$ for all sectors are equal to the marginal cost (the payment rate) r of capital; then:

$$K_i = \frac{(1-\alpha_i) \cdot PVA_i \cdot VA_i}{r} \quad 12$$

The value added price is the channel through which VAT implementation directly affects the demand and reallocation of the production factors. Whatever the time horizon, this price is stated such as in equations 13 and 14, respectively for non-VAT sectors (ntv) and VAT ones (ptv). The use of prices PQ_j in equation 13, *i.e.* market prices gross of all taxes, indicates that VAT levied on inputs constitutes a permanent cost for ntv sectors. On the contrary, ptv sectors have the refund of the VAT bore on their inputs. The refundable VAT is then equal to $Cif_{ptv} \cdot \sum_{nrh} tv_{nrh} \cdot PQHT_{nrh} \cdot CIJ_{nrh,ptv}$, where tvc and $PQHT$ respectively represent the effective VAT rate applied to non-hostel product nrh and the price (net of VAT) of the aforesaid product³. It is however worth to note that ptv sectors are only partially subject to VAT, considering the fact that an extent of these sectors (informal activities) escapes from VAT. Thus the VAT refund is just applicable to a proportion Cif_{ptv} of the intermediate consumptions belonging to activities that are truly covered by the VAT.

³ The VAT levied on hostel products is not refundable, in accordance with tax legislation.

$$PVA_{ntv} = \frac{PX_{ntv} \cdot X_{ntv} - \sum_j PQ_j \cdot CIJ_{j,ntv}}{VA_{ntv}} \quad 13$$

$$PVA_{ptv} = \frac{PX_{ptv} \cdot X_{ptv} - \left(\sum_j PQ_j \cdot CIJ_{j,ptv} - Cif_{ptv} \cdot \sum_{nrh} tv_{nrh} \cdot PQHT_{nrh} \cdot CIJ_{nrh,ptv} \right)}{VA_{ptv}} \quad 14$$

3.2 - Modeling the elements of VAT settlement: the VAT base, effective rates and payable VAT

- **Calculus of the payable VAT receipts**

Equation 15 represents the payable VAT receipts transferred by hostels and restaurants sector (*hote*) to the Treasury. In this equation, elements in brackets denote the tax base: household consumption of domestic products (*C*) and uses of these products *j* company as an intermediate consumption (*CIJ*). Equation 16 determines the payable VAT in the case of all but hotels and restaurants products (*nrh* products). In this equation, VAT base for each *nrh* product is then equal to the use of this product as (1) final consumption by households, (2) intermediate consumption by non-VATable sectors *ntv*, and (3) intermediate consumption by “partially” VATable sectors *ptv*.

$$TVA_{hote} = tv_{hote} \cdot PQHT_{hote} \cdot \left(C_{hote} + \sum_j CIJ_{hote,j} \right) \quad 15$$

$$TVA_{nrh} = tv_{nrh} \cdot PQHT_{nrh} \cdot \left[C_{nrh} + \sum_{ntv} CIJ_{nrh,ntv} + \sum_{ptv} CIJ_{nrh,ptv} \cdot (1 - Cif_{ptv}) \right] \quad 16$$

- **The VAT effective rates equations**

The effective rates *tv* entered in equations above are weighted average rates of VAT levied on imports M_{imp} on the one hand, and on domestic substitutes D_{imp} on the other hand. These VAT rates are gross of municipal additional taxes (*cac* for local products and *cac2* for imports). They are determined through equations 17 and 18, respectively for tradable goods (*imp*) and non tradable ones (*nimp*). In these equations, *tv* are VAT effective rates net of municipal additional taxes; PM_{imp} and PDM_{imp} are market prices gross of VAT, respectively for imports and local substitutes.

$$tvc_{imp} = \frac{tv_{imp} \cdot \left[\frac{PDM_{imp}}{1 + tv_{imp} \cdot (1 + cac)} \cdot D_{imp} \cdot (1 + cac) + \frac{PM_{imp}}{1 + tv_{imp} \cdot (1 + cac2)} \cdot M_{imp} \cdot (1 + cac2) \right]}{PQHT_{imp} \cdot Q_{imp}} \quad 17$$

$$tvc_{nimp} = tv_{nimp} \cdot (1 + cac) \quad 18$$

Effective rates tv arise from equation 19 for ptg products (products formerly subject to VAT general rate), equation 20 for ptr products (products formerly subject to VAT reduced rate); while equation 21 define de nil VAT effective rate for ntv products (non-VATable products) because of the nullity of the correspondent nominal VAT rate.

$$tv_{ptg} = TVG.Tcr_{ptg} \quad 19$$

$$tv_{ptr} = rg.TVG.Tcr_{ptr} \quad 20$$

$$tv_{ntv} = 0 \quad 21$$

TVG denotes the “nominal” instead of “effective” VAT general rate. The nominal VAT reduced rate is then equal to TVG times the « legal coefficient » rg . The effective rate tv of any VATable product is finally equal to the corresponding VAT nominal rate multiplied by the proportion really included into the VAT base for that product (tcr). This proportion is a weighted sum of imports part (Tpm) and domestic part (Tpl) in the VAT base:

$$Tcr_i = Tpl_i + Tpm_i \quad 22$$

$$Tpl_i = \frac{\frac{PDM_i}{1 + tv_i \cdot (1 + cac)} \cdot D_i \cdot Fp_i}{PQHT_i \cdot Q_i} \quad 23$$

$$Tpm_{imp} = \frac{\frac{PM_{imp}}{1 + tv_{imp} \cdot (1 + cac2)} \cdot M_{imp} \cdot (1 - Tcb_{imp}) \cdot (1 - Exon_{imp})}{PQHT_{imp} \cdot Q_{imp}} \quad 24$$

Equation 23 implies that: (1) only a Fp_i portion of the production from a VATable sector is really subject to VAT; (2) the VAT base involves also all taxes levied on domestic part of the composite product, apart from VAT itself and municipal additional taxes.⁴ In the same way, equation 24 computes Tpm by excluding imports exemptions ($Exon$) and smuggling products (Tcb)

⁴ These taxes are integrated in the domestic market price PDM .

from the VAT base, while involving all other customs duties and taxes (in market price of imports PM), except the VAT and the corresponding municipal additional taxes.

The VAT modeling presented above is such that the entire model remains free from any VAT influence as soon as the VAT general rate TVG takes the zero value, as it's the case at the benchmark performance.

3.3 – Welfare indicators

The model involve three sets of indicators for welfare analysis: (1) the hicksian equivalent variation and compensating variation (Hicks (1939); Shoven and Whalley (1992)); (2) the Hicks-Boiteux welfare loss (see Diewert (1985); Fortin and Rousseau (1986)); and (3) the Gini index computed according to the “method of triangles” (see Chauvat and Réau (1996)).

Set two equilibrium states for a given consumer: a benchmark state (ex ante) and a counterfactual state (ex post). The hicksian equivalent variation (EV) denotes the amount which is necessary to add to (or to deduct from) the benchmark income of the consumer so that he enjoys an utility level equal to the counterfactual one, on the basis of ex ante relative prices. With regard to the compensating variation (CV), it indicates the amount which is necessary to add to (or to cut off from) the consumer's counterfactual income, so that he recovers his benchmark utility level, on the basis of ex post relative prices. According to the calculus rationale adopted in this study, an improvement of utility or welfare results in a positive EV and a negative CV . The reverse is proved accurate for both indicators in the case of a welfare worsening.

In the model applied in this study, the EV and CV are stated from expenditure equations derived from ELES type utility functions (Extended Linear Expenditure System)⁵. Those extend the usual Stone-Geary functions (Linear Expenditure System) by including households' savings as representative of a future consumption. For a given class of households h , the ELES utility function is written as following:

⁵ See Luch (1973); Howe (1975); Burniaux and van der Mensbrugghe (1991); Van der Mensbrugghe (1994).

$$\ln(IW_h) = \sum_{i=1}^n \mu_{i,h} \cdot \ln(CMI_{i,h} - \mathcal{G}_{i,h}) + \mu_{s,h} \cdot \ln(SM_h) \quad 25$$

$$\text{with } \sum_{i=1}^n \mu_{i,h} + \mu_{s,h} = 1$$

where IW_h denotes the utility of the household h ; $CMI_{i,h}$, his consumption of goods i ; $\mathcal{G}_{i,h}$, his incompressible consumption for i ; SM_h , his savings; $\mu_{i,h}$ and $\mu_{s,h}$, respectively his marginal propensities to consume and marginal propensity to save. The demand (equation 27) for each goods i by the household and his savings (equation 28) result from the maximization of the utility (equation 25) subject to the budgetary constraint (inequation 26):

$$\sum_{i=1}^n PQ_i \cdot CMI_{i,h} + SM_h \leq YDM_h \quad 26$$

$$CMI_{i,h} = \mathcal{G}_{i,h} + \frac{\mu_{i,h} \cdot SNUM_h}{PQ_i} \quad 27$$

$$SM_h = \mu_{s,h} \cdot SNUM_h \quad 28$$

where PQ_i is the market price of goods i ; YDM_h , the disposable income of h ; $SNUM_h$, his supernumerary income, i.e. the disposable income remaining after acquisition or provision of the incompressible consumption:

$$SNUM_h = YDM_h - \sum_i PQ_i \cdot \mathcal{G}_{i,h} \quad 29$$

Expenditure functions (equation 31) requested for the formulation of EV and CV equations are obtained by deriving the reverse of indirect utility functions (equation 30), which are themselves computed by replacing $CMI_{i,h}$ and SM_h in equation 25 by their respective formulas (denoted in equations 27 and 28). EV and CV equations – equations 32 and 33 -, where numerals 0 and 1 return respectively to benchmark and counterfactual equilibrium states, are then obtained by applying the calculation principles of EV and CV , given expenditure functions (equation 31).⁶

⁶ Given an expenditure function f_{dep} , EV and CV are computed through the following formulas:

$$EV = f_{dep}[PQ^0, IW(PQ^1, YDM^1)] - f_{dep}[PQ^0, IW(PQ^0, YDM^0)]$$

$$CV = f_{dep}[PQ^1, IW(PQ^0, YDM^0)] - f_{dep}[PQ^1, IW(PQ^1, YDM^1)]$$

$$IW_h = \prod_i \left[\frac{\mu_{i,h}}{PQ_i} \cdot \left(YDM_h - \sum_i PQ_i \cdot \mathcal{G}_{i,h} \right) \right]^{\mu_{i,h}} \cdot \left[\mu_{s_h} \cdot \left(YDM_h - \sum_i PQ_i \cdot \mathcal{G}_{i,h} \right) \right]^{\mu_{s_h}} \quad 30$$

$$f_{dep,h}(PQ, IW_h) = \left(\frac{IW_h}{\mu_{s_h}^{\mu_{s_h}} \cdot \prod_i \mu_{i,h}^{\mu_{i,h}}} \right) \cdot \prod_i PQ_i^{\mu_{i,h}} + \sum_i PQ_i \cdot \mathcal{G}_{i,h} (= YDM_h) \quad 31$$

$$EV_h = SNUM_h^1 \cdot \prod_i \left(\frac{PQ_i^0}{PQ_i^1} \right)^{\mu_{i,h}} - SNUM_h^0 \quad 32$$

$$CV_h = SNUM_h^0 \cdot \prod_i \left(\frac{PQ_i^1}{PQ_i^0} \right)^{\mu_{i,h}} - SNUM_h^1 \quad 33$$

The Hicks-Boiteux welfare loss⁷ is calculated through equation 34, whereas the Gini index is computed through equation 35 where n is the number of households classes; F_h , increasing cumulative frequencies of households' weights; R_h , cumulative and increasing relative values of household's incomes.

$$CMS = -\sum_h VE_h \quad 34$$

$$Gini = \sum_{h=1}^{n-1} (F_h \cdot R_{h+1} - F_{h+1} \cdot R_h) \quad 35$$

3.4 – Model closure

Two principles applied in the model closure are to be underlined here: the principle of «Equal Yield Tax Analysis» and the principle of fixed Current Balance (stated in foreign currencies). Equal Yield Tax Analysis aims to compare various taxation schemes while keeping constant the public expenditure and the State revenue ; on the contrary, new tax rates (VAT for this case) are endogenous.⁸ This analytical approach is fitted to capture the intrinsic incidence of alternative tax scenarios by isolating them from induced effects which may be related to the change in the State revenue, the State expenditures and savings. Keeping the Current Account exogenous

⁷ It is equal to (less) the sum of the hicksian equivalent variations where prices correspond to an arbitrary pareto-optimal benchmark equilibrium; counterfactual equilibrium used for the evaluation of the loss is that achieved by the economy after all taxes. Such benchmark and counterfactual equilibria are respectively approximated here by the before-simulation and after-simulation scenarios. A negative value of this indicator is welfare improving and conversely for a positive value.

allows to avoid the case in which the welfare improvement would be due to the widening of foreign debt. Whereas the imports and exports can vary differently in quantity terms, the fixed Current Balance constraint is fulfilled via the adjustment of the real exchange rate, *i.e.* the world price level divided by the domestic price level, and multiplied by the nominal exchange rate. The world prices are exogenous, due to the small country assumption. Likewise, the nominal exchange rate is also exogenous and stated as the model numeraire. The real exchange adjustments are consequently performed through changes in the consumer price index, which is endogenous.

IV. SIMULATIONS

Four pairs of simulations are performed, each pair including the simulation of the same scenario in short run on the one hand, and in long run case on the other hand. The first three scenarios rank amongst various imperfect forms that the VAT have more or less embodied in Cameroon since its adoption in 1994. The last scenario portrays a pure VAT, which would be the ultimate stage of a VAT implementation. All these four scenarios imply the cancellation of the former indirect taxes applied to products henceforth subject to VAT, except customs duties and miscellaneous special taxes. Selected results from simulations are reported in annex.

4.1 - Scenario 1: standard scenario of the imperfect VAT applied in 1994

The first scenario involves some key features of VAT as implemented at July 1, 1994:

- two VAT rates: a normal rate of 15% and one reduced rate of 5%;
- the same VAT nominal rate is applied as well to the imports as to the domestic substitutes;
- exemption of exports and the inputs, as a general rule;
- a 40% reduction of imports exemptions;
- an imperfect deduction of refundable VAT on VATable companies' intermediate consumption: as an experimental proxy, 10% of VAT credits is not refundable;
- a narrow base of VAT.

⁸ See: Musgrave (1959); Shoven and Whalley (1977); Chia, Wahba and Whalley (1992); Ballard et. al. (1985).

The results from simulations indicate that in the short run, this scenario is welfare improving at least for the global welfare of households, compared to the benchmark situation: the Hicks-Boiteux welfare loss is -10.497 billion CFA francs⁹). However this improvement returns exclusively to the urban households and semi-urban ones. The rural households rather face a welfare worsening which is equivalent to 1,088 billion CFA francs in terms of compensatory variation. In the long run, on the contrary of short run effects, the total welfare worsens, with a social cost equal to 87,780 billion CFA francs. The implementation of the VAT results in a relatively more regressive tax system, since the change in the Gini index is positive, whatever the time horizon of the analysis. In the short run as in the long run, activities with light ex ante tax burden (*LBS*) are, on the whole, gainers from the resource reallocation; whereas activities with heavy ex ante tax burden (*HBS*) record reallocation losses and consequently face a fall of their value added. Value added price belonging to *HBS* increases less than that of *LBS*. Moreover, the market relative price of *HBS*'s output increases and, hence, the demand for this output decreases. The reallocation scheme, which arises from this imperfect VAT scenario, is rather opposite to the generally hoped effects from the introduction of VAT into an economy, according to which the *HBS* would have gained from the resource reallocation. In addition, it is noticeable that the shift from short run to the long run is characterized by a reinforcement of this counter intuitive reallocation pattern, so that capital demand adjustments in the long run result in the migration of a portion of this factor from *HBS* to the *LBS*.

4.2 - Scenario 2: scenario 1 + abolition of the VAT reduced rate (adoption of a uniform VAT rate)

This scenario is the same one as the first, but removes the VAT reduced to the favor of a uniform application of the VAT normal rate. This measure was taken in Cameroon on January 1, 1999, as a device to render the VAT more neutral, since the application of a uniform VAT rate is one of the key features of a pure VAT.

The incidence of this scenario stands out from that of the first, when considering the width of performance indicators' changes. But signs of these changes remain roughly the same ones. Thus in the short run, the welfare increases with a social cost equal to -70,314 billion CFA francs. This

⁹ 1 CFA franc=0.01 French franc; 1 Euro = 655.956 CFA francs.

increase is more significant than that recorded in the short run in scenario 1 (social cost of -10,497 billion CFA francs), and this improvement is beneficial to all household classes, while starting with the urban ones, the semi-urban then and for the least, to the rural ones. However, in the long run, this welfare gains disappear and become rather losses. The rural households bear the most significant loss, whereas the urban ones support the least. Notwithstanding, these long run losses (social cost equal to 19,595 billion CFA francs) are smaller than those recorded in scenario 1 (social cost equal to 87,780 billion CFA francs). The fact remains that this scenario implies a rise in tax regressivity compared to scenario 1, owing to the larger increase of Gini index. In the field of resource allocation, as in scenario 1, short term gains enjoyed by sectors with light ex ante tax burden grow in the long run, at the expense of larger losses of *HBS*. Nevertheless, the gains of the ones and the losses of the others collapse considerably compared to scenario 1, as well considering the short run as comparing the long run results.

4.3 - Scenario 3: scenario 2 + complete refund of the VAT burdening the intermediate consumption of companies subject to VAT

The complete refund of the VAT striking upstream the intermediate consumption of companies was invigorated in Cameroon on January 1, 1999, with the suppression of the so called “butoir rule” which were prohibiting any cash refunding of VAT credits. Thus the companies which, in essence of their activities, face a widening accumulation of their VAT credits (without any other efficacious way to deduct them) can henceforth regain these VAT credits in cash from de Treasury. However, like above-mentioned, the deduction remains incomplete because of the still ongoing “lag rule” which states a one month lag before deducting VAT bore on inputs. As a consequence, this scenario remains exploratory to some extent.

In the short run, the welfare gains are more significant than those of the previous scenarios. Urban households still have the most welfare improvement, followed by the semi-urban ones, and finally by the rural ones. In the long run, contrarily to what happens in the first two scenarios, the welfare changes remain positive for urban and semi-urban households, so that rural households are the only ones who face a welfare worsening in this time horizon. The income distribution is more unequal in this scenario than in the precedents. This regressivity strengthens in the long run. The

resource reallocation scheme, whether in the short run or in the long run, is similar to that in the first two scenarios. However the gains recorded by the *LBS* and, in parallel, the resource reallocation losses of the *HBS*, become more and more negligible.

4.4 - Scenario 4: scenario 3 with broadening the VAT base to all the sectors/products of the economy (exploratory scenario of a pure VAT)

We compare here the effects of short term with those of long term arising from implementation of a pure VAT. All the economic activities (and in particular their outputs) are completely subject to VAT. The simulations results indicate that in the short run, this scenario induces an improvement of the whole welfare compared to the basic situation. However, whereas this improvement is an unprecedented one for the urban households, then for the semi-urban ones, the rural households rather record a welfare worsening. What results in a strong regressivity of pure VAT system: the increase in the Gini coefficient being here the highest compared to that of all other simulations. Nevertheless, it would be worth to notice that, contrarily to the preceding imperfect VAT scenarios, which are welfare worsening when one shifts from the short run to the long run time horizon, the welfare generated by the pure VAT increases in an incredible way when the economy shifts from the short to the long run. The social gain ranges then from 62,451 to 230,266 billion CFA francs. In addition, in the long run, all household classes gain from this significant improvement. The pure VAT prove to be, by far, the most regressive of the four scenarios performed in this study, as well in the short run as in the long run. Even though, its long inequality in income distribution is lesser than the short run one. Contrary to the preceding scenarios which generate a counterintuitive production factors allocation, the reallocation induced by the pure VAT scenario is in accordance with generally expected effects a VAT implementation in an economy. Thus activities which bore heavier tax burden before VAT implementation henceforth attract more productive factors than activities belonging to *LBS*. Furthermore, the value added of the *HBS* activities increases more when shifting from short run to long run time horizon.

V. CONCLUSION

The economic policies taken or to consider can be analyzed from several points of view, in order to have a broader spectrum of their alternative effects. Amongst various optics of analysis in this concern, the comparison of the short run or transitional effects of a policy to its long run effects could be of an unquestionable interest in the decision-making or economic policy orientation. By assimilating the short run to a period when only labor is mobile between production sectors and the long run to a time horizon at which the capital becomes also mobile, the present study focussed on the difference which would arise between short run and long run effects of a VAT implementation. The results from simulations performed here by using a CGE model applied to the Cameroon case, allow us to underline some salient facts which come from this comparative approach. It thus appears that even if an imperfect VAT could be welfare improving in the short run, this improvement would tend to turn into a welfare deterioration in the long run. On the contrary, if the VAT implemented is a pure one, the transitional welfare improvement of the short run widens in the long run; in the same line, the short time welfare worsening, if any, tends to disappear or to turn into gains in the long run. Beyond the identification of these differential effects, the study emphasizes in a crucial way the regressive character of VAT as a taxation mode. This regressivity strengthens as one tends from embryonic VAT towards a pure VAT. Ultimately, it arises from our study, at least for the Cameroon case, that to promote a sustainable welfare improvement from VAT implementation, this VAT must be gradually likened to a pure VAT; but some pro-socioeconomic policies must be planned in order to preclude undesirable effects inherent in the greatest tax regressivity.

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Annex: Selected results from simulations outputs

Variables	Changes with respect to benchmark equilibrium: in % ; except : « Hicksian equivalent and compensating variations » and the « Welfare social cost » expressed in billions of CFA Francs							
	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
	Short run	Long run	Short run	Long run	Short run	Long run	Short run	Long run
<i>Welfare and Distribution</i>								
<u>Indirect Utility</u>								
•Rural Households	-0.005	-0.203	0.113	-0.074	0.124	-0.054	-0.015	0.354
•Semi-urban Households	0.035	-0.113	0.119	-0.013	0.131	0.008	0.160	0.401
•Urban Households	0.049	-0.209	0.224	-0.007	0.247	0.032	0.352	0.749
<u>Hicksian Equivalent Variation</u>								
•Rural Households	-1.077	-45.128	25.169	-16.530	27.540	-12.065	-3.301	78.606
•Semi-urban Households	6.709	-21.778	22.835	-2.400	25.155	1.514	30.685	76.978
•Urban Households	4.865	-20.875	22.311	-0.665	24.602	3.163	35.067	74.683
<u>Hicksian Compensating Variation</u>								
•Rural Households	1.088	45.429	-25.393	16.620	-27.807	12.143	3.378	-81.259
•Semi-urban Households	-6.781	21.940	-23.044	2.414	-25.404	-1.523	-31.264	-79.242
•Urban Households	-4.921	21.047	-22.523	0.669	-24.853	-3.184	-35.589	-76.505
<u>Global Indicators</u>								
•Welfare social cost	-10.497	87.780	-70.314	19.595	-77.297	7.388	-62.451	-230.266
•Gini index (base value = 0.305)	0.038	0.029	0.050	0.052	0.056	0.060	0.223	0.189
<i>Resource Allocation and Prices</i>								
<u>Demand for Labor</u>								
•Sectors with light ex ante tax burden	0.247	0.314	0.046	0.113	0.023	0.086	-1.139	-1.133
•Sectors with heavy ex ante tax burden	-0.698	-0.886	-0.129	-0.319	-0.064	-0.242	3.212	3.195
<u>Demand for Capital</u>								
•Sectors with light ex ante tax burden	-	1.050	-	0.755	-	0.706	-	-2.515
•Sectors with heavy ex ante tax burden	-	-1.287	-	-0.926	-	-0.865	-	3.083
<u>Value Added</u>								
•Sectors with light ex ante tax burden	0.160	0.566	0.026	0.333	0.010	0.298	-0.764	-1.625
•Sectors with heavy ex ante tax burden	-0.320	-1.105	-0.059	-0.650	-0.030	-0.582	1.432	3.116
<u>Value Added Price</u>								
•Sectors with light ex ante tax burden	1.195	0.333	1.174	0.423	1.252	0.549	1.358	3.525
•Sectors with heavy ex ante tax burden	0.324	0.277	0.696	0.381	0.818	0.509	4.120	4.483
<u>Consumer Price for Domestic Goods</u>								
•Sectors with light ex ante tax burden	0.882	0.131	0.946	0.329	1.034	0.456	2.111	4.027
•Sectors with heavy ex ante tax burden	1.609	1.593	1.306	1.098	1.371	1.157	0.694	1.188
<u>Consumer Price for Composite Goods</u>								
•Sectors with light ex ante tax burden	0.786	0.281	0.858	0.447	0.936	0.559	2.584	4.442
•Sectors with heavy ex ante tax burden	1.199	1.241	0.868	0.665	0.942	0.747	0.643	1.085
<u>Miscellaneous Indicators</u>								
•Consumer prices index. net of VAT	-1.199	-1.658	-1.343	-1.790	-1.331	-1.757	-2.965	-1.692
•Consumer prices index. gross of VAT	1.011	1.008	1.009	1.005	1.010	1.006	1.017	1.028
•Wage rate	0.947	0.429	1.048	0.497	1.138	0.618	0.680	1.922
•Capital payment rate	-	0.149	-	0.283	-	0.418	-	6.590
•Total investment (volume)	3.555	5.487	3.142	5.070	3.210	5.094	7.022	7.130
•Corporate savings	6.589	0.229	1.157	0.365	1.276	0.528	5.385	7.763
•Households savings	1.060	0.552	1.062	0.517	1.152	0.633	2.113	3.484