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COFFEE AND OIL SHOCKS IN THE SHORT AND THE LONG RUN:
An Application of Alternative CGE Models for Colombia*

Eduardo Lora

*This paper is part of the proyect "Linking Real and Financial Variable in a SAM-based Model for Colombia", that is currently conducted by FEDESARROLLO (Bogota) under the auspices of the International Development Research Center (Canada). The autor is researcher at Fedesarrollo and Senior Associate Menber of St. Anthony's Collage, Oxford University, for 1989.

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Colombia is usually singled out as one of the most stable economies of the region. During the present decade, while most other countries have suffered severed recessions as a result of foreign exchange constraints, Colombia has maintained its record of moderate but uninterrupted economic growth. Colombian inflation rates would be unacceptable for any developed economy, but they have also been remarkably stable (around 25%) since the mid seventies. Even more exceptional has been the Colombian record in relation to the external debt. When the debt crisis broke out in 1982 and most Latin American countries were heavily indebted, the level of Colombian debt was still relatively moderate by all standard debt indicators. Although some sizable macroeconomic disequilibria did appear in the early eighties, they had been totally corrected by 1985, leaving enough room to keep servicing all external debts according to their original terms. At present, Colombia is the only Latin American country that has not rescheduled its external obligations.

Colombia has recently recovered its position as a net oil exporter, and has become a new supplier of coal and nickel to the world markets. By the early nineties, mining exports will be at least twice as important as traditional coffee exports, already stagnant due to world demand trends. Given their expertise in economic stabilization in general, and in handling coffee bonanzas in particular, Colombians are confident that they would be able to avoid the undesired effects that oil shocks have had elsewhere. This paper assesses whether that self-confidence is well grounded and whether past experience with coffee bonanzas can be of any help in the event of an oil shock.

The analysis in carried out on the basis of two Computational General Equilibrium (CGE) models that reflect,

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respectively, the short and long run main features of the Colombian economy. Both models operate on a common statistical basis, derived from a social accounting matrix previously built for 1985 (Chica, 1989). This accounting framework is the subject matter of Section I. Sections II and III deal with the underpins of the two models, and Section IV discusses the methods of estimation of the few extraneous parameters required by the models. Section V compares the autonomous and policy-induced effects of coffee and oil shocks in the short and the long run. The main conclusions of this exercise are summarized in Section VI.

I. THE ACCOUNTING FRAMEWORK

Most CGE models are based on Social Accounting Matrices (SAM) describing the basic relationships between the main economic activities and the economic agents involved. The present ones are no exception. The SAM used for our models comprises 6 main sectors of production, with their corresponding units of production, namely i) coffee, ii) raw materials, iii) mining, iv) foodstuffs, v) industry and other urban goods and services (for short, industry from now on), and vi) government services (see Table 1). The distinction between these sectors is clear-cut and needs no additional explanations. However, it is worth noticing that each of the first four sectors encompasses not only its primary component, but also its manufacturing, except, of course, in the case of raw materials. For reasons that will be clear shortly, sectors of production are not to be confused with their corresponding units of production. The former can be seen as factories dealing with production decisions only, while the latter are the institutional units in control of the factors of production other than labour, and whose main role is distributing the primary sources of income. Apart from the six main sectors of production just mentioned, the SAM defines three other production sectors: i) imported inputs, ii) public fixed-investment goods and iii) private fixed-investment goods. As we will see below, this is done in order to take into account some particular features of these activities.

The SAM considers 5 social classes, namely i) rural workers, ii) peasants, iii) rural renters, iv) urban workers, and v) capitalists. At least in theory, these social classes are defined on the basis of their main sources of income. However, it must be accepted that, in some cases, this is a rather artificial criterion. In particular, it is of little help to deal with the large numbers of informal workers in the urban activities in Colombia.

This disaggregation of sectors, production units and social classes can now be put at work in the social accounting matrix.

The matrix is made up of seven sets of accounts describing the main economic activities. (For a concise summary of the accounting framework, see Table 2, which also contains a complete listing of the elements of the models that will be discussed in Sections II and III. The complete set of accounts in SAM format can be seen in Appendix 1). In the first set, the various types of goods and services are produced and sold to their final users. This takes place in a stage-wise fashion. In the first stage, production sectors buy and mix domestic intermediate inputs. The result of this first stage is sold out to the second stage, whose only role is adding the imported intermediate inputs. Although, in practice, these two stages must necessarily take place simultaneously, the advantage of seeing them as two separate activities is that each one can be modelled in a different way, as we will see in Sections II and III. This remark applies to most of the accounts in which each activity is decomposed. Once domestic and imported intermediate inputs are mixed, the result in each sector is the corresponding gross production at factory cost. At this point, the part of this production that is intended for the domestic market is transferred to the next stage of the production process, while that part to be exported goes to open the export accounts (see below). We have now moved to the fourth stage of the production process, where indirect taxes are levied on productions for the domestic market. Finally, in the fifth stage, domestic production valued at market prices for the home market coming from the previous account is mixed up with imports of final goods coming from the import accounts (see below). Once this last stage is completed, goods and services are ready to be sold to their different domestic users. They may be the same or other sectors of production (in their first stage), the consumers or the investors. But, before going to the accounting of final demands it is necessary to discuss how primary incomes generated in the third stage of the production process are redistributed and assigned to their different uses.

Primary incomes accrue either to one of the two types of labour of the system or to the units of production of the corresponding sector. The income thus perceived has to be redistributed to their final recipients. In the case of labour earnings, this is done simply by transferring all the proceeds to the income accounts of the rural or labour workers. In the case of non-labour earnings, the proceeds are split among various recipients, may them be peasants, renters and capitalists in the case of agricultural activities, or capitalists and firms in the case of mining and industry activities (the treatment of government activities is discussed in greater detail below). We have now moved from the first to the second stage of the income process. Each social class and both industry and mining enterprises have now received their shares from their participation in the production activities and will start to assign them to different purposes. Just for convenience we consider that transfers to and from abroad take place at this

stage. Net incomes are then transferred to the corresponding domestic income accounts of each institutional sector. In a third stage of the process, incomes are split in four: i) direct taxes, ii) other transfers to the government and to other economic units, iii) saving and, in the case of social classes, iv) consumption. We have now reached the fourth and last stage of the process of assignment of incomes. In this final stage, incomes assigned to consumption are split among the different types of goods and services available in the market.

Goods and services not consumed domestically can either be exported or used as investment goods. This gives origin to two other sets of accounts. As we mentioned above, those dealing with exports receive that part of the domestic production to be sold abroad. Their role is to collect export subsidies or pay export taxes from/to the government and then sell the goods abroad.

In the case of investment, two different types of (unconnected) accounts appear, according to the goods invested. For fixed capital goods, the corresponding purchase is made from specific production accounts where domestic and imported goods have been previously mixed. The reason for using separate production accounts for the supply of capital goods is that the share of imports in this case is substantially higher than in any other type of goods. In turn, investment in inventories is considered a purchase from total domestic supplies of each type of good (the last stage of the production process).

As mentioned before, total supplies of each type of goods comes out of the production process as the result of mixing domestic with imported productions. This implies that imports have been done somewhere else in the system. In fact, our SAM contains a set of import accounts to deal with imports. This is done in two stages. In the first one, goods and services are bought from abroad, and duties and trading margins are paid to the government. In the second stage, trading margins are added to these imports before being mixed with domestic productions (last stage of the production function). Lacking better information, it is assumed that all trading margins accrue as gross profits to urban firms.

So far we have described the first six sets of accounts. The remaining two are extremely simple in comparison. One is the set of accounts for taxes: a single account is open for each type of tax (or subsidy), all of them transferring their proceeds to the government income account. The other is the set of closure accounts, which consists of two accounts for current transactions with the rest of the world (one for goods, one for services and transfers), where net external saving is accounted for, and two accounts for domestic net saving (one for the government, one for the private sector). As closure accounts, all of these accounts receive the final balance of all the previous sets of accounts.

Table 1
MAIN ELEMENTS OF THE CGE MODELS FOR COLOMBIA

I. PRODUCTION SECTORS
- Coffee (C)
- Raw materials (R)
- Mining (M)
- Foodstuffs (F)
- Industry and other urban activities (I)
- Government services (G)

II. PRODUCTION UNITS
- Coffee producers (CU)
- Raw materials producers (RU)
- Mining enterprises (MU)
- Foodstuffs producers (FU)
- Industrial and other urban enterprises (IU)
- Government (G)

III. FACTORS OF PRODUCTION (FOR THE LONG-RUN MODEL)
- Rural labour (RL)
- Rural capital and land (RC)
- Urban labour (UL)
- Urban capital (UC)

IV. OTHER PRODUCTION-RELATED ACTIVITIES
- Imported inputs (IP)
- Private fixed-investment goods (FI)
- Public fixed-investment goods (GI)
- Inventories (IC)

V. SOCIAL CLASSES
- Rural workers (RW)
- Peasants (PE)
- Rural renters (RE)
- Urban workers (UW)
- Capitalists (CA)

Table 2
ACTIVITIES, ACCOUNTS AND SPECIFICATION OF FUNCTIONS

ACTIVITY	SECTORS/AGENTS HAVING ACTIVITY (=ACCOUNTS)	Specification of CGE Models FIX		FUNCTIONS USED (by column)	
		Short Run	Long Run	Short Run	Long Run
A. Production					
1. Domestic inputs are mixed	C, R, M, F, I, G			IO	IO
2. Imported inputs added	C, R, M, F, I, G			CES	CES
3. Value added	C, R, M, F, I, G	Q(R,F) P(C,G)	P(G)	IO+RENT or MARKUP(I)	CD or IO+RENT(G)
4. Indirect taxes paid	C, R, M, F, I, G			IO(C,M,I,G) or CET(R,F) +TIAX	IO(C,M,G) or CET(R,F,I)+ TIAX
5. Imports mixed with domestic production	R, M, F, I, GI, FI	P(M)		CES	CES
B. Income					
1. Primary incomes received and distributed	RW, UW, CU, RU, MU, FU, IU, G (RL,RC,UL,UC,Gx in the long-run)	P(RW) NP(UW)	(All Q)	IDIST	IDIST
2. Exogenous transfers paid	UW, CA, IU, MU, G			FEXOT+UNSPEC +TEXO(G)	FEXOT+UNSPEC +TEXO(G)
3. Income is split in taxes, other transfers, consumption and saving	RW, PE, RE, UW, CA, IN, MU, G			DTAX+IDIST	DTAX+IDIST
4. Consumption of goods/services	RW, PE, RE, UW, CA, G	Q(G)	Q(G)	LES or VSHR(G)	LES or VSHR(G)
C. Exports					
1. Exports after taxes/subsidies paid/received	C, R, M, F, I	P(C) Q(M)	P(C)	IO(C,M,I) or CET(R,F)+ TTAX or RENT(C)	IO(C,M) or CET(R,F,I)+ TTAX or RENT(C)
D. Imports					
1. Imports after duties	IP, R, M, F, I, FI, GI			IMPORT+TTAX	IMPORT+TTAX
2. Trading margins added	IP, R, M, F, I, FI, GI			IO+MARKUP	CD
E. Investment					
1. Investment	FI, IC, G	Y(FI,G)		VSHR(G,FI) or DQEXO(IC)	VSHR(G,FI) or DQEXO(IC)
F. Tax accounts					
1. Indirect taxes				IDIST	IDIST
2. Import duties				IDIST	IDIST
3. Coffee taxes				IDIST	IDIST
4. Export subsidies				IDIST	IDIST
5. Direct taxes				IDIST	IDIST
6. Other taxes				IDIST	IDIST
G. Closure accounts					
1. Balance of trade		P	P	EXPINF or EXPO(C) or EXPORT(I)	EXPINF or EXPO(C)
2. Balance of services		P	NP	FEXOF	FEXOF
3. Government saving				UNSPEC	TEXO+UNSPEC
4. Saving-investment					

The preceding description of accounts is based on a disaggregation of sectors of production, production units and social classes very well suited to deal with private economic activities, though not so much government ones. For this reason, it is worth discussing the treatment of government activities in a separate way. The government appears in all main economic activities (look for the "G"s in Table 2). As producer of non-market services, it constitutes a separate sector of production. As such, the government has four accounts, corresponding to the four first stages of production. In the first two stages the government buys the domestic and imported goods and services required by public administration activities. The result carries on to the third stage, where the government mostly pays wages and salaries to the civil servants and public workers in public administration activities. A small (and usually negative) profit results from this stage, given that some services (like health and education) are actually paid for by the public on a (partial) market base. The result of this stage is then sold to a fourth government account that pays the few indirect taxes that government services are liable to. The final result is the "market" value of government gross product, although this is only a convenient label, given that most of government services have no market at all. It is for this reason that, for accounting purposes, the main consumer of those services is the government itself, as we will see shortly.

So far we have seen the government's role in the first four stages of production. Although there can be no imports of government services, the government is also involved in the last stage of production, where composite domestic-cum-imported commodities are produced. The reason for this is that the government is not only a consumer of its own services, but also an investor in capital goods. Hence, the government buys domestic and imported capital (mainly manufactured) goods and mixes them to produce the type of capital goods that later on (in the accounts) is going to buy.

As an income earner the government also appears in all the stages of income generation and assignment. It first receives the (usually negative) profit of its own production of government services. In the second stage of the income process, it plays a central role as responsible for the major part of service payments and transfers to and from abroad. However, given that the bulk of government revenues come from taxes, it is also in this second stage that transfers from all tax accounts to the government are made. Total government incomes, after net transfers abroad, are then split in three: domestic transfers, consumption and saving. Each one of these transactions gives origin to a new account. Domestic transfers are carried on to the government transfer account, that roughly corresponds to the

third stage of the income process. The total amount of transfers is split here among the various beneficiaries of government payments not accounted for before. Interests on domestic public debts, rents, royalties and provisions for social security services are all paid at this stage. The amount assigned to consumption opens the consumption account of the government, whose only purpose is to buy the production of domestic government services not paid for by households (production's stage four). In turn, the amount assigned to saving goes to finance the purchase of public investment goods produced as composite commodities in stage five of the process of production. Finally, the difference between public saving and investment carries on to the closure account of government net saving.

In total, the SAM just described contains 89 accounts (see Table 2 or Appendix 1). It is worth stressing that a substantial part of this amount results from disaggregating activities that in practice are carried out simultaneously. If all artificial disaggregations are left aside, the system collapses to just 25 accounts. However, the more complex system of accounts discussed in this section is required for the design of alternative CGE models, to which we now turn.

II. A SHORT-RUN CGE MODEL FOR COLOMBIA [1/]

Following the transaction-value approach to macroeconomic modelling, the construction of a CGE model involves four major steps (Drud, et.al., 1983). The first one is to build the adequate accounting framework, which we did in the previous section. The three remaining steps are i) specify the behavioural or technological rule associated to each cell of the SAM; ii) chose numerical values for the parameters, and iii) define the constraints ensuring the consistency of the whole model. Since we are interested in building two alternative CGE models on the basis of a common accounting framework, these three steps will have to be followed twice. In the current section we undertake steps i) and iii) simultaneously for the short-run version of the model, postponing step ii) for a later section.

[1/] The main elements of this model were originally developed by Londono (1988). In the present version, a number of extensions and modifications are introduced. Specifically, imports are modelled using CES functions, export supplies are assumed to result from CET functions while some export demands are considered infinitely elastic, and a large number of unimportant transfers (most of them involving the government) are endogenized adopting simple policy assumptions. Other modifications include a more detailed treatment of indirect taxes and slightly different closure rules.

In order to specify the behavioural and technological rules and the constraints of the model, it is convenient to go again through the list of accounts presented in Table 2. As a matter of convenience, we discuss specifications for the columns of the accounts (i.e. for the outlays) only, unless otherwise indicated. Specifications for the rows of each account (i.e. for the proceeds) are, of course, those of the columns of the accounts with which they cross. The complete list of specifications arranged in SAM format can be seen in Appendix 2. The acronyms in block letters that will be found in that Appendix and the present two sections are those used in the HERCULES version of the GAMS computational package developed by the World Bank (Drud and Kendrick, 1986). Verbal and mathematical definitions of the specifications can be found in Appendix 4.

As we have seen, the first two stages of production are associated with the mixing-up of inputs in every one of the six sectors considered. As producers are likely to be locked to the existing technologies in the short run, we assume that domestic inputs for each sector have to be mixed in fixed physical proportions, according to input-output (IO) coefficients, and that the whole bundle of domestic inputs in each sector can be imperfectly substituted for imported inputs according to constant elasticity of substitution functions (CES, a more detailed explanation below).

In order that the result of these two first stages of production is carried on to the following stage a further input-output coefficient in the row of each of the previous accounts is required. Factors of production must now come into play, which requires some previous discussion on the constraints faced by each individual sector. In the short run, a number of production activities are constrained by market rigidities and policy rules in Colombia. As a result, either prices or quantities are fixed in several markets. In the production activities, domestic market prices are policy determined in the cases of coffee, mining and government services. The domestic price of coffee is an important policy tool used to control coffee plantings in the long run and to stabilize aggregate demand in the short run in the face of continuous and, at times, dramatic fluctuations of external coffee prices. Domestic prices of mining productions (mainly oil derivatives) are also fixed by the government, who holds a substantial proportion of property shares in the sector. By definition, the government also controls the price of government services, although this is of very little macroeconomic importance, given that only a tiny fraction of those services are actually sold to the public. In the short run, quantities are also given in some production activities. Thus, those of raw materials and foodstuffs are largely determined by past plantings.

For economic modelling purposes, the presence of price and quantity rigidities implies that either the producers or the consumers are not allowed to maximize their utility functions, and, therefore, are located off their corresponding supply or demand functions. In what follows, we assume that rigidities affect producers only, so that consumers are always allowed to carry out their plans. This implies that, when quantities are fixed, prices are determined by the demand functions and that, when prices are fixed, production accommodates regardless of profitability and capacity considerations. Of course, the latter assumption can only hold within rather narrow limits (something we must bear in mind for comparative static exercises) [2]. These assumptions amount to saying that producers behave passively in the face of price or quantity rigidities. From the point of view of factor payments this implies that one type of primary income in each sector is a residual. Since hired labour is assumed to change with production according to fixed input-output ratios, we assume gross profits accruing to units of production in each sector to be the residuals needed to match gross product values with total costs. Hence, in each of the five sectors having either prices or quantities fixed, the third stage of the production process is modelled through a combination of input-output coefficients (IO) and a residual profit (RENT).

At least in principle, both prices and quantities are allowed to change freely in industrial and other urban activities. However, as production capacity is usually in excess in these activities, and oligopolistic market conditions prevail in the short run, we can not assume that capital is paid according to its marginal productivity, but rather on the basis of a mark-up rate levied on all variable costs. Hence, in this case input-output coefficients are to be combined with a mark-up determining gross profits (MARKUP).

In the fourth stage, indirect taxes are to be paid on productions for the domestic market only (given that exports are exempted from value-added taxes, which are the main form of indirect taxation in Colombia). Of course, this requires transferring to the new accounts only that part od the productions of each sector that are to be sold in the domestic market. As before, an input-output coefficient (IO) may be used for this purpose. However, this is not the way that transfer is done in the cases of raw materials and foodstuffs. For reasons that will be explained in connection with the treatment of export functions, in these two cases a constant elasticity of

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[2] Given the massive stocks of coffee accumulated in the past by the marketing board (the Coffee Growers Association), inventories changes can be allowed to deal with substantial (particularly external) demand shifts in this case.

transformation (CET) function is used instead. Once this has been done, indirect taxes are levied in fixed proportions over and above gross production values at factory cost available for the home market by means of an indirect tax (ITAX) rate in each sector. As we will also see in the discussion of export activities, indirect taxes on coffee are levied in a different way, so no tax rate is applied in this case.

The fifth and last stage of production has the role of mixing domestic productions at market values coming from the previous stage with imports at market values (to be discussed below) giving as a result a single composite commodity in each sector. As in the case of intermediate inputs, following Armington (1969) we assume that imports and domestic goods are imperfect substitutes whose share in total final demands is determined according to a constant elasticity of substitution function (CES). The key parameter of these functions is the elasticity of substitution, which has to be estimated extraneously. It should be noted that production sectors in this sixth stage are not the same as in the previous stages. This is because neither coffee nor government services are imported. However, two new sectors have appeared, namely private and public fixed investment goods. These sectors mix imports of capital goods (mainly machinery and equipment) with domestically produced urban goods (some equipment, but also all types of constructions).

We can now discuss the modelling of income functions. As we have seen, primary incomes accrue either to the workers or to the production units. The model considers two types of independent labour markets --rural and urban--, both having fixed nominal wages and excess supply. It is important to notice that this assumption is more valid for the urban than for the rural labour market. Urban wages are relatively stable regardless of the labour market situation, which not only reflects the effectiveness of labour legislation, but also the custom of establishing wages on an annual basis. In contrast, rural wages change widely, as the ability of minimum wage regulations to stabilize rural workers' incomes seems to be negligible and hiring and firing is totally smooth and unrestricted in agricultural activities. Nonetheless, we assume rural wages to be fixed in nominal terms in the short run because, given that producers are off their supply curves, it is not possible to have demand functions for labour depending on the wage rate (factors are not paid according to their marginal productivities). In other terms, since quantities produced are exogenous, nominal wages have to be exogenous as well, because both have to be determined simultaneously.

Total wages received by the two classes of labour just considered are totally transferred to the corresponding groups of workers in the second stage of the income process. Gross profits

accruing to each unit of production are also redistributed in this stage to its different recipients. This is done assuming fixed distributional shares (IDIST) for each account. The third stage of the process is equally easy to model. We simply assume that transfers to and from abroad are exogenous in dollar terms (FEXO) [3/], with the remaining incomes being transferred to the next stage as residuals (UNSPEC). However, some additional specifications are required in the case of government. As we mentioned above, it is at this stage that government current income is split between external transfers, domestic transfers, consumption and saving. We then assume that the total amount of domestic transfers is also exogenously given (in this case, in domestic currency, TEXO). As we will see shortly, government consumption is determined at a later stage of the income process. Hence, it can be treated here as a residual (UNSPEC). Given these first three components, the fourth is by necessity another residual (UNSPEC).

We can now move to the third set of income accounts. At this stage, total net incomes of all private groups of agents are split between taxes, domestic transfers to other agents, saving and, in the case of social classes, consumption. We assume that direct taxes are levied at fixed rates on total net incomes of each group of agents (DTAX), and that the remaining income is split in fixed proportions to the other purposes (IDIST). In the case of the government, no direct taxes are levied and the total amount of this account is split in fixed proportions (IDIST) between the various transfer recipients (as consumption and saving were financed in the previous stage).

Finally, incomes set aside for consumption by each of the five social classes considered are assumed to be assigned to the various types of goods and services according to linear expenditure systems (LES). Following Geary (1950-51) and Stone (1954), this specification assumes that total consumption of each good is made up of a committed quantity that is independent of the level of income, and a discretionary component that is a fixed proportion (in value terms) of the remaining income. The key parameters that are needed to implement this system are the amounts of committed quantities of each type of good for each social class. In the case of the government, total consumption takes place in public administration services that have been produced by the government sector in the production accounts. To determine the amount of this consumption we assume that the government is committed to provide a certain amount of services, regardless of their cost. We thus suppose that government

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[3/] Notice that transfers from abroad are accounted for in the rows of the recipient institutional agents, while transfers to abroad are placed in their columns.

consumption is fixed in quantity terms and its total value spent in buying government services (VSHR).

It is worth noticing that the way saving and consumption are modelled rules out any interdependency between the two. This may be a serious forthcoming in such circumstances where important essentials, like foodstuffs, may have substantial price changes. In such a case, one would expect committed expenditures to crowd out (or in, if prices fall) saving, especially that of rural and urban workers. However, given that the saving ratio of these social groups is extremely low, negative saving could easily appear, which would impose more difficult assumptions (for instance, that these social groups have ready access to some form of loans).

We can now discuss the modelling of the external sector. Export accounts could be seen as a further stage of the production process, whose role is to receive the domestic goods to be exported and to pay export taxes levied on them (some of them negative, as Colombian non-traditional exports are subsidized). To do the former, two different types of procedures are followed, depending on the characteristics of the sectors. In those cases where total quantities produced are fixed (raw materials and foodstuffs) we assume that gross production is distributed between the domestic and the foreign market according to a constant elasticity of transformation function (CET) 4/. This specification, due to Powell and Gruen (1968), implies that goods sold in both markets are not completely homogeneous and that some costs are incurred in shifting goods from one market to the other. Due to these transformation costs, export and domestic prices may be different, as is actually the case for the type of goods considered. As we will see in Section IV, the required elasticities of transformation to apply this specification can be derived from existing econometric estimates. In the remaining sectors, where quantity restrictions stem not from supply limitations, but from other rigidities affecting either the domestic or the foreign market, the former specification is no longer valid. In these other cases, we simply use input-output coefficients (IO) to transfer productions to the corresponding accounts (i.e. the next stage of the production process for home sales and the first of the two accounts dealing with exports for sales abroad).

Once we have transferred into the export accounts the corresponding productions at factory cost, export subsidies or

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4/ As this specification determines how production at factory prices is distributed, it applies to the rows of the accounts of stage three of production, where they cross with the columns of stage four of production and the columns of the export accounts.

taxes must be subtracted or added, to determine the value of exports at market prices. In Colombia, all minor exports are entitled to fiscal subsidies according to pre-specified rates. Hence, a negative indirect tax coefficient (ITAX) is appropriate for this purpose in the relevant cases (raw materials, foodstuffs and manufactured goods). In the cases of coffee and mining a different treatment is required. In these sectors, both domestic and export prices are fixed, the former due to government intervention and the latter as a result of the structure of the external markets. In order to bridge the variable gap between the two, a form of residual is needed. Thus, a rent appears in both cases (RENT). In the case of coffee, its proceeds are received by a tax account to be later transferred to the government. This account plays the role of the National Coffee Fund, a public entity in charge of the revenues produced by the regulation of coffee exports. In the case of oil, where no such mechanism has yet been developed, it is simply assumed that export rents accrue to the mining firms (through a non-market factor account). As we have seen, two specifications are required in each of the columns of the export accounts. These two specifications explain exports from the point of view of supply. As a matter of convenience, we now turn to the demand side of exports.

According to the accounting framework of Section I, all types of exports are bought by a single account, namely the balance of trade (one of the closure accounts listed in Table 2). Hence, it is in the column of this account where export demands have to be modelled. For this purpose, it is assumed that "minor" exports of raw materials and foodstuffs face infinitely elastic demands from the rest of the world (EXPINF). Hence, world prices in foreign currency being given, quantities exported are determined exclusively on the basis of supply considerations, as reflected in the constant elasticity of transformation functions explained above. Although manufactured goods are also minor exports, we model them in a different way in the short run. Since production capacity is slack in this sector, transformation functions are irrelevant, because exports do not compete with domestic sales. Hence, we are forced to assume that exports of manufactured goods are constrained by the presence of foreign demands that are not infinitely elastic (EXPORT) [5/]. This may be due to monopolistic competition or some form of market differentiation, as it is likely the case for this type of goods. In the case of coffee a different treatment of external demand is

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[5/] It is worth noticing that this treatment rules out devaluation rents because export and domestic prices are considered the same (apart from differences in taxation). In the short run, this implies that exporters react to a foreign exchange devaluation by immediately reducing their export price in foreign currency and supplying the additional exports demanded from abroad.

also required. Export quantities and prices are fixed in this case by an intricate system of basic and contingent quotas annually re-established by the International Coffee Pact. Hence, both prices and quantities must be taken as given from abroad (EXP0 and fix quantity). Finally, in the case of mining exports (mainly hydrocarbons and coal), where Colombia is a marginal supplier, export prices can also be considered as given (EXPINF). However, at least in the short run, the quantum of mining exports must also be taken as given, not as a result of market restrictions but due to the constraints imposed by the network of pipelines and other domestic transport facilities to the ports. That is why we also have a fix quantity in this case.

In the second stage of production we established that imported inputs were to be mixed with domestic intermediate goods according with CES functions. We used the same specification to combine domestic and imported final goods in the last stage of the production process. Having determined the sources of demand for imports, we can now see how its supply is determined. As we have mentioned, this takes place in two stages. In the first stage, imports take place at given world prices and import duties are paid at given rates. This requires two equations for each type of import. One is needed to calculate the value of imports exclusive of duties on the basis of the world price, the (also fixed) exchange rate and the quantity of imports valued at base prices (IMPORT). The other is required to figure out the amount of duties given the result of the previous equation and a tax rate (ITAX). The result of this first stage is carried on to the second stage with an input-output coefficient (IO) and then trading margins are paid on the basis of a mark-up rate (MARKUP).

As mentioned before, the model considers three types of investment. The first two --private and public fixed investments- are assumed exogenous in nominal terms, while the third-- inventories changes-- is assumed exogenous in real terms (DQEXO). It must be mentioned that inventories changes should be used as an equilibrating variable in some markets, especially in the case of coffee. This is not done simply due to software limitations. As a result, to avoid overdetermination of the level of production, the quantity of coffee can not be fixed in the short run, in spite of the long-term nature of coffee plantings [6]/.

The following set of accounts included in the model is that dealing with the various types of taxes. We have already seen the bases of collection of these taxes. In order to balance these accounts, their total proceeds are transferred to the government

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[6]/ This implies that the exogenous value of inventories changes would have to be figured out by an additional equation external to the CGE model.

income account, which is done by distributional coefficients (IDIST) taking the value of one in all cases.

The system is closed with the remaining set of accounts. Each one of these accounts contains a residual cell (UNSPEC) that assures the global consistency of the model. The closure accounts are the two current external balances (trade and services) and the two net saving balances (public and private), which implies that there are no financial constraints --either internal or external-in the economy. Of course, this type of closure can only be acceptable in the short run.

III. THE LONG-RUN MODEL

The economy of the previous Section was plagued with rigidities reflecting the inability of some prices and quantities to move freely in the short run. As techniques were also assumed rigid and capital immobile, very limited choice was given to producers to modify the mixture of inputs and factors of production in the different sectors of the economy. On the other hand, as we just mentioned, the possibility of financial constraints was ruled out. An alternative long run model for the Colombian economy can then be built modifying these assumptions.

In the short run model, units of production had the role of collecting and distributing non-labour earnings. This was essential to the model, as each sector was receiving at least a rent or mark-up as a result of price and quantity rigidities. Rents could differ substantially among sectors, as capital and other factors of production apart from labour were locked to their current sectors of activity. Of course, none of this can hold in the long run. If factors have any degree of mobility, their corresponding returns will tend to be the same in all sectors. Therefore, the distinction between units of production becomes largely immaterial, while differentiating among factors of production becomes crucial [7]/. In what follows, it is assumed that there are four different factors of production, namely rural labour, urban labour, all forms of rural capital (including land) and urban capital. It is further assumed that all these factors display fixed supplies and their corresponding rates of return are free to change. However, rents can still exist in the coffee sector on the assumption that export quantities are fixed by the system of quotas enforced by the International Coffee Pact. As in the short run model, coffee rents are assumed to be collected by

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[7]/ However, mining and urban firms continue appearing in the model, as they still play a role in the redistribution of income. The plan of accounts and the complete list of specifications in SAM format for the long run model

the government (through the account representing the National Coffee Fund).

Since factor mobility is allowed, we must also assume that production techniques can be modified. With this purpose, fixed input-output coefficients in stage three of production and stage two of imports are changed for variable coefficients according to standard Cobb-Douglas production functions [8/].

Factor mobility and flexibility of prices and wages assure that producers can not be constrained by demand. This implies that exports and domestic sales must compete against each other, a possibility we had ruled out in the short run for manufactured goods. To take this into account, we will now assume that the domestic production of urban goods is split between the two markets according to a given constant elasticity of transformation function (CET). This allows us to release the assumption that manufactured exports face downward slopping demand curves. As for the remaining "minor" exports, we now assume that those of urban goods face an infinitely elastic demand (EXPINF).

Finally, closure rules must also be changed. We now assume that net borrowing by the government and net external borrowing are both fixed in nominal terms. By implication, we are also assuming net borrowing of the private sector to be fixed. This is so because total net borrowing for all economic agents is necessarily nil. As the exchange rate is also fixed in nominal terms, we are also assuming that the current account balance in dollar terms is fixed. Obviously, this closure method requires private and public investments to be endogenous.

A summary of the differences between the short and the long run models can be seen in Table 2. Most price and quantity rigidities (appearing in the columns labelled FIX) have been removed. The only prices that are kept fixed are the price of government services and the price of the two external balances (i.e. the exchange rate). The only quantities fixed are the consumption of public services by the government and the volume of coffee exports. These rigidities are maintained because they arise not from short run inflexibilities, but from policy rules or foreign market structures. It must be noticed that neither the domestic price of coffee nor that of mining products is fixed in the long run. In the case of coffee, the price paid to producers has to become endogenous in the presence of external quotas, unless inventories could absorb the differences between supply

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[8/] This implies fixing all value shares, which may seem equally restrictive. However, this is a simple way of introducing some technical flexibility in the lack of reliable estimates of the elasticities of substitution between factors.

and demand (something unsustainable in the long run). In the case of oil, the possibility of controlling the domestic price is ruled out in the long run by capital mobility in the presence of an infinitely elastic demand from abroad. However, as we will see in Section V, this does not imply that domestic oil prices have to match oil world prices in the long run. A wedge between both can de driven by taxing exports, not by controlling the price of oil derivatives in the domestic market.

IV. EXTRANEOUS PARAMETERS
[PENDING]

V. COFFEE AND OIL SHOCKS IN THE SHORT AND THE LONG RUN

Our two CGE models can now be put at work to address the central question of this paper: Are coffee and oil shocks equivalent either in the short or in the long run? If so, experience accumulated in the handling of coffee bonanzas in the past can be readily applied in the event of an external oil shock. Otherwise, great caution must be exerted to avoid Dutch-disease type problems as those encountered by oil exporting countries all over the world.

In what follows, we will concentrate on the effect of external price increases on a rather limited number of variables, namely the levels of aggregate and sectoral production and exports, the rates of aggregate and sectoral price increases, the behaviour of real disposable incomes of the different social groups of the economy and the behaviour of real investment. As we will see, these variables reflect the main consequences of the shocks and the policies that could be possibly applied by the government to counteract them.

Our first set of experiments has to deal with the short run consequences of a 50% increase in the export price of coffee. Five alternative experiments are carried out in order to analyze different policy responses to the shock. The main results can be seen in Table 3. In the first experiment, only the external price of coffee changes. All policy variables, including the domestic price of coffee remain at their base values. Since the wider gap between the external and the domestic price of coffee is bridged by a rent accruing to the public sector (see the column "Coffee rents"), the shock has no consequence whatsoever in the rest of the economy (except, of course, for the increase in total GDP prices, which include exports). This first experiment clearly shows that a coffee shock can in principle be absorbed in the short run without any policy reaction or institutional modification. This, of course, reflects the fact that the Colombian institutional environment has been shaped to a very large extent by past external coffee shocks.

Table 3
SIMULATION RESULTS:
EFFECTS OF A COFFEE SHOCK UNDER ALTERNATIVE POLICY RESPONSES
(Percentage variations)

	Short Run					Long Run		
Cases:	1	2	3	4	5	1A	4A	5A
Production								
GDP	0	1.6	2.6	-1.0	-1.2	1.4	0.3	0.4
Coffee	0	-1.8	0.3	-2.0	-2.1	0.2	0.3	-0.1
Raw materials	0	0	0	0	0	0.6	4.0	0.0
Mining	0	1.1	1.7	-0.5	-2.6	-8.1	-8.4	-4.3
Foodstuffs	0	0	0	0	0	0.3	0.2	-0.5
Urban goods	0	2.3	3.9	-1.6	-2.5	2.7	2.7	0.4
Export Volumes								
Coffee	0	0	0	0	0	0	0	0
Raw materials	0	-0.8	-1.5	0.7	1.2	-1.1	1.4	1.0
Mining	0	0	0	0	0	-69.3	-71.5	-11.5
Foodstuffs	0	-3.9	-2.1	-1.9	-0.5	-0.8	-1.5	0.2
Urban goods	0	-0.4	-0.2	-0.2	0	1.9	1.9	0.4
Fixed Investment								
Public	0	-0.4	20.9	-21.4	0	28.8	9.0	35.4
Private	0	-0.4	-0.3	-0.1	0	-0.8	22.0	-0.4
Domestic Prices								
GDP	2.8	4.4	3.6	3.6	3.0	3.7	3.9	2.6
Coffee	0	50.0	0	50.0	50.0	1.9	2.7	-1.0
Raw materials	0	2.0	3.8	-1.7	-3.0	2.9	4.2	-1.8
Mining	0	0	0	0	0	0	0	0
Foodstuffs	0	7.0	3.6	3.4	0.9	1.9	2.7	-1.1
Urban goods	0	0.5	0.3	0.2	0	0.8	0.9	0
Real Incomes								
Rural workers	0	-4.2	-1.8	-2.4	-1.1	0.8	1.5	-0.8
Peasants	0	29.7	2.9	27.4	25.9	0.7	1.2	-0.8
Renters	0	16.7	4.3	12.6	9.9	1.0	1.7	-1.1
Urban workers	0	-0.5	1.7	-2.2	-2.2	1.3	1.2	0.4
Capitalists	0	4.3	3.5	0.7	0.0	-1.2	-1.3	0.0
Coffee Rents	140.5	50.0	140.5	50.0	50.0	137.0	135.6	142.3

Table 3 (contd.)

DESCRIPTION OF CASES:

Short run:

1. The world price of coffee increases 50%, no policy response.
2. Both world and domestic coffee prices increase 50%.
3. Only the world price increases but the government spends in new investments an ammount equivalent to the extra payments to coffee growers in case 2.
4. Both world and domestic coffee prices increase and the government reduces its investment expenditure by an amount equivalent to the extra payments actually recieved by the coffee growers.
5. Both world and domestic coffee prices increase and the government liberalize imports by an amount in domestic currency equivalent to the extra payments actually recieved by the coffee growers.

Long run:

1A. The world price of coffee increases 50% and there is no policy response. Since the price paid to the producers is endogenous in the long run, cases 1 and 2 for the short run converge in case 2A in the long run. Given that public investment is endogenous in the long run, case 3 also converges in this case in the long term.

4A. Compensatory fiscal policy by the same amount of case 4 takes now place by reducing the level of the public deficit, that is endogenous in the long run.

5A. Import liberalization as in case 5.

A second experiment shows the effects of a similar relative increase in the domestic price of coffee, possibly as a result of strong political pressure on the part of the coffee growers. However, given that the domestic price was assumed to be lower than the external price before the shock, only part of the additional income is received by the producers. As a result of the additional demand, GDP grows 1.5% (mainly due to increased urban production) and total GDP inflation jumps from 2.8% to 4.4%. Food is the main source of additional inflation, as higher prices are the only means to accommodate larger household demands for primary goods in the short run. This gives origin to very important changes in income distribution. Rural workers are badly affected, while all types of non-working classes enjoy substantial improvements in their real incomes.

A third experiment is addressed to enquire as to what extent some of the previous effects are due to the pattern of consumption of the coffee growers and can therefore be avoided by spending the same amount of money in a different way. Thus, it is assumed that, instead of rising the internal price of coffee, the government increases its investment programs by the same amount (a relative increase of public investment of 20.9%). The result is a larger increase in total production (2.6% vs 1.5%) and less inflation (3.6% vs 4.4%), especially in the food market (3.6% vs 7%). Regressive income redistribution is partly avoided by this new policy response, although the larger improvements are again those of the non-working classes.

The two remaining experiments analyze alternative macroeconomic policies aimed at offsetting the short run effects of the increase of the domestic price of coffee of experiment 2. Following a rule of thumb usually applied in Colombia, the monetary base is implicitly stabilized as a means of controlling aggregate real demand. In the first case, this is done by cutting public investment by the same extra amount paid to the coffee growers. In the second, by liberalizing imports by that same amount in domestic currency [9]/. The results are far from satisfactory from a policy point of view. In both cases, GDP growth is seriously curtailed (-1 and -1.2% in comparison to +1.5% in experiment 2), affecting a wide range of sectors. With respect to inflation control, fiscal restraint turns out to be much less effective than import liberalization. Finally, in neither of the two cases are regressive redistribution effects substantially curtailed.

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[9]/ Although all imports are endogenous, an import liberalization can be assumed to take place by shifting the composition of final demands in the base case.

The main conclusion of this set of experiments is well known in Colombia, thanks to the experience of the seventies. Once the domestic price of coffee has been increased, compensatory policies can completely offset inflationary pressures only by plunging the economy into recession. If the coffee surplus is to be redistributed, a less risky and more effective way of doing it in the short run is by expanding government expenditure. We will discuss below whether this is a sustainable policy in the long run.

But, before leaping into the long run, we can see how a similar set of short run policies work in the event of an external oil shock. As before, we assume that world oil prices increase 50%, in this case affecting both exports and imports of mining products [10]/. In the absence of any policy response, the shock has very little impact on the rest of the economy, as can be seen in case 1 of Table 4. This is due to the fact that the agents entitled to the mining rents, which include the government, have low expenditure propensities (investment is fixed in nominal terms in the short run).

Although both sectors are roughly of the same size in terms of their production values, the effects of a similar increase in the domestic price of oil are stronger and more pervading than those of coffee (case 2). Rising the domestic price of oil brings about a sizable depression of economic activity, especially in industry and in the mining sector itself. The former is affected by increased production costs, while the latter is faced with shrinking demands as surpluses appearing in the home market on account on higher prices can not be sold abroad because of transport constraints. Economic recession prevents prices from increasing substantially: total GDP prices go up by only 2.4% as higher mining and industry prices are largely offset by cheaper raw materials and foodstuffs. Not surprisingly, rural renters and peasants have to bear the burden of these relative price changes. But as recession hits the urban and mining areas, neither the urban workers, not even the capitalists get any improvement in their living standards.

As the previous experiment makes clear, no benefit can be derived from increasing domestic oil prices when oil exports can

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[10]/ Due to bottlenecks in the oil refining industry, Colombia imports gasoline and a few other hydrocarbons and exports crude and fuel oil. However, it must be stressed that apart from hydrocarbons, it also exports coal and, in smaller quantities, nickel and some precious metals. Since our model has a single mining product comprising all these activities, we are implicitly assuming that an oil shock affects the prices of all these products in the same proportion.

Table 4
SIMULATION RESULTS:
EFFECTS OF AN OIL SHOCK UNDER ALTERNATIVE POLICY RESPONSES
(Percentage variations)

	Short Run					Long Run			
Cases:	1	2	3	4	5	1A	3A	4A	5A
Production									
GDP	0.2	-3.5	1.9	-5.6	-5.8	-0.1	0.0	0.1	0.4
Coffee	0	-0.4	0.2	-0.6	-0.7	-1.2	0.0	-1.2	-1.5
Raw materials	0	0	0	0	0	-2.9	0.0	-1.0	-3.2
Mining	-0.4	-14.1	1.3	-16.1	-18.8	22.7	-4.5	22.5	26.2
Foodstuffs	0	0	0	0	0	-0.3	0.0	-0.4	-0.9
Urban goods	0.3	-5.4	3.0	-8.6	-9.9	-1.6	0.9	-1.5	-3.9
Export Volumes									
Coffee	0	0	0	0	0	0	0	0	0
Raw materials	0.0	2.9	-1.0	4.0	10.0	-24.1	-0.1	-22.9	-22.7
Mining	0	0	0	0	0	248.5	-29.1	247.2	305.8
Foodstuffs	-0.3	3.4	-1.5	5.2	6.9	-16.9	0.0	-17.2	16.1
Urban goods	-0.2	-2.2	-0.3	-2.0	-1.7	-30.8	1.0	-30.7	-31.9
Fixed Investment									
Public	-0.2	-2.0	17.0	-18.8	-1.4	1.9	12.1	-9.7	12.8
Private	-0.2	-1.6	-0.4	-1.3	-0.5	46.3	-1.0	60.2	52.0
Domestic Prices									
GDP	1.7	2.4	2.2	1.7	0.9	44.3	1.0	44.4	42.8
Coffee	0	0	0	0	0	36.6	0.2	37.2	33.1
Raw materials	0.2	-7.0	2.6	-9.5	-22.8	50.8	0.3	51.7	45.6
Mining	0	50.0	0	50.0	50.0	50.0	0	50.0	50.0
Foodstuffs	0.5	-5.4	2.5	-8.2	-10.7	35.6	0.2	36.1	32.0
Urban goods	0.2	2.5	0.3	2.3	1.9	47.8	-0.1	47.8	46.6
Real Incomes									
Rural workers	-0.4	1.3	-1.4	2.9	4.4	-5.4	0.2	-5.1	-6.5
Peasants	0.2	-7.8	1.8	-10.2	-13.7	-4.6	0.2	-4.3	-5.7
Rural renters	0.4	-10.6	2.8	-13.9	-18.4	-6.5	0.3	-6.2	-8.0
Urban workers	-0.1	-4.7	1.1	-6.1	-6.0	0.4	0.4	-0.4	-0.3
Capitalists	1.9	-2.9	2.5	-5.7	-6.4	9.3	-0.7	9.3	11.0
Coffee Rents	0	0	0	0	0	-66.2	-0.4	-67.2	-59.9

Table 4 (contd.)

DESCRIPTION OF CASES:

Short run:

1. The world price of oil increases 50%, no policy response.
2. Both world and domestic oil prices increase 50%.
3. Only the world price increases and the government collects the extra earnings by imposing a tax of 50% on oil exports, whose proceeds go to finance additional public investments.
4. Both world and domestic oil prices increase and the government reduces its investment expenditure by an amount equivalent to the extra export earnings.
5. Both world and domestic oil prices increase and the government liberalize imports by an amount equivalent to the extra export earnings.

Long run:

1A. The world price of oil increases 50% and there is no policy response. Since the price paid to the producers is endogenous in the long run, cases 1 and 2 for the short run converge in this case in the long run.
3A. Oil exports taxed as in case 3.
4A. Compensatory fiscal policy by the same amount of case 4 takes now place by reducing the level of the public deficit, that is endogenous in the long run.
5A. Import liberalization as in case 5.

not be expanded in the short run. Case 3 shows that the government can do much better by imposing a tax on oil exports in order to finance public investment. As in the case of coffee, this type of policy encourages production in the urban and even in the mining sectors in the short run, while preventing major relative price changes and redistribution effects. Whether this type of policy is sustainable in the long run is yet to be discussed.

The four remaining experiments for the short run in the case of oil show the degree of efficacy of alternative stabilization policies. Assuming that both internal and world oil prices have increased by 50%, experiment 4 assesses the effects of a fiscal compensatory policy aimed at maintaining the monetary base unchanged. In order to achieve this, public investment is cut by an amount equivalent to the increase in nominal exports. Inflation in the domestic market is effectively controlled in this way, with raw materials and foodstuffs prices making room for the increased prices of mining and urban goods. The cost of this achievement is deep economic depression (-5.6% GDP growth), especially in the urban and mining sectors (-8.6% and -16.1%). Furthermore, this type of policy reinforces the effects that the increase of domestic oil prices is bound to have on income distribution and living standards. No more encouraging is an import liberalization aimed at monetary stabilization (experiment 5). Essentially, all the previous effects are further enhanced by this policy.

A number of conclusions can be drawn at this point. Given the institutional framework regulating coffee and mining activities in Colombia, external shocks are not intrinsically destabilizing in the short run. Rents resulting from external price increases accrue either to the government or to other economic agents whose expenditure propensities are very low in the short run. Need for stabilization arises when external price increases are transferred to the domestic prices of the goods affected. In the case of coffee, higher inflation rates become the major area of concern. Although inflationary pressures may also appear, economic depression is the most worrying effect in the event of a similar increase in the domestic price of oil. Standard short run stabilization rules are poor guides in any of these two cases. Should the domestic price of coffee have been increased, monetary stabilization ensues recession without defeating inflationary pressures. More effective price stabilization can be achieved by similar means when the shock occurs in the oil sector, but only at the cost of further economic depression and drastic income redistribution. Regardless of the origin of the shock, better results are obtained in either case by transferring the additional external proceeds to the government in order to finance extra investments. But is this sustainable in the long run?

As already mentioned, both coffee and oil domestic prices are necessarily endogenous in the long run. In the case of coffee, unless the government is prepared to finance massive stock accumulation continuously, it must fix its domestic price in order to accommodate supply to the existing demands. As shown in case 1A of Table 3, substantial domestic coffee price increases are thus a temporary phenomenon. As a result, let to themselves, coffee bonanzas have moderate effects in the long run. Since no substantial relative price changes are ensued by it, real disposable incomes of all social groups tend to remain unchanged, or to return to their original levels had the domestic price of coffee been temporarily increased. Interestingly enough, however, coffee bonanzas do cause negative effects in the mining sector. Experiment 1A shows a decline of 8.1% in mining production and 69.3% in mining exports in the long run, while those of other sector remain virtually unchanged. This merely reflects the fact that mining is the only sector where the law of one price holds. Exports have to decline to bring the trade balance back to its long run equilibrium level [11]/. Finally, it should be noticed that in the long run, a coffee bonanza is a source of finance to the public sector. According to our simulation results, a 50% increase in the external price of coffee allows the government to increase public real investment in 28.8% without any damaging effect in private investment or production [12]/. It must be remembered that this result is based on the assumption that the government faces a financial constraint in the long run of the same size of its net borrowing requirement before the coffee shock. We saw above that transferring the external coffee rents to the government in order to expand public investment was a better strategy in the short run than increasing the domestic price of coffee and simultaneously pursuing stabilization policies. We have now seen that this is sustainable in the long run.

As cases 4A and 5A show, the combination of higher domestic coffee prices and stabilization policies dissolves in long run situations that are very similar to that resulting from no policy intervention. This, of course, implies that major changes have to take place over the medium run in order to offset most of the short run effects produced by such a combination of policies.

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[11]/ This assumes that the economy was in long run equilibrium before the shock. If the trade surplus sustainable in the long run is larger than it originally was, mining will be less affected.

[12]/ This model does not take into account the effect of investment on capital accumulation and productivity. Were it considered, private production would be substantially boosted in the long run.

When fiscal compensation is pursued (case 4A), economic growth recuperates in the long run, but reaching a level slightly inferior to that of the previous scenario. The level of inflation remains virtually unchanged between the short and the long run, but individual prices change dramatically, thus affecting income distribution. However, in relation to the previous long run scenario, investment is the only area of economic activity where changes are really substantial. Although public investment eventually picks up, it is private investment which shows the larger increase (22%).

In the long run, import liberalization (case 5A) is less damaging for the mining sector than either of the two previous strategies. Import liberalization also helps to reduce inflationary pressures over the long run by punishing all rural social classes. Finally, and somewhat surprisingly, a policy of import liberalization has virtually no effect on private investment, while boosting public investment more than any of the previous strategies (35.4% increase).

Unlike the case of coffee, an oil shock tends to affect the domestic price of mining products by the same proportion in the long run. Given the insatiable external demand for energy, the domestic market can only be properly supplied by offering the producers identical returns on both markets. But higher oil prices attract capital and labour until their respective returns are also the same in all sectors using those factors of production. This is why an oil shock, let to itself, has much stronger economic effects than a similar coffee shock over the long run. Experiment 1A in Table 4 shows that domestic price increases are much bigger in the long than in the short run (44.3% vs 2.4%), even those of agricultural commodities using "urban" capital and labour only in very small proportions. Free from transport bottlenecks and other rigidities, the pattern of production and exports also tends to change substantially in favour of the mining activities in the long run. Since total production remains virtually unchanged, this occurs at the expense of the rest of the sectors. For the same reason, higher real incomes of capitalists have as counterpart reduced living standards of all rural classes.

Experiment 3A shows that most of these unwelcome effects can be effectively avoided by imposing a tax on oil exports of the same level of the external price increase. As a result, the volume of oil exports necessarily decrease, and so does its production. However, by doing this, all other exports and economic activities are at least maintained at their initial levels, inflation is kept totally under control and no important real income losses occur. Since the export tax is also stabilizing in the short run, these results show that it can be the appropriate response to an oil shock. However, attention must be paid to the fact that such a policy severely damages private

investment, which goes from a 46.3% increase in the previous scenario to -1% in the present one. Only part on this undesirable effect is compensated by a larger increase in public investment (which goes up from 1.9% to 12.1%).

Experiments 4A and 5A of Table 4 assess the long run effects of stabilization policies likely to be adopted in order to compensate the effects of the increase of the domestic price of oil in the short run. As in the case of coffee, these stabilization policies make no important differences in the long run, apart from the volume and composition of investment. When fiscal compensation is adopted, public investment is crowded out in favour of private investment, which now increases more than 60%. When import liberalization is pursued, both private and public investment increase substantially in absolute terms and with respect to the no-stabilization case, which makes an important difference in relation to a coffee shock. Attractive as it may be, in the long run import liberalization enhances production and export concentration in the mining activities and deepens the welfare losses of all social classes, except the capitalist.

VI. FINAL REMARKS

Coffee and oil shocks are essentially different in nature both in the short and in the long run. Given the institutional structure in which these two productions take place in Colombia, external shocks have little initial impact in either case. Unwelcome effects arise in the short run when the government transfers the external price increase to the domestic prices of these goods. When this occurs, differences between both sectors start to surface. Domestic price increases in the case of coffee give origin to inflationary pressures while boosting production. In contrast, oil price increases cause no major inflationary problems but tend to depress economic activity.

In the long run differences between the two become more important. Coffee bonanzas are essentially short-lived as far as their spontaneous repercussions are concerned, because limited external demand compels the domestic price of coffee to go back to its original level. This prevents major relative price and income distribution changes, unless the government is prepared to finance continuous stock accumulation. Oil shocks have much stronger and pervading effects in the long run because external demand is insatiable. Let to itself, an oil shock tends to increase all domestic prices and to reduce all non-oil sectors of production until wages and capital earnings equilibrate across sectors. This, in turn, brings about sweeping changes in the pattern of income distribution, mainly benefitting capitalists at the expense of the rest of society.

Standard stabilization policies can not deal with any of these effects either in the short or in the long run. In the short run, attempts to stabilize the monetary base in the face of an increase in the domestic price of coffee are unable to restrain price increases, while causing economic recession. No more effective are these policies to deal with the undesired effects of an oil shock once its domestic price has been increased, because they tend to deepen economic depression.

Over the long run the effects of stabilization policies tend to fade away becuase resource reallocation, relative price changes and income redistribution can not be prevented by them. However, the choice of stabilization policies is not entirely inconsequential, not even in the case of coffee, where all those resource reallocation effects tend to be very moderate. In fact, real investment size and composition can both be affected by the choice of policies. In comparison to the situation without policy changes after the coffee shock, a policy of fiscal restraint favours private investment at the expense of public investment, while a policy of import liberalization boosts public investment leaving private investment virtually unchanged.

The choice of stabilization policies have more far reaching consequences in the long run in the event of an oil shock. As before, fiscal restraint crowds out public investment in favour of private investment, but now import liberalization increases both private and public investment in relation to the case without policy responses. However, resource concentration in mining activities and income redistribution in favour of the capitalist are both enhanced by import liberalization policies.

Finally, it is worth stressing that export taxes can be used as an stabilization policy in the short run and maintained in the long run in the event of an oil shock, but not in the case of a coffee shock, where export rents accruing to the government are endogenous to the volume of exports. This policy is an effective means of avoiding price changes and resource shifts resulting from an oil shock. However, this can only be achieved at the cost of curtailing private investment in relation to any of the other alternatives, which obviously makes the choice of policy more difficult.

As our results make clear, coffee and oil shocks can not be dealt with in the same way. Coffee bonanzas are less pervading than oil shocks, because domestic resource reallocation is limited in the long run by world demand. Given this limitation, domestic price increases are short-lived in nature and stabilization policies rather limited in their effects. As a result, coffee bonanzas are more easily handled than oil shocks. Thus, the so much praised ability of Colombian economic authorities to mitigate the damaging effects of external shocks may prove deceiving in the event of an oil shock.

Appendix 1
COLOMBIA: SOCIAL ACCOUNTING MATRIX, 1985
(Col$ million)

A.1. Activity: Production. Stage: Combination of Domestic Inputs

	COFFEE-DI	RAWMAT-DI	MINING-DI	FOODST-DI	INDUST-DI	GOVERN-DI
COFFEE-DO	156821					
RAWMAT-TO	6	3870		3368	3140	2591
MINING-TO	1858	824	66946	41889	38803	218
FOODST-TO		26		7690	123387	1763
INDUST-TO	39242	23883	61685	446212	117149	28432
				171713	1271453	86210

A.2. Activity: Production. Stage: Imported Inputs Mixed

+	COFFEE-II	RAWMAT-II	MINING-II	FOODST-II	INDUST-II	GOVERN-II
COFFEE-DI	197927					
RAWMAT-DI		28603				
MINING-DI			128631			
FOODST-DI				670872		
INDUST-DI					1553932	
GOVERN-DI						119214
INPUTS-IM	714	2101	34921	44673	429015	7384

A.3. Activity: Production. Stage: Value Added

+	COFFEE-AC	RAWMAT-AC	MINING-AC	FOODST-AC	INDUST-AC	GOVERN-AC
COFFEE-II	198641					
RAWMAT-II		30704				
MINING-II			163552			
FOODST-II				715545		
INDUST-II					1982947	
GOVERN-II						126598
SURPCO-FA	56312					
SURPRA-FA		75926				
SURPFO-FA				567755		
RURALW-FA	83326	43549		195024		
URBANW-FA	11844		34110	50427	1349916	417280
CAPITA-FA					1335658	
MINING-FA			174809			
GOVERN-FA						-6804

A.4. Activity: Production. Stage: Payment of Indirect Taxes

+	COFFEE-DO	RAWMAT-DO	MINING-DO	FOODST-DO	INDUST-DO	GOVERN-DO
COFFEE-AC	172419					
RAWMAT-AC		99763				
MINING-AC			214478			
FOODST-AC				1503786		
INDUST-AC					4492112	
GOVERN-AC						537074
INDIRE-TA		-5274	13056	8246	266567	4835

A.5. Activity: Production. Stage: Domestic and Imported Final Goods Mixed

+	RAWMAT-TO	MINING-TO	FOODST-TO	INDUST-TO	GOVERN-TO	INVEST-TO
RAWMAT-DO	94489					
MINING-DO		227535				
FOODST-DO			1512032			
INDUST-DO				4063211	374750	320718
RAWMAT-IM	695					
MINING-IM		13297				
FOODST-IM			19150			
INDUST-IM				92429		
GOVERN-IM					81110	
INVEST-IM						87633

B.1. Activity: Income. Stage: Distribution of Primary Incomes

+	SURPCO-FA	SURPRA-FA	SURPFO-FA	RURALW-FA	URBANW-FA	CAPITA-FA
RURALW-YN				321899		
PEASAN-YN	17906	15329	80215			
RENTIE-YN	23669	60597	316144			
URBANW-IN					1863577	
CAPITA-IN	14737		171396			743642
URBANE-IN						662504
GOVERN-IN						-10514

+	MINING-FA	GOVERN-FA
MINING-IN	174809	
GOVERN-IN		-6804

B.2. Activity: Income. Stage: Payment of Exogenous Transfers

+	URBANW-IN	CAPITA-IN	URBANE-IN	MINING-IN	GOVERN-IN
SERVIC-RO	12665	20208	134278	42404	36355
URBANW-YN	1970870				
CAPITA-YN		1406435			
URBANE-YN			793756		
MINING-YN				494976	
GOVERN-CO					531264
GOVERN-TR					176154
GOVERN-SA					131472

B.3. Activity: Income. Stage: Income Assignment

+	RURALW-YN	PEASAN-YN	RENTIE-YN	URBANW-YN	CAPITA-YN	URBANE-YN
URBANW-IN						
CAPITA-IN						
URBANE-IN						284007
MINING-IN					143571	
DIRECT-TA					45338	309591
OTHER--TA			1346	33994	21039	65523
RURALW-CO	291144			126536	63131	44370
PEASAN-CO		110055				
RENTIE-CO			294376			
URBANW-CO				1769265		
CAPITA-CO					960548	
SAVING-IN	30756	3395	104687	41075	172808	90265

+	MINING-YN	GOVERN-TR	SERVIC-RO
URBANW-IN		117111	2846
CAPITA-IN	89686	58429	64747
URBANE-IN	97766	13628	10566
MINING-IN		4304	3336
GOVERN-IN			2462
DIRECT-TA	20691		
OTHER--TA	14011	-17318	
SAVING-IN	272822		

B.4. Activity: Income. Stage: Consumption

+	RURALW-CO	PEASAN-CO	RENTIE-CO	URBANW-CO	CAPITA-CO	GOVERN-CO
COFFEE-DO	1094	386	1356	6152	3850	
RAWMAT-TO	585	206	725	3289	2058	
MINING-TO	2298	714	3092	21970	13590	
FOODST-TO	148898	65754	103195	418520	124412	
INDUST-TO	137462	42711	185004	1314361	813061	
GOVERN-DO	807	284	1004	4973	3577	531264

C. Activity: Exports.

+	COFFEE-EX	RAWMAT-EX	MINING-EX	FOODST-EX	INDUST-EX
COFFEE-AC	177704				
RAWMAT-AC		50416			
MINING-AC			157993		
FOODST-AC				24965	
INDUST-AC					176409
COFFEE-TA	98191				
MINING-FA			1		
SUBSID-TA		-1	-1	-1	-1

+	TRADEB-RO
COFFEE-EX	275895
RAWMAT-EX	50416
MINING-EX	157993
FOODST-EX	24965
INDUST-EX	176409

D.1. Activity: Imports. Stage: Duties Levied on Imports at CIF value

+	INPUTS-PM	RAWMAT-PM	MINING-PM	FOODST-PM	INDUST-PM	GOVERN-PM
TRADEB-RO	403699	489	9353	13469	65011	78297
DUTIES-TA	73568	132	2524	3634	17541	

+	INVEST-PM
TRADEB-RO	51674
DUTIES-TA	33758

D.2. Activity: Imports. Stage: Commercialization

+	INPUTS-IM	RAWMAT-IM	MINING-IM	FOODST-IM	INDUST-IM	GOVERN-IM
INPUTS-PM	477267					
RAWMAT-PM		621				
MINING-PM			11877			
FOODST-PM				17103		
INDUST-PM					82552	
GOVERN-PM						78297
CAPITA-FA	41541	74	1421	2046	9877	2813

+	INVEST-IM
INVEST-PM	85432
CAPITA-FA	2201

E. Activity: Investment

+	INVENT-CO	INVEST-CO	GOVERN-SI
COFFEE-DO	-6339		
RAWMAT-TO	-11503	15034	
MINING-TO	-3300		
FOODST-TO	78589		
INDUST-TO	8855		
INVEST-TO		408353	
GOVERN-TO			455860

F. Activity: Transfer of Taxes to Government

+	INDIRE-TA	DIRECT-TA	DUTIES-TA	OTHER--TA	COFFEE-TA	SUBSID-TA
GOVERN-IN	287430	142593	131156	230730	98191	-4

G. Activity: Saving-Investment (Closure Accounts)

+	GOVERN-SA
GOVERN-SI	455860
SAVING-IN	-324388

+	SAVING-IN
TRADEB-RO	63686
SERVIC-RO	-161953
INVEST-CO	423387
INVENT-CO	66302

NOTE: The following accounts change in the long-run model:
SURPCO-FA, SURPRA-FA and SURPFO-FA become RURALC-FA
CAPITA-FA and MINING-FA become CAPITA-FA

Appendix 2

COLOMBIA: SPECIFICATION TABLE FOR THE SHORT RUN CGE MODEL

A.1. Activity: Production. Stage: Combination of Domestic Inputs

	COFFEE-DI	RAWMAT-DI	MINING-DI	FOODST-DI	INDUST-DI	GOVERN-DI
COFFEE-DO	IO					
RAWMAT-TO	IO	IO		IO	IO	IO
MINING-TO	IO	IO	IO	IO	IO	IO
FOODST-TO		IO		IO	IO	IO
INDUST-TO	IO	IO	IO	IO	IO	IO

A.2. Activity: Production. Stage: Imported Inputs Mixed

+	COFFEE-II	RAWMAT-II	MINING-II	FOODST-II	INDUST-II	GOVERN-II
COFFEE-DI	CES					
RAWMAT-DI		CES				
MINING-DI			CES			
FOODST-DI				CES		
INDUST-DI					CES	
GOVERN-DI						CES
INPUTS-IM	CES	CES	CES	CES	CES	CES

A.3. Activity: Production. Stage: Value Added

+	COFFEE-AC	RAWMAT-AC	MINING-AC	FOODST-AC	INDUST-AC	GOVERN-AC
COFFEE-II	IO					
RAWMAT-II		IO				
MINING-II			IO			
FOODST-II				IO		
INDUST-II					IO	
GOVERN-II						IO
SURPCO-FA	RENT					
SURPRA-FA		RENT				
SURPFO-FA				RENT		
RURALW-FA	IO	IO		IO		
URBANW-FA	IO		IO	IO	IO	IO
CAPITA-FA					MARKUP	
MINING-FA			RENT			
GOVERN-FA						RENT

A.4. Activity: Production. Stage: Payment of Indirect Taxes

+ COFFEE-DO RAWMAT-DO MINING-DO FOODST-DO INDUST-DO GOVERN-DO

COFFEE-AC	IO					
RAWMAT-AC		CET				
MINING-AC			IO			
FOODST-AC				CET		
INDUST-AC					IO	
GOVERN-AC						IO
INDIRE-TA		ITAX	ITAX	ITAX	ITAX	ITAX

A.5. Activity: Production. Stage: Domestic and Imported Final Goods Mixed

+ RAWMAT-TO MINING-TO FOODST-TO INDUST-TO GOVERN-TO INVEST-TO

RAWMAT-DO	CES					
MINING-DO		CES				
FOODST-DO			CES			
INDUST-DO				CES	CES	CES
RAWMAT-IM	CES					
MINING-IM		CES				
FOODST-IM			CES			
INDUST-IM				CES		
GOVERN-IM					CES	
INVEST-IM						CES

B.1. Activity: Income. Stage: Distribution of Primary Incomes

+ SURPCO-FA SURPRA-FA SURPFO-FA RURALW-FA URBANW-FA CAPITA-FA

RURALW-YN				IDIST		
PEASAN-YN	IDIST	IDIST	IDIST			
RENTIE-YN	IDIST	IDIST	IDIST			
URBANW-IN					IDIST	
CAPITA-IN	IDIST		IDIST			IDIST
URBANE-IN						IDIST
GOVERN-IN						IDIST

+ MINING-FA GOVERN-FA

MINING-IN	IDIST	
GOVERN-IN		IDIST

B.2. Activity: Income. Stage: Payment of Exogenous Transfers

+	URBANW-IN	CAPITA-IN	URBANE-IN	MINING-IN	GOVERN-IN
SERVIC-RO	FEXOT	FEXOT	FEXOT	FEXOT	FEXOT
URBANW-YN	UNSPEC				
CAPITA-YN		UNSPEC			
URBANE-YN			UNSPEC		
MINING-YN				UNSPEC	
GOVERN-CO					UNSPEC
GOVERN-TR					TEXO
GOVERN-SA					UNSPEC

B.3. Activity: Income. Stage: Income Assignment

+	RURALW-YN	PEASAN-YN	RENTIE-YN	URBANW-YN	CAPITA-YN	URBANE-YN
URBANW-IN						
CAPITA-IN						
URBANE-IN						IDIST
MINING-IN					IDIST	
DIRECT-TA					IDIST	IDIST
OTHER--TA			DTAX	DTAX	DTAX	DTAX
RURALW-CO	IDIST			IDIST	IDIST	IDIST
PEASAN-CO		IDIST				
RENTIE-CO			IDIST			
URBANW-CO				IDIST		
CAPITA-CO					IDIST	
SAVING-IN	IDIST	IDIST	IDIST	IDIST	IDIST	IDIST

+	MINING-YN	GOVERN-TR	SERVIC-RO
URBANW-IN		IDIST	FEXOF
CAPITA-IN	IDIST	IDIST	FEXOF
URBANE-IN	IDIST	IDIST	FEXOF
MINING-IN		IDIST	FEXOF
GOVERN-IN			FEXOF
DIRECT-TA	DTAX		
OTHER--TA	IDIST	IDIST	
SAVING-IN	IDIST		

B.4. Activity: Income. Stage: Consumption

+	RURALW-CO	PEASAN-CO	RENTIE-CO	URBANW-CO	CAPITA-CO	GOVERN-CO
COFFEE-DO	LES	LES	LES	LES	LES	
RAWMAT-TO	LES	LES	LES	LES	LES	
MINING-TO	LES	LES	LES	LES	LES	
FOODST-TO	LES	LES	LES	LES	LES	
INDUST-TO	LES	LES	LES	LES	LES	
GOVERN-DO	LES	LES	LES	LES	LES	VSHR

C. Activity: Export

+	COFFEE-EX	RAWMAT-EX	MINING-EX	FOODST-EX	INDUST-EX
COFFEE-AC	IO				
RAWMAT-AC		CET			
MINING-AC			IO		
FOODST-AC				CET	
INDUST-AC					IO
COFFEE-TA	RENT				
MINING-FA			RENT		
SUBSID-TA		ITAX	ITAX	ITAX	ITAX

+	TRADEB-RO
COFFEE-EX	EXP0
RAWMAT-EX	EXPINF
MINING-EX	EXPINF
FOODST-EX	EXPINF
INDUST-EX	EXPORT

D.1. Activity: Import. Stage: Duties Levied on Imports at CIF Value

+	INPUTS-PM	RAWMAT-PM	MINING-PM	FOODST-PM	INDUST-PM	GOVERN-PM
TRADEB-RO	IMPORT	IMPORT	IMPORT	IMPORT	IMPORT	IMPORT
DUTIES-TA	ITAX	ITAX	ITAX	ITAX	ITAX	

+	INVEST-PM
TRADEB-RO	IMPORT
DUTIES-TA	ITAX

D.2. Activity: Imports. Stage: Commercialization

+	INPUTS-IM	RAWMAT-IM	MINING-IM	FOODST-IM	INDUST-IM	GOVERN-IM
INPUTS-PM	IO					
RAWMAT-PM		IO				
MINING-PM			IO			
FOODST-PM				IO		
INDUST-PM					IO	
GOVERN-PM						IO
CAPITA-FA	MARKUP	MARKUP	MARKUP	MARKUP	MARKUP	MARKUP

+	INVEST-IM
INVEST-PM	IO
CAPITA-FA	MARKUP

E. Activity: Investment

+	INVENT-CO	INVEST-CO	GOVERN-SI
COFFEE-DO	DQEXO		
RAWMAT-TO	DQEXO	VSHR	
MINING-TO	DQEXO		
FOODST-TO	DQEXO		
INDUST-TO	DQEXO		
INVEST-TO		VSHR	
GOVERN-TO			VSHR

F. Activity: Transfer of Taxes to Government

+	INDIRE-TA	DIRECT-TA	DUTIES-TA	OTHER--TA	COFFEE-TA	SUBSID-TA
GOVERN-IN	IDIST	IDIST	IDIST	IDIST	IDIST	IDIST

G. Activity: Saving-Investment (Closure Accounts)

+	GOVERN-SA
GOVERN-SI	UNSPEC
SAVING-IN	UNSPEC

+	SAVING-IN
TRADEB-RO	UNSPEC
SERVIC-RO	UNSPEC
INVEST-CO	UNSPEC
INVENT-CO	UNSPEC

NOTES:
1. Acronyms are defined in Appendix 4.
2. The following accounts change in the long-run model:
   SURPCO-FA, SURPRA-FA and SURPFO-FA become RURALC-FA
   CAPITA-FA and MINING-FA become CAPITA-FA

Appendix 3

COLOMBIA: SPECIFICATION TABLE FOR THE LONG RUN CGE MODEL

A.1. Activity: Production. Stage: Combination of Domestic Inputs

	COFFEE-DI	RAWMAT-DI	MINING-DI	FOODST-DI	INDUST-DI	GOVERN-DI
COFFEE-DO	IO			IO	IO	IO
RAWMAT-TO	IO	IO		IO	IO	IO
MINING-TO	IO	IO	IO	IO	IO	IO
FOODST-TO		IO		IO	IO	IO
INDUST-TO	IO	IO	IO	IO	IO	IO

A.2. Activity: Production. Stage: Imported Inputs Mixed

+	COFFEE-II	RAWMAT-II	MINING-II	FOODST-II	INDUST-II	GOVERN-II
COFFEE-DI	CES					
RAWMAT-DI		CES				
MINING-DI			CES			
FOODST-DI				CES		
INDUST-DI					CES	
GOVERN-DI						CES
INPUTS-IM	CES	CES	CES	CES	CES	CES

A.3. Activity: Production. Stage: Value Added

+	COFFEE-AC	RAWMAT-AC	MINING-AC	FOODST-AC	INDUST-AC	GOVERN-AC
COFFEE-II	CD					
RAWMAT-II		CD				
MINING-II			CD			
FOODST-II				CD		
INDUST-II					CD	
GOVERN-II						IO
RURALC-FA	CD	CD		CD		
RURALW-FA	CD	CD		CD		
URBANW-FA	CD		CD	CD	CD	IO
CAPITA-FA			CD		CD	
GOVERN-FA						RENT

B.2. Activity: Income. Stage: Payment of Exogenous Transfers

+	URBANW-IN	CAPITA-IN	URBANE-IN	MINING-IN	GOVERN-IN
SERVIC-RO	FEXOT	FEXOT	FEXOT	FEXOT	FEXOT
URBANW-YN	UNSPEC				
CAPITA-YN		UNSPEC			
URBANE-YN			UNSPEC		
MINING-YN				UNSPEC	
GOVERN-CO					UNSPEC
GOVERN-TR					TEXO
GOVERN-SA					UNSPEC

B.3. Activity: Income. Stage: Income Assignment

+	RURALW-YN	PEASAN-YN	RENTIE-YN	URBANW-YN	CAPITA-YN	URBANE-YN
URBANW-IN						
CAPITA-IN						IDIST
URBANE-IN					IDIST	
MINING-IN					IDIST	IDIST
DIRECT-TA			DTAX	DTAX	DTAX	DTAX
OTHER--TA				IDIST	IDIST	IDIST
RURALW-CO	IDIST					
PEASAN-CO		IDIST				
RENTIE-CO			IDIST			
URBANW-CO				IDIST		
CAPITA-CO					IDIST	
SAVING-IN	IDIST	IDIST	IDIST	IDIST	IDIST	IDIST

+	MINING-YN	GOVERN-TR	SERVIC-RO
URBANW-IN		IDIST	FEXOF
CAPITA-IN	IDIST	IDIST	FEXOF
URBANE-IN	IDIST	IDIST	FEXOF
MINING-IN		IDIST	FEXOF
GOVERN-IN			FEXOF
DIRECT-TA	DTAX		
OTHER--TA	IDIST	IDIST	
SAVING-IN	IDIST		

B.4. Activity: Income. Stage: Consumption

+	RURALW-CO	PEASAN-CO	RENTIE-CO	URBANW-CO	CAPITA-CO	GOVERN-CO
COFFEE-DO	LES	LES	LES	LES	LES	
RAWMAT-TO	LES	LES	LES	LES	LES	
MINING-TO	LES	LES	LES	LES	LES	
FOODST-TO	LES	LES	LES	LES	LES	
INDUST-TO	LES	LES	LES	LES	LES	
GOVERN-DO	LES	LES	LES	LES	LES	VSHR

E. Activity: Investment

+	INVENT-CO	INVEST-CO	GOVERN-SI
COFFEE-DO	DQEXO		
RAWMAT-TO	DQEXO	VSHR	
MINING-TO	DQEXO		
FOODST-TO	DQEXO		
INDUST-TO	DQEXO		
INVEST-TO		VSHR	
GOVERN-TO			VSHR

F. Activity: Transfer of Taxes to Government

+	INDIRE-TA	DIRECT-TA	DUTIES-TA	OTHER--TA	COFFEE-TA	SUBSID-TA
GOVERN-IN	IDIST	IDIST	IDIST	IDIST	IDIST	IDIST

G. Activity: Saving-Investment (Closure Accounts)

+	GOVERN-SA
GOVERN-SI	UNSPEC
SAVING-IN	TEXO

+	SAVING-IN
TRADEB-RO	TEXO
SERVIC-RO	UNSPEC
INVEST-CO	UNSPEC
INVENT-CO	UNSPEC

NOTES:
1. Acronyms are defined in Appendix 4.
2. The following accounts differ from the short-run model:
   RURALC-FA is an aggregation of SURPCO-FA, SURPRA-FA and SURPFO-FA;
   CAPITA-FA is an aggregation of MINING-FA and CAPITA-FA.

Appendix 4
SPECIFICATIONS USED IN THE MODELS [1/]

CD - Cobb-Douglas Production Function

The use of inputs takes place in fixed value shares resulting from the first order optimality conditions of a function of the form

$$\log Q(j) = \text{SUM}(i, A(i,j) * \log F(i))$$

where Q(j) is the volume of production of good j, A(i,j) is the marginal productivity of factor i in the production of good j and F(i) are the factors of production.

The equations used for each cell are of the type

$$TSOL(i,j) = A(i,j) * YSOL(j)$$

where YSOL(j) is the gross production value of good j (i.e. the total of the column).

CES - Constant Elasticity of Substitution

The use of inputs in a production function takes place in value shares that depend on their relative prices according to the first order optimality conditions of a function of the form

$$\log Q(j) = -(1/SIGMA(j)) * \log(\text{SUM}(i, A(i,j) * F(i) ** (-SIGMA(j))))$$

where SIGMA(j) is the elasticity of substitution.

The equations for each cell are

$$TSOL(i,j) = A(i,j) * YSOL(j) * (PSOL(i)/PSOL(j)) ** (1-SIGMA(j))$$

where PSOL(i) and PSOL(j) are the prices of input i and the good being produced.

CET - Constant Elasticity of Transformation

The production of different goods out of a single input takes place in value shares that depend on their relative prices according to the first order optimality conditions of a function

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[1/] Based on Drud and Kendrick (1986).

analogous to a CES production function. The equation for each cell are thus

```
TSOL(i,j) = B(i,j) * YSOL(i) * (PSOL(i)/PSOL(j)) ** (1-SIGMAR(i))
```

where B(i,j) are the base shares, YSOL(i) is the gross production value of the good being input, PSOL(i) its price, PSOL(j) is that of the different outputs and SIGMAR(i) is the elasticity of substitution.

DQEXO - Change in Exogenous Quantity

The change of inventories of good i is exogenous in quantity terms according to the parameter FV, so that the equation for the corresponding cell is

```
TSOL(i,j) = FV(i,j) * PSOL(i)
```

DTAX - Direct Tax

A direct tax is levied at a tax rate THETA(i,j) defined as a percentage of post-tax income. Hence, the equation for the corresponding cell is

```
TSOL(i,j) = THETA(i,j) / (1+THETA(i,j)) * YSOL(j)
```

where YSOL(j) is total pre-tax income.

EXPORT - Export Demand Function

This specification assumes that export demand from the rest of the world depends on the price of the goods to be exported, PSOL(i), relative to those of the world market, WP(i,j) converted to domestic currency by the exchange rate PSOL(j). Hence the export value in the cell is given by

```
TSOL(i,j) = PSOL(i) * FQ(i,j) *
            (WP(i,j) * PSOL(j) / PSOL(i))**ETA(i,j)
```

where FQ(i,j) is the base quantity exported and ETA(i,j) is the elasticity of demand.

EXP0 is a special case of EXPORT, where ETA is zero, so that the export value becomes

```
TSOL(i,j) = PSOL(i) * FQ(i,j)
```

EXPINF is another special case of EXPORT, where ETA is infinite

and the transaction takes place at the world price of the good converted to domestic currency,

$$TSOL(i,j) = WP(i,j) * PSOL(j) * QCSOL(i,j)$$

where QCSOL(i,j) is the volume of exports that has to be determined by a supply function elsewhere in the model.

FEXOF and FEXOT - Exogenous Payments From or To Abroad

The payment in foreign currency, FV(i,j), is exogenous. Therefore the value of the cell is given by

$$TSOL(i,j) = FV(i,j) * PSOL(j)$$

where PSOL(j) is the exchange rate.

IDIST - Distribution of Income in Fixed Proportions

The total income of the account, YSOL(j), is distributed to the cells in the column in fixed proportions given by A(i,j). Therefore, the value of the cell is

$$TSOL(i,j) = A(i,j) * YSOL(j)$$

IMPORT - Import Supply Function

The supply of foreign goods is assumed to be perfectly elastic. Therefore, the value of each import results from its world price, WP(i,j), the exchange rate, PSOL(i) and the quantity of imports (determined elsewhere) that is measured as the product of a quantity based on prices of imports inclusive of import duties, (YSOL(j)/PSOL(j)), properly corrected by a factor AO(i,j) that takes into account the duties of the base period,

$$TSOL(i,j) = (WP(i,j)*PSOL(i)) * (YSOL(j)/PSOL(j)) * AO(i,j)$$

IO - Input-Output Production Function

The use on inputs take place in fixed physical ratios, therefore the value of each cell is given by

$$TSOL(i,j) = A(i,j) * YSOL(j) * PSOL(i)/PSOL(j)$$

where A(i,j) is the technical ratio (at base prices), YSOL(j) is the gross value of product j and PSOL(i) and PSOL(j) are the current prices of the input and the output, respectively.

ID - Indirect Tax

An indirect tax is levied at a fixed rate in the same manner of a direct tax rate.

LES - Linear Expenditure System

Consumption of each good is assumed to be made up of a committed quantity component independent of income, ALPHA(i,j), and a discretionary component proportional to the remaining income according to a proportionality factor BETA(i,j). Such system follows from the first order optimality conditions of a utility function of the form

$$U = SUM(i,\ BETA(i,j) * \log(\ QCSOL(i,j)-ALPHA(I,J))\ )$$

from where, the value consumed of each type of good i appearing in the cell is

$$TSOL(i,j) = ALPHA(i,j) * PSOL(i) + BETA(i,j) * (Y(j) - SUM(k,\ ALPHA(k,j)*P(k)))$$

where k are all the goods included in the system.

MARKUP - Mark-up Over and Above Costs

This type of payment is equivalent to a tax levied at a fixed rate on all other payments of the column, that presumably correspond to the total variable costs incurred in the production of the good. See DTAX.

RENT - Rent

A rent is a residual of the gross value of a product, YSOL(j) and the rest of the payments of the column.

UNSPEC - Residual Transaction

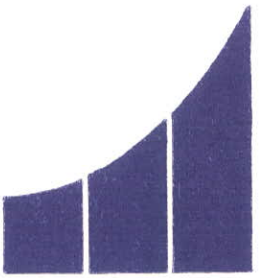
In this specification, the value of the cell is a residual between all other income and expenditures in the row and the column of the account.

VSHR - Consumption According to Fixed Value Shares

The value consumed of each good is a fixed proportion of total consumption. Hence

$$TSOL(i,j) = A(i,j) * YSOL(j)$$

where A(i,j) is the share and YSOL(j) is total consumption. This specification is consistent with a Cobb-Douglas utility function.



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