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Export Diversification as a
Counter to Export Instability:
The Example of Colombia

by

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Export Diversification as a Counter to Export Instability: The Example of Colombia

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Abstract

This paper examines the income and allocation effects of an appropriate export diversification policy by means of a computable general equilibrium model for Colombia. This kind of policy is often envisaged as a counter to unstable export earnings which are considered to be detrimental to economic growth. The results show that irrespective of the reduction of the costs of export instability an appropriate diversification of exports raises income in the Colombian economy.

Export Diversification as a Counter to Export Instability: The Example of Colombia

I. Introduction

The concentration on a few export goods which have highly volatile prices and proceeds is widely regarded as an important cause of export instability (see for example Massell (1970) and Knudsen and Parnes (1975)). Recently MacBean and Nguyen (1980) have pointed out that commodity concentration alone is not sufficient to cause high export fluctuations. The dispersion of the export earnings instability of a country's individual export commodities matters as well. In the above study it was shown, that the relationship between overall export earnings instability and commodity concentration is the higher the smaller the dispersion of the instability of individual export goods. Thus a country exporting mainly primary commodities could reduce its overall export instability by giving a greater weight to those commodities in its export bundle which exhibit a distinctly lower earnings instability than the traditional export goods.

This observation derived from a mathematical model, coincides with the result of an empirical study by Brundell, Horn and Svedberg (1981). In a cross section analysis of non-oil exporting countries the quantity of exports, degree of openness and the share of manufactures in total exports of a country were all found to be negatively correlated with the degree of instability of its export earnings. From this study it follows that diversification of exports does not necessarily lead to lower export instability, unless the share of manu-

factures in the export bundle is increased[1]. To put it more succinctly: the diversification of exports must be appropriate.

The purpose of this paper is to investigate the income and allocation effects of a long run economic policy which intends to achieve reduced export earnings instability by giving incentives for an appropriate export diversification. This kind of policy can be seen as a potential long-run solution of the instability problem while other measures like compensatory financing facilities could be justified on the grounds that they facilitate the adjustment process.

The approach of the present study is countryspecific, i.e. a rather typical raw commodity producing and exporting country, Colombia, is considered. This allows for a much more detailed analysis of the effects of appropriate diversification strategies than a multi-country analysis. Furthermore, the costs of export instability for Colombia have been previously estimated within the context of an economy-wide computable general equilibrium model (Mayer [1982]). In this study it was shown that an increase in export instability by (say) 10 per cent would induce a decrease in real domestic absorption in Colombia by about 0.6 per cent. Hence, from a comparison of results of the above and the present study conclusions can be drawn as to whether it is worthwhile for Colombia (and similar countries) to take measures against export instability or to bear the costs of instability.
The remainder of the paper is structured as follows: Section 2 presents some features of the Colombian economy and shows the relevance of the problem for this country. Section 3 develops the methodological approach and Section 4 discusses the results of the investigation. Section 5 contains some concluding remarks.

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[1] It is widely recognized that export earnings from manufactures are more stable than those from primary commodities. Hence an increase in the share of manufactures in total exports leads both to a decline in the commodity concentration of exports and to a wider dispersion of the degree of instability of the proceeds of individual export commodities.

II. Key Structural Features of the Colombian Economy in the Base Period of the Analysis

Table 1 shows the economic structure of the Colombian economy in the base period of the analysis. An interesting feature of the Colombian economy is its high export concentration in one product, coffee. As the international coffee market is highly volatile in price and quantity traded the country experiences a considerable degree of instability of overall export earnings[2]. Exports of manufactures have a share of 28.5 per cent in total exports. In the manufacturing sector, however, only the production of processed foods and textiles has an export potential[3]. Therefore, measures to increase the share of manufactures in total exports would have to concentrate on these items. As can bee seen from the structural breakdown of imports, "other manufactures" hold the biggest share. Industries producing these goods are mainly import competitive[4].

Given these structural features of the Colombian economy an appropriate export diversification policy would have to decrease the share of coffee and increase the share of processed foods and textiles in total exports. The Colombian government did follow this policy until the first oil price shock. However, the world economic downturn which followed curtailed the expansion of non-coffee exports.

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[2] As measured by the average deviation from an exponential trend in the time period 1955-1977 Colombia's total export earnings instability amounts to 25 per cent. In a sample of 146 countries 53 countries experienced higher and 82 countries less export earnings instability (UNCTAD [1979]).

[3] Imports of processed foods and textiles represent only 2.91 per cent of this industry's domestic output.

[4] Imports of "other manufactures" represent 36.2 per cent of this industry's domestic output.

Table 1 - Some Structural Features of the Colombian Economy[a] in the Base Period of the Analysis

Trade as percentage of GDP	14.7
Primary Factor Intensity	
Wage share of value added	0.46
Fixed capital share of value added	0.43
Land share to value added	0.11
Industrial Structure of the GDP	
Share of GDP accounted for by	
Coffee production	0.06
Other primary productions	0.26
Food processing	0.12
Textiles	0.04
Other manufactures	0.16
Services	0.36
Commodity Composition of Exports	
Percentage accounted for by	
Coffee	40.4
Other primary productions	17.9
Processed foods	6.9
Textiles	8.7
Other manufactures	12.9
Services	13.2
Commodity Composition of Imports	
Percentage accounted for by	
Primary commodities	7.9
Processed foods	4.9
Textiles	2.2
Other manufactures	70.9
Services	14.1

[a]Figures are obtained from the DANE 1973 input-output table in purchasers' prices.

III. Analytical Framework

Under conditions of free trade and an optimal allocation of factors a policy induced change in the structure of a country's exports leads always to a decline in its income. This is so, because the country is thereby forced to reduce specialization according to its comparative advantage and to move resources into other sectors where they exhibit a lower marginal product than before. However, most developing countries' economies suffer from a variety of price distortions in product and factor markets with the consequence that they can be expected to produce somewhat different from their optimum. Moreover, many primary commodity exporting countries can influence the world market price of their export commodity to some extent such that an analysis which relies upon the small country assumption may be misleading. Under these conditions (and internationally mobile factors) the income effect (measured as a percentage change of GDP) of an appropriate diversification policy is given by the weighted sum of three components: the induced percentage change of the terms of trade, the level of employment and a residual which - for the moment - is named "efficiency" gain or loss. No clear-cut answer, however, can be given from theoretical reasoning what the net effect of this policy would be. Therefore, only a quantitative analysis of the effects of such a policy in a concrete case can provide the answer.

In this study a computable general equilibrium model of the Johansen type, applied to Colombia is used as an instrument for analysis. Since Johansen's pioneering work (see Johansen [1960]) this kind of model has found increasing attention in quantitative economics. The common features of this group of models are their construction around an input-output system of accounts and their ability to endogenize both commodity and factor prices and quantities within an equilibrium process. The model used here has been developed and recently

presented by Dixon, Parmenter, Sutton and Vincent (1982). As a complete outline of the model would be beyond the scope of this paper, only a short description is given (see also Vincent [1981] for an application of the model to developing countries and Mayer [1982] for an application to Colombia).

Basically the model, applied to Colombia, distinguishes between a production side with six industries producing six commodities[5] and a demand side containing intermediate, export, consumption, government and investment demand. Imports are treated as imperfect substitutes with domestically produced commodities and exports are a function of the world market price of the respective export goods. Government and related demand categories are treated as exogenous to the model.

Industries produce according to a constant returns to scale (CRTS) production function of a three level or nested form. At the first level the Leontief assumption relates a unit of output to fixed amounts of intermediate commodities and the aggregate of primary factors. At the second level CES functions describe the substitution possibilities between imported and domestic sources of each commodity whereas CRESH functions describe the substitution possibilities between the three primary factors aggregate labour, fixed capital and agricultural land. Finally, at the third level, CES functions describe the substitution prospects between the two labour categories (unskilled and skilled) within aggregate labour. Demands for domestically produced and imported intermediates as well as for primary factors are derived by cost minimization subject to the production function. To achieve a given level of output producers demand primary factors such that marginal value products and factor prices are equated.

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[5] These are 1. Agriculture, 2. Mining, 3. Coffee, 4. Food processing and textiles, 5. Raw materials processing and manufacturing of investment goods, and 6. Services.

Capital creation in the producing sector takes place by cost minimization subject to a two level production function. At the first level "composite" (i.e. domestically produced and imported) commodities are combined in fixed proportions to create one unit of capital for an industry. At the second level CES functions allow for substitution between domestically produced and imported commodities of the same category.

The average household maximizes its utility from a consumption bundle of the six commodity input categories subject to CES functions describing substitution prospects in consumption between domestically produced and imported consumer goods and to an aggregate consumer budget constraint. The resultant consumer demand functions for domestically produced and imported commodities have as arguments aggregate expenditure, domestic and foreign own- und cross-prices, respectively.

The markets for commodities, primary factors and foreign exchange are cleared by equating supply and demand (consisting of intermediate, household and demand for capital creation) for domestic commodities and primary factors (i.e. labour, capital and land), and equating export receipts to import expenditures and the change in the trade balance (in foreign currency)[6].

A further comment concerns the allocation of investment. A given investment fund is distributed over all industries such that appropriately defined expected rates of return are equilibrated.

Equations (1) to (9) describe a "stylized" version of the model in general terms. No information is provided there about the specific structural form of the original model. Yet understanding of the original model will be facilitated by this abstraction.

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[6] While in the commodity and generally also in factor markets supply equals demand excess supply or demand may occur in the foreign exchange market unless balanced trade is assumed. This implies accommodating movements in the capital or foreign exchange account.

$$(1) \qquad Y_i = Y(F_{i1}, F_{i2}, F_{i3})$$

$$(2)\text{-}(4) \qquad dY_i/dF_{ij} = r_{ij}/P_i, \quad j = 1, 2, 3$$

$$(5) \qquad \sum_i P_i Y_i = ABS + TB$$

$$(6) \qquad TB = P^e X - P^m M$$

$$(7) \qquad M = M(ABS, P^m/P)$$

$$(8) \qquad X = X(P^e/P)$$

$$(9) \qquad \sum_i \alpha_i P_i = P = 1$$

Y_i stands for value added, F_{i1}, F_{i2}, F_{i3} for capital, labour and land respectively, r_{ij} for the real return to factors in industry i, ABS for real domestic absorption, TB for the trade balance, X for exports and M for imports and P, P^m, P^e for the domestic, import and export prices (the last two being in foreign currency).

Equation (1) describes the production function, equations (2)-(4) specify the condition for factor demands in the i-th industry. Equation (5) equates domestic supply to real domestic absorption and the trade balance. Note that the model has nothing to say on how real domestic absorption is distributed between consumption, investment and government demand. The relationship between these final demand categories must be specified exogenously. In the following it is assumed that base year shares of these demand categories in absorption are maintained. Equation (6) defines the trade balance; (7) describes imports as a function of real domestic absorption and the terms of trade. Equation (8) is the export function, and (9) fixes the numeraire[7].

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[7] As models of this type can only determine relative prices one price variable must be assumed exogenous. For ease of exposition in the "stylized" version the domestic price acts as the numeraire whereas in the original model the exchange rate is fixed.

The above model consists of nine equations and thirteen variables. Therefore, to solve the model for the endogenous variables, four variables must be assumed exogenous. First, land is treated as exogenous to the Colombian economy (hence rents on land are endogenous). Secondly, either employment will be assumed determined by demographic factors and thus exogenous to the model (with endogenous wages - henceforth called scenario 1), or real wages will be assumed fixed through institutional rigidities and thus exogenous to the model (with endogenous labour, which is supplied along a horizontal supply curve - henceforth called scenario 2). The alternative scenarios take into account possible different flexibilities of the labour market reacting to the export diversification policy. Scenario 1 depicts the full employment case while scenario 2 assumes a slack labour market. The actual behaviour of the Colombian labour market probably lies between these extremes.

Thirdly, real returns to capital are assumed to be determined by world market conditions (hence capital is endogenous and mobile internationally - not an unrealistic assumption for the Colombian case). Fourthly, the economy is assumed to face a balance of trade constraint such that export receipts must match import expenditures.

While assumption (1) always holds the other assumptions (especially mobile capital) are valid in the medium to long run. An export diversification policy, however, is also mainly a medium to long term strategy such that a model closure like the above seems adequate to simulate the effects of this policy.

In comparison with a solution of the "stylized version", solving the original model, which consists of more than 300 equations, is a non-trivial task. Therefore, Johansen's (1960) solution procedure is adopted. Equations are first

converted to linear form by logarithmic differentiation. The model may then be represented by

$$(10) \quad Ax = 0$$

where A is a nxm matrix of elasticities[8], x is the mx1 vector of percentage changes in the model's variables and n is the number of equations. After closing the model by assigning values to m-n exogenous components of x a solution of (10) is possible via

$$(11) \quad x_1 = A_1^{-1} A_2 x_2$$

where x_1 and x_2 are respectively the mx1 and (m-n)x1 vectors of endogenous and exogenous variables and A_1 and A_2 the corresponding segments of A[9].

IV. Assumptions for Simulation and Results

For the numerial computations it is assumed that the appropriate export diversification policy would aim at reducing coffee exports by 10 per cent and increasing exports of pro-

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[8] The elements of A represent functions of the various economic parameters governing for example import-domestic substitution, primary factor substitution, consumer demand and export demand behaviour and a set of coefficients representing various cost and sales shares. These latter coefficients, which depict the relative strengths of commodity - industry - primary factor linkages in the base year economy, are computed from the 1973 Colombian input-output table. Details of the source of information for the construction of A are given in the appendix.

[9] Alternatively a non-linear solution algorithm could be applied to the structural equations before differentiation. This method has the advantage of being free from "linearization-errors". However, computations are rather complicated and inflexible with respect to different settings of exogenous variables. As there is some evidence that the linearization errors of the Johansen-method are rather small for moderate exogenous shocks of this type of model, the linear solution algorithm was adopted in the present study (see also Dixon et al. [1982]).

cessed foods and textiles everything else being equal. from table 1 it emerges that after a decline of the export share of coffee from 40.4 per cent to 36.4 per cent the export share of processed foods and textiles must rise from 15.6 per cent to 19.6 per cent to achieve balanced trade, that is exports of this category must be increased by 29.5 per cent[10]. The policy instruments for this reorganization of exports could take the form of a tax-cum-subsidy policy, a policy normally recommended when there are distortions in the factor and commodity markets.

Results for the policy effects are given in tables 2 and 3. Thereby scenario 1 depicts the full employment case and scenario 2 a slack labour market. It is important to emphazise that the numbers in these tables represent merely projections of the effects of the postulated changes in exports on the indicated variables. The country model is assumed to be initially in a state consistent with the structural system that gave rise to A in (10). The projections represent the percentage changes in the endogenous variables after an adjustment period long enough[11] for the shocks to work their way through the economy[12]. They are conditional on the numerous theoretical and parameter assumptions together with the assumptions implied in the exogenous setting of key variables. A non-zero percentage change of an endogenous variable indicates that this variable takes a value in the solution period which differs by the indicated amount from that value it would have reached if there had been no policy interventions.

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10 This implies that the share of the remaining categories in total exports does not change. Rather the change in coffee exports is matched by the change in the exports of processed foods and textiles, because $0.404*(-10)+0.156*25.9 = 0$.

11 The extent calendar time interpretation of this period is somewhat vague. A period of five years is postulated to accomodate the adjustments required.

12 The approach is one of comparative statics. Leads lags and adjustment dynamics are thereby ignored.

An inspection of table 2 reveals positive effects of the export diversification policy on real GDP under scenario 1. Colombia's terms of trade increase by 2.59 per cent due to the reallocation of exports. This is achieved because the export price elasticity of demand is much lower for coffee than for processed foods and textiles reflecting Colombia's rather big share (about 12 per cent) in the world coffee market. Hence the increase of the world market price for Colombian coffee, which is induced by the cutback of coffee exports, is higher than the decrease of the world market price for Colombian foods and textiles provoked by the export expansion of these commodities. With trade representing 15 per cent of GDP (see table 1) the terms of trade gain is translated into a 0.38 per cent increase of GDP.

Further, marginal productivity of capital increases such that - with internationally determined real returns to capital - capital imports are induced. Growth of the productive capital stock contributes to another 0.22 per cent gain in GDP[13]. However, as table 2 reveals, there is also an "efficiency" loss for the economy such that GDP can only increase by 0.43 per cent[14].

With an exogenously given level of aggregate employment, demand for unskilled labour, which is intensively employed in primary sector industries (i.e. 1 to 3), falls while demand for skilled labour, which is intensively employed in secondary and tertiary industries (i.e. 4 to 6), rises[15]. The reallocation of exports allows aggregate export earnings and import expenditures to increase.

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[13] Calculated as percentage change of the productive capital stock (0.52 per cent) times the fixed capital share of value added (0.43, see table 1).

[14] This arises from a net loss of government revenues of 0.17 per cent of GDP due to the export diversification policy.

[15] Note that labour is assumed to be "vertically mobile". In the model the costs of retraining labour are not accounted for. As long as reallocations from unskilled to skilled labour are moderate, however, training on the job would suffice to achieve the required higher qualification of the labour force.

Table 2: Projections of Selected Macro Variables for Colombia[a]

	Scenario 1	Scenario 2
Real GDP	0.43	0.36
Employment	0(ex)[b]	-0.10
Unskilled labour	-0.07	-0.17
Skilled labour	0.50	0.39
Real Wages[c]	-0.05	0(ex)
Aggregate Capital	0.52	0.45
Domestic Consumer Price Index[d]	0.15	0.17
Aggregate Exports/Imports (foreign currency value)	0.95	0.86

Notes:

a All variables are in percentage changes

b (ex) denotes exogenous setting of the variables

c Wages for skilled and unskilled labour change by the same amount, i.e. wage relativities remain fixed.

d Computed as a weighted average of the percentage changes in the domestic prices of consumer goods where the weights are commodity shares in aggregate consumer spending. As in the model the exchange rate acts as the numeraire, the change in the domestic price index indicates relative (to world market prices) changes of domestic prices in response to the exogenous shocks.

At the industry level table 3 shows a decline in output of industries 2 and 3 and an increase in other industry outputs. Demand for agricultural products increases through higher domestic absorption (and hence consumption expenditure) and increased demand for intermediates by the food processing industries. This demand change is met by an output expansion of the domestic industry, a cut in exports and an enlargement of imports[16].

With 44.33 per cent of its total output going into exports the mining industry is highly export oriented. Thus it cannot pass on cost increases from higher prices of intermediates to demanders. As exports decrease because of the increased price for mining products (and imports increase) output has to fall as well.

The high export share of total production holds for the coffee industry too (81.85 per cent). Therefore, to achieve the policy induced cut in exports of that product, production has to decrease by a comparable amount. The assumed beneficiary of the restructuring of exports is the food processing and textile industry. With only 6.2 per cent of its production going into exports in the base year, the policy induced rise in exports can be achieved by only a moderate increase of output. As the price and via higher domestic absorption the demand for products of this industry rises imports go up as well.

The gain in real domestic absorption also benefits industries 5 and 6[17]. The increased demand for products of industry 5 is satisfied by an expansion of production, reduction of exports and rise of imports. The service industry, however,

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[16] 37.26 per cent of the agricultural production is consumed by households, 42.64 per cent is demanded by the food processing industries.

[17] For investment purposes 6.94 per cent of the output of industry 5 and 10.46 per cent of the output of industry 6 is required in the base period. For consumption purposes these shares are 26.04 per cent for industry 5 and 38.55 per cent for industry 6 respectively. Moreover, expenditure elasticities are 1.92 for industry 5 and 1.15 for industry 6.

Table 3: Projections of Selected Industry-specific Variables for Colombia[a]

	Scenario 1			Scenario 2		
	Output	Exports	Imports	Output	Exports	Imports
1. Agriculture	0.17	-14.45	4.34	0.15	-13.95	4.17
2. Mining	-0.38	-1.33	0.41	-0.77	-2.02	0.29
3. Coffee	-8.34	-10(ex)[b]	--	-8.35	-10(ex)	--
4. Processed Foods and Textiles	2.14	25.88 (ex)	1.52	2.08	25.88 (ex)	1.49
5. Processed Raw Materials and Investment Goods	0.39	-1.56	0.61	0.25	-2.16	0.51
6. Services	0.42	0(ex)	0.55	0.34	0(ex)	0.53

Notes:

a. All variables in percentage changes

b. (ex) denotes exogenous setting of the variable.

produces mainly non-tradables such that export cuts are not allowed in this industry to satisfy higher domestic demand.

A comparison of the effects under scenario 2 with those under scenario 1 reveals no basic differences. As table 2 shows, the alternative to the moderate wage decrease under scenario 1 is a reduction of aggregate employment under scenario 2. More unskilled labour is set free and less skilled labour gets employed under scenario 2.

The terms of trade gain is the same as under scenario 1. However, income gains by capital imports and losses by reduced employment and "efficiency" are nearly balanced such that the GDP gain is mostly due to the terms of trade improvement. Furthermore, because of this factor market rigidity less capital is imported and less products are traded than before. The effect of fixing real wages is to dampen the response of industry variables as well (see table 3).

V. Conclusions

The model simulations have shown a positive income effect of an appropriate export diversification policy for Colombia. Furthermore, as has been pointed out in the introduction, an appropriate export diversification lowers the degree of export earnings instability. Therefore, gains from two sides can be expected for Colombia if the described policy is followed: first, by an increase of GDP through the restructuring of the economy and, secondly, by a decrease of the costs of export earnings instability. Hence the policy evaluated in this study is superior to export earnings stabilization schemes which provide gains for the economy only in terms of reduced costs of instability. Nevertheless,

as an appropriate export diversification policy is mainly a long run strategy export earnings stabilization by international arrangements can be justified in the transition stage. Furthermore, appropriate export diversification would not be a feasible strategy to reduce the costs of export instability if the importing countries raise protectionist barriers to Colombian exports of manufactured goods.

Appendix

Key Parameter Settings: Colombia

A. Industry Parameters

Industries	CES, Primary Factor[a] Substitution Elasticities between labour and capital	Allen-Uzawa pairwise Substitution elasticities[b]		
		between labour and capital	between labour and land	between land and capital
1. Agriculture	--	1.4	0.5	-0.2
2. Mining	1.15	--	--	--
3. Coffee	--	1.4	0.5	-0.2
4. Food Processing and Consumer goods	0.79	--	--	--
5. Raw Material Processing and Investment goods	0.69	--	--	--
6. Services	0.60	--	--	--

a) Calculated from de Melo (1975) and Keppler (1979).

b) Calculated from Thirsk (1974).

B. Product Parameters

Products	Import domestic substitution elasticities[a]	Household expenditure elasticities[b]	Budget shares of private household consumption[c]	Reciprocals of export demand elasticities (absolute values)[d]
1. Agriculture	5.0	0.81	0.20	0.05
2. Mining	0.5	0.0	0.0	0.05
3. Coffee	--	0.81	0.01	0.67
4. Food Processing and consumer goods	3.1	0.92	0.41	0.05
5. Raw material Processing and Investment goods	0.5	1.92	0.02	0.05
6. Services	2.0	1.15	0.37	0.05

a) Calculated from de Melo and Robinson (1980).

b) Calculated from Howe (1974).

c) Calculated from DANE (1973).

d) Reflects the "small-country-assumption" for all commodities except coffee. The export price elasticity of demand for coffee was taken from de Melo (1978).

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