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Paper presented at the Workshop of the
International Conference on Cocoa Economy
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# "Methodological issues in the analysis of the competitivity of cocoa sub-sectors"

Ellen Hanak Freud and Claude Freud[1]
CIRAD, Paris
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## 1. Introduction

With world prices for cocoa at historically low levels, producing countries are faced with a challenge that mattered little in the sellers' market of the 1970s, when even high cost producers could turn a profit: How to stay competitive in the international marketplace, that is, to produce and sell cocoa at a cost at or below the market price?[2] To respond to this challenge, cocoa producers, like industrial enterprises, need to be able to establish their costs, as a first step toward making adjustments. This task comes automatically for large-scale agro-industrial plantations, such as those in the Sabah province of Malaysia, which are currently in the process of rationalising their operations by pulling out cocoa trees achieving sub-standard yield levels (Bloomfield, 1993). It is less obvious in situations where production is in the hands of smallholders, with other actors responsible for marketing and overseas sale.

Which factors determine the cost advantages of some cocoa producers over others? And what degrees of freedom do countries possess to regain or maintain their competitive position? These questions are the starting point for a multidisciplinary research project recently launched by CIRAD. The aim of the research is to establish a matrix for analysis which producing countries can use to take into account the range of factors may influence their competitiveness: the advantages conferred by the initial conditions of the natural resource base, the ability to keep down costs through a judicious combination of factors of production, and the scope for cost-reducing technological innovations. The purpose of this paper is to present a methodological overview of the approach, which consists of conducting a detailed decomposition of the costs of the subsector, according to different types of technology. Through examples from cocoa-producing areas in Cameroon, the paper indicates the key elements of the analysis (economic, sociological and agronomic), and the multiple

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[2] This definition of competitivity is similar conceptually to the notions of absolute and comparative advantage in neo-classical trade theory, which refer to commercial advantages stemming from relatively low production costs, in the absence of distortions created by taxes and subsidies. While the first refers to cost advantages for a single product, the second permits a comparison of such advantages over a range of products, and so indicates those products for which an economy can make the greatest gain. These two notions are distinct from that of "competitive advantage" as it is used in some of the recent economics literature, to refer to commercial advantages including those stemming from distortionary policies (see Stanton, 1990).

uses of comparable cost matrices for the analysis of current and potential cost competitiveness. The paper concludes with a discussion of the limits and advantages of the approach compared with alternative approaches to the analysis of competitivity problems.

## 2. A Methodological Overview of a Commodity Systems Approach to Competitivity Analysis

### 2.1 Some elements of background

A range of structural factors determine the basis for a country's competitiveness in the production and sale of a primary commodity such as cocoa : (i) the conditions of the natural resource base which affect the yield prospects; (ii) the human resources which determine the ability to master various types of production systems; and (iii) the state of physical and institutional infrastructure which affects the conditions of input delivery and output marketing. It is the combination of these factors which determines the structure of costs of the subsector, which we will refer to as the *commodity system* (in French, the *filière*) : a system covering the totality of the production process, from the upstream activities of input and credit supply to the downstream activities of processing and sale on international markets. Before proceeding to outline the methodology for analysing the cost structure, we examine briefly the role of the different factors which need to be taken into account.

**The natural resource base**. For agricultural commodities in general, a point of departure in the analysis of competitivity lies in the assessment of the characteristics of the natural resource base - soil quality, climatic conditions, and susceptibility to diseases and pests - which make it possible to achieve a given level of yield with more or less additional inputs. For cocoa production, phytosanitary conditions are a major concern, as the presence of a major pest such as *phytophtora megakarya* or *witches' broom* can augment production costs considerably (Petithuguenin, 1993; Lass and Bloomfield, 1992). With respect to rainfall conditions, there are some tradeoffs to be taken into account, as dryer conditions permit sun-drying of beans while at the same time subjecting cocoa seedlings to higher risk of loss through hydric stress. Soil quality may be an issue in comparing production systems over the life of the initial plantation - for instance between systems with volcanic soils versus less fertile, more acidic tropical lowland soils. As François Ruf has indicated in a number of his works (1987, 1991, 1993), it may also play a major role in the comparison between systems under initial plantation on virgin or secondary forest versus those replanted on old cocoa stands, the latter being more susceptible to weeds and pests, and exhibiting higher seedling loss rates.

To these elements of resource base **quality**, one must add the consideration of **quantity** - the availability of land resources to be put into cocoa, which affects the volume of cocoa which can be produced at a given cost. Cocoa is obviously at a relative disadvantage in this respect in areas where there are many viable alternative uses for the land, such as Malaysia, compared with some of the "frontier" areas where cocoa cultivation is replacing unoccupied forest land.

**The human resource base : mastery of the production systems.** It is certain that yield levels (as well, in some instances, as quality levels) depend on the mastery of certain techniques - such as land preparation and frequent weeding in the establishment phase, and careful handling at the fermentation stage. Mastery of production systems is a function of producers' ability to follow the optimal cultural practices and of their management capacity, factors which depend both on human capital (talent, knowledge gained by instruction) and the availability of manpower. In smallholder systems in many cocoa producing countries (especially, but not exclusively, in Africa), technical shortcomings are frequently related to this latter factor : in effect, labor shortages prevent certain practices from being undertaken which would increase yields or quality. In large-scale plantation-based systems, high management-to-worker ratios can lead to substantial cost disadvantages in comparison with smallholder-based systems, canceling out their often substantial yield advantage.

**The state of physical and institutional infrastructure.**
It has long been recognised that in-country transportation conditions and distance between production locations and ports can play a major role in conferring a cost advantage or disadvantage to a producing area. Indeed, for some of the remoter production areas of Indonesia and Brazil, as well as for some of the major African producing countries, "marketing margins" account for a substantially higher proportion of total costs in comparison with Malaysian or Indonesian large-scale plantations which have low-cost access to ports.[3]

There is increasing recognition that these margins depend not only on the physical aspects of the transportation and communications infrastructure, but also on the nature of what one might call the "institutional infrastructure" - the way in which input and output marketing is organised, by which types of operators (private, cooperative, public), and with what degree of competition. Preliminary evidence from comparisons among coffee producing countries suggests that privately-run systems may be more flexible in their adjustment of the marketing margin than public or cooperative operators : better able to compress costs when world market prices are low, they appear able to reserve for themselves a relatively higher margin than publicly-mandated systems when market conditions are buoyant (Freud and Hanak Freud, 1993. The evidence of high margins for Indonesian smallholder cocoa producers, even during a period of low world market prices, raises the question of the degree of competition in privately run systems (Pragma Corporation, 1992). This will be an important element to follow for the number of cocoa-producing countries in Africa undergoing liberalisation in the context of structural adjustment reforms.

Another factor affecting countries' competitivity which receives relatively less attention is the freight costs linking producing countries to overseas points of sale. For instance, the cost of shipment between South-East Asia and Germany is lower than the cost between francophone Africa and France, although the distance is twice as great. While scale economies may have some role to play, factors relating to the degree of competition in these markets may also be key. This makes it important to compare countries' competitivity situations on a cost-insurance-freight basis rather

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[3] See, for example, Pragma Corporation (1992) and Bloomfield (1993).

than just free-on-board. Freight cost differences also affect the price of imported inputs used in cocoa production, and thus the relative profitability of input-intensive cultural practices.

**The dynamic nature of competitivity**. Many of these structural factors - soil quality, rainfall, location, population density - are a function of the country's resource endowments. Yet none are static in nature. They can evolve in a negative direction as a result of human action: loss of fertility as a result of soil mining cultural practices, erosion and loss of rainfall due to deforestation, etc. Or, to the contrary, human action can encourage their improvement. These days, favorable price policy (including exchange rates) is what most often comes to the forefront of public discussions concerning competitivity in the markets for tropical agricultural products, on the grounds that an undistorted incentive structure in product and factor markets will encourage the most efficient use of resources and hence the development of competitive export sectors. While not denying the potential role of price and exchange rate policy, we consider it important to explicitly consider the role of other types of interventions which do not necessarily arise because of market forces alone: infrastructure investments which lower transport costs, institutional reforms which cut down on marketing inefficiencies, agricultural research results which make it possible to increase productivity or reduce soil degradation (combined with technical training to provide farmers with the new information, and possibly also credit programs to enable investments to take place), etc.

It is through a detailed analysis of the cost structure of the commodity system, taking into account the technical conditions of production, that it becomes possible to see the scope for various types of policy, investment, and research interventions to improve a country's competitive conditions, over the short, medium and longer term: in the short term, through fiscal reforms which alter the incentive structure; in the medium term, through institutional reforms and infrastructural investments which can alter the structure of the commodity system both upstream and downstream; and in the longer term, through research designed to relieve bottlenecks and enhance the productivity of the production and transformation processes.

## 2.2 Cost accounting of the commodity system : a matrix for the analysis of competitivity issues

The system of cost accounting we propose is drawn from a method of project evaluation frequently used in French-speaking countries, where it is known by the name *"Méthode des Effets"* or "effects method".[4] The basic building blocks of the analysis are detailed operating accounts for representative agents at different stages of the commodity system, including production, processing, and the various stages of commercialisation, from the farm-gate up to the cost-insurance-freight point. These primary accounts provide information on the cost of purchased inputs and services (the

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[4] Some main references for the methodology are: Prou & Chervel (1970), Chervel & LeGall (1977), Bridier & Michaïlof (1980), and Duruflé, Fabre and Yung (1988).

intermediate consumption category), and the share of value added going to direct wages, interest payments, taxes (or subsidies), depreciation of investments, and profits.

Table 1 provides examples of such accounts at the farm level for two systems of production in the Centre and West of Cameroon for the 1991/92 season. The examples are chosen to illustrate a key element of the comparative part of the analysis: that to capture the differences in natural conditions and cultural practices, it is essential to make comparisons among commodity systems at different levels of yields and techniques, rather than according to an average yield level for the country. The systems at 250 and 450 kg/ha correspond to systems using low and intermediate levels of field maintenance and of phytosanitary treatments against black pod, and zero and low levels of treatments against capsids, respectively. As will be seen in the aggregated accounts for the commodity system (Tables 2 and 3), these two cases also differ in their marketing structure - a parastatal organisation (SODECAO) operating in the Centre, and lower cost private operators in the West. In cases where there are different technologies at the processing stage, these also would need to be analysed as separate cases, rather than as averages, to permit comparisons.

It is through the intermediate consumption category of the farm-level accounts that one captures the "upstream" activities of input supply. These elements can themselves be decomposed, to reveal the local value added component and the share of imports. For instance, in the full price of chemical inputs at the farm level, there is an imported component (the imported price), as well as local costs of port handling and shipment to the farming areas. Similarly, the intermediate consumption items of the operating accounts of the marketing agents (not shown here) would include purchased fuel, itself composed of imports and local value added : the indirect wages, taxes, and indirect profit, interest payments and depreciation arising from the purchase. This decomposition, done with the aid of interindustry exchange tables,[5] is the second stage of the cost-accounting exercise. The result is a cost matrix which summarises total costs and profits at each stage of the commodity system, broken down into imports, and direct and indirect local value added. Tables 2 and 3 provide the completed tables for the two examples. In these examples, we have treated only the farm-level accounts as direct value added, so that all other labor costs appear as indirect wages. Since the data did not permit us to identify separately the indirect interest payments and depreciation from the gross income of the non-farm-level actors, these items are grouped together with indirect profits under the heading indirect gross income.

The advantage of taking the accounts to this second stage is that the matrix permits the comparison of costs between systems by nature as well as by function. It gives a fairly precise idea of total labor costs under the different systems (direct plus indirect), of (the relative intensity of imports, and of the net effect of government finances. For a given country, this type of decomposition facilitates the analysis of factor productivity, and of sensitivity of the results to changes in such factors as

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[5] If such tables are unavailable, the decomposition can be done on the basis of interviews with importers.

import duties, exchange rates, and wage rates, as we will demonstrate below. In cross-country comparisons, the decomposition can be revealing of the source of cost advantages and disadvantages for various items. For instance, are differences in costs of equipment and chemical inputs across countries due to differences in duties, to preferential markets, or to a lower cost of manufacture domestically?

To be meaningful, the cost matrices need to be built through a close association of an interdisciplinary team. Although the final work of pulling together the accounts and decomposing the intermediate consumption items may fall to the economist, the role of the agronomist is crucial for the identification of the different systems, and the technical possibilities for moving between technologies. Similarly, a specialist in farming systems analysis (sociologist, socio-economist) has a major role to play in identifying the reasons for gaps in performance resulting in lower yields.

A number of methodological issues arise in the construction of the accounts. One area where judgements must be made concerns the valuation of factor prices and exchange rates. It is our view that the basic calculations should be done at face, or market, value, as this most closely reflects the actual state of affairs. This implies use of the official exchange rate for conversions of traded items.[6] For land, the method implies the use of actual rental rates, equal to zero in both cases here. It also implies the valuation of family labor at the going agricultural wage rate (its marginal value in the marketplace). In the examples presented here, the going daily wage is 10 F. With this method, a result of net profitability for the farmer indicates above-market returns to family labor, and a result of net loss the opposite. In our examples, both systems of production give higher than market-wage returns to family labor at the farm-level sale price of Fr. 4,40.

Note that this principle of pricing at face value does **not** imply ignoring the effects of direct subsidies or taxes. If all costs of the commodity system had to be recovered (leaving farmers with the residual of the world price less processing and marketing costs), those in Central Cameroon would be earning a profit only Fr. 0,09/kg, while those in the West would be earning Fr. 1,00/kg. For this marketing season, the state was effectively subsidising the commodity system for the gap between total costs and a lower world market price. In situations where inputs are subsidised, these can be easily taken into account directly in the primary operating accounts, with a **financial** column, reflecting the actual charges to the producer (and hence his actual profits), and an **economic** column, reflecting the full cost (and hence the profits he would make if charged the full value). In our examples, chemical inputs are priced at market values, reflecting the recent removal of subsidies. Seed cocoa beans (an item in the investment costs) have remained fully subsidised (at zero cost to farmers). We have not yet incorporated this subsidy element in the accounts for want of data on seed production costs.

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[6] Movements in of exchange rates can pose difficulties for international comparisons across time, to the extent that purchasing power of a given currency equivalent can vary across countries according to differential inflation rates. In such comparisons, it is preferable to focus on proportions of total costs, rather than absolute values (Freud and Hanak Freud, 1993).

A second important area of judgement concerns the treatment of investment costs for the establishment phase of cocoa. The issues that arise include the nature of costs which should be imputed, the method of depreciation, and the length of life of the investment. Concerning the first point, we consider only the actual costs of investment incurred (in smallholder systems, typically little besides labor inputs, which in our examples amount to approximately 325 days/ha. for the first five years under the assumption of cocoa established on forest land). Real interest costs are included only to the extent that the system actually relies on credit (we consider interest payments to be a real cost disadvantage of large-scale plantations vis à vis smallholder producers). Secondly, we opt for a very simple method of depreciation: the attribution of actual investment costs in equal shares over the number of years of the primary production period, which can vary anywhere from 15 to 25 years. Given that the length of life of the investment can considerably alter the profitability of the operation, this is an area where it is important to consider alternative scenarios.[7] In our examples we depreciate over 25 years; if this period is shortened to 15 (implying a total investment period of 20 years including the nursery phase), this raises the annual per hectare costs by roughly 40 percent, to Fr. 304, and the per kg. costs to a third of the total in the low-yield example.

In several important respects, the method we employ differs from studies on production costs in the English language tradition.[8] First, the practice is quite common to employ shadow prices for exchange rates and factors, on the grounds that these better capture the true economic values. A difficulty with this approach is that such values are highly subjective, and rarely the same from study to study. This leads to problems of comparability among data bases which in principle should consist of the same elements. Since, in any event, this method generally reflects a picture of the commodity system "as it might be" if the prices were different, we find it preferable to explicitly conduct simulations of the accounts under the assumptions embodied in shadow prices. As we will show below, it is a straightforward exercise to simulate the effect of a real depreciation or a change in the wage rate, for instance.

Second, these studies generally opt for a depreciation method which puts all costs (and benefits) over the life of the investment into present value terms, in contrast to our method of considering recurrent costs and depreciation of investments on an annual basis . While the present value method may be an accurate representation of investment decisions by large-scale plantations which rely on bank credit for their

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[7] The fact that some varieties of cocoa trees can continue to produce at low yield levels for many years after their primary production cycle poses an interesting methodological issue, since many small farmers are reluctant to replant as long as the trees generate some revenue. A useful way to consider this problem may be to treat such "post-prime" systems as fully depreciated, but make an allowance in the accounts for putting aside investment resources needed to finance a period of replanting.

[8] For instance, the cost of production studies by Landell Mills Commodity Studies, Inc. (see Fry, 1990 and Bloomfield, 1993), the comparative study of cocoa producers by M. Bateman et. al. (1990), and the farm budget analysis done by the World Bank in project preparation and evaluation.

capital, we believe that it poses some problems for the analysis of smallholder systems. By imposing what in principle are real market interest rates as discount rates on the full length of the life of the investment, this effectively treats smallholders as if they on par with large corporations engaging in debt-financing. The result is to very heavily weigh their investment costs in relation to recurrent costs and benefits. To take an example for the Côte d'Ivoire presented in Bateman et. al. (1990), the establishment costs in net present value terms are of the order of one-third of total costs over a 30-year investment life at relatively high yield levels, well above the level of 10 - 20 percent which one would find under our method, and which we consider to be more realistic.

In addition, this depreciation method is a less transparent tool for the analysis of competitivity problems. Relying as it does on the compression of a range of cost items into a few summary net present value statistics, it loses the ability of the original cost data to reflect the proportion of costs by nature at different stages of the commodity system. Transparency is similarly a problem with the shadow price method. By contrast, the operating accounts method is sufficiently straightforward as to permit not only experts in government ministries, but various actors engaged in the commodity system such as cooperatives, the extension service, and the agricultural research service, to follow the developments of regional and national competitivity conditions.

A third area of divergence is data coverage. Production cost studies in the English language tradition often stop short of including the full costs of the commodity system, concentrating just on the production phase (the typical case in project evaluations), or at best up to ex-fermentary (the case of Landell-Mills Commodity Studies work). Since commercialisation costs can vary considerably among countries and regions, this should not be overlooked in the analysis of competitivity.

### 2.3. An application of the cost matrices to competitivity analysis.

Table 4 presents some basic indicators of competitivity derived from the cost matrices for our two examples. Turning first to the physical measures of labor productivity, we see that the system in Western Cameroon outperforms the lower-yield system in the Centre, despite a substantially higher per-hectare labor input. The productivity edge is only slight if we compare recurrent labor inputs only, with the Centre producing a bit under 6 kg per day and the West producing a bit over that level. Once labor inputs in plantation establishment are factored in, however (case B in the table), the West outperforms the Centre by 15 percentage points, and nearly one kg. per manday, since the higher yields reduce the per kg. depreciation costs of this investment.

The cost-based measures permit comparisons over the entire commodity system. From the production cost statistics, we see that the slight advantage of the West at the farm level (of 10 %) is doubled by the lower commercialisation costs prevailing there (stages II and III in tables 2 and 3). While part of this difference is attributable to greater accessibility of the West (the transport to port costs being only 0,14 F/kg versus 0,28 F/kg for the Centre), a big part is due to the overhead costs

of the parastatal service/marketing organisation SODECAO operating in the Centre (incurring 0,49 F/kg in additional costs).

These cost differences lead to a substantial divergence in the returns to farmers. From the standpoint of the competitivity of the cocoa subsectors, we examine first the situation in the absence of subsidies. The most dramatic indicator, of net farm income per kg. (only one-tenth as large in the Centre as the West), is not the most meaningful, since in these owner-operated systems what counts for decision-making is returns to manday. Under an assumption of sunk costs for investment (case A), the returns are substantially above the market wage in both systems. Once investment costs are taken into account, however, the returns in Central Cameroon fall to a level close to the market wage of 10 F/day, while they remain significantly higher in the West, at over 15 F/day. Comparing the ratios of returns to manday in the two systems with the ratios of the physical productivity of labor, we see the impact of the additional burden of commercialisation costs on the earnings from cocoa-growing in Central Cameroon, who would make 30% less per day than their counterparts in the West in the absence of subsidies, despite a gap of only 15 percent in their labor productivity. Part of this difference was compensated for by a higher subsidy rate in the Centre, of close to 5 F/day, double the amount received by farmers in the West.

Local value added and domestic resource cost ratios are cost-based measures designed to reveal the net gains to the national economy from the production and sale of cocoa under different production and marketing systems. Local value added is calculated as the international sale price less all imported costs. We see that the two systems are identical in this respect, since they consume equal amounts of imported goods per kg. of fermented and dried cocoa beans brought to the c.i.f. stage. With 30 percent of international earnings from cocoa going to imported inputs, neither cocoa system is particularly import-intensive, and the result is a large proportion of value added from the crop (distributed mainly to direct and indirect wages and profits). The domestic resource cost measures are the ratio between local costs and net foreign exchange earnings. A ratio of under 1 indicates a comparative advantage in the commodity, since it signifies the use of fewer domestic resources than the value of earnings of foreign exchange. We see that both systems are competitive by this standard, although the Central Cameroonian case by only a hair's length. By comparing the DRCs at different stages of the commodity system, the burden of high cost commercialisation in the Centre again shows up: the advantage of the West vis a vis the Centre jumps from 14 % at the farm-gate to 30 % when the various marketing costs are taken into account.

Table 5 presents some simulation experiments which permit us to examine how these results might be affected by changes in various parameters of the commodity system. We examine four types of changes, relating to both price and productivity issues: a real currency depreciation (that is, a nominal devaluation which is not compensated for by domestic inflation); an increase in farm input prices (which could arise from a change in the world market price); a decrease in domestic marketing costs (which could arise from a cost-cutting exercise or institutional reform); and an increase in labor productivity (the result of technical innovations at the farm level, for instance as the result of agricultural research). For the simulation of a real

depreciation, we examine two scenarios, the first (case A) whereunder nominal farm wages stay unchanged, and only the local value of the cocoa and of imported goods are altered, and the second (case B), where farm wages are altered in step with the devaluation (a scenario which is more likely in the case of owner-operated farming with little or no landless farm hands on the labor market). For the sake of comparison, we have assumed a change of the order of 30% in each scenario, and have examined the consequences for a selection of the competitivity indicators presented in Table 4, which we will consider as the "baseline scenario." In all cases, we have assumed no direct subsidies, so that net farm income and returns to manday are calculated as the residual of the world price less other costs rather than on the basis of a guaranteed producer price.

Among the scenarios, only the one assuming an increase in farm input prices is unfavorable from the standpoint of the various competitivity indicators. The price change increases the costs of the production technologies in both cases (which both rely on phytosanitary treatments with imported inputs). However, since neither system is heavily input-intensive, the result is not devastating to net returns to labor, nor to local value added. The DRC of cocoa production in Central Cameroon shifts slightly over the "critical point" of 1, but remains well below this value in the West. Although costs increase slightly more in the West, which uses more inputs than in the Centre, the overall advantage of cocoa in the West outweighs this fact.

The scenarios which produce the most dramatic results are those simulating a real depreciation. Notice that the only difference between the two cases is the attribution of value added between direct farm labor and net farm income. This attribution matters for the calculation of farm-level costs, and hence for the DRC indicator. When farm labor is kept at constant nominal wages, there is a large drop in the DRCs, by 23%. On the more reasonable assumption that farm wages rise with the rise of the cocoa price, the returns to manday are the same (since they consist of wages plus net farm income per day of work), but the DRC falls by a more modest 10%. The returns to manday are substantially higher than the baseline case, and surpass the 30% change in the local value of cocoa. In effect, the real depreciation translates into a drop in the relative costs of all non-imported goods in the rest of the commodity system. The local value-added from cocoa production increases by precisely the amount of the real depreciation, again a reflection of the change in relative prices.

Scenarios such as this play a large role in the arguments in favor of devaluation as a tool for improving competitivity conditions. A note of caution must therefore accompany their use. The scenarios explicitly assume that the end-result of nominal devaluations is a *real* depreciation of 30%. In practice, it is difficult for countries to achieve such a level unless their currencies have become substantially debased and the effect of devaluation is to reduce the gap between official and parallel rates. In the case of countries such as Cameroon, which has a convertible currency, there is little likelihood of a nominal devaluation not being met by a large (if not equivalent) dose of inflation, with a much smaller net real effect on relative prices.

It is with alternative policy measures in mind that we have examined the scenarios for decreasing domestic marketing costs directly (rather than as an indirect

effect of devaluation). Here, we see that the returns to manday increase more strongly in the case of Central Cameroon, where marketing costs weigh more heavily. The DRCs drops more strongly in both the Centre and the West than in the case of real depreciation with constant real farm wages, and the share of commercialisation costs in the total fall below 40 % for the first time. There are thus clearly gains to be made in pursuing this type of action, particularly if the gains from exchange rate policy are limited by inflationary pressures.

The potential role of agricultural research is indicated briefly in the final scenario. With a 30% increase in the productivity of recurrent labor in cocoa production, there is a corresponding increase in the potential returns per manday. Such an increase in productivity could obviously also permit the system to respond more flexibly to a drop in the world market price, since it permits cost compression without a drop in incomes in relation to the baseline case.

## 3. The limits and advantages of a commodity systems approach

Competitivity analysis based on costs of production is subject to two types of critiques, which can be likened to the case of photography, where the subjects are various commodity systems: there is at once the difficulty of taking a good picture, and the limits of what even a high quality photo can tell you about the subjects.

The criticisms falling into the first category concern mainly the issues of completeness and of comparability across photographs. The problem of completeness has been noted earlier: the entire chain of costs in the commodity system, by type of technology, is needed to get a good individual photo. Such photos can take into account a number of issues related to competitivity which farm-level-only cost of production analysis cannot capture (Sharples, 1990, Ahearn et. al., 1990): transport costs, costs and benefits from achieving quality premiums, costs and benefits of adding value to a commodity by further processing. To compare these photos, it is important that the treatment is equivalent across cases. For instance, in international comparisons, one needs to take into account the employer's contribution (insurance, pension fund, taxes) for formal sector labor, and to include research and extension as costed services. Difficulties of comparability arise most often when using data published by agricultural ministries or similar authorities, which are not necessarily collected according to the same premises. They also arise unnecessarily because too often studies publish only a highly reduced form version of the cost structure, modified by shadow prices and present value transformations.

The criticisms of the second type relate to the principle of photography itself. A photo is by nature static, and applies to a given situation. One can't know for certain how the actors in the commodity system will respond to changes in factor and product prices. Although one can assume that they may adjust their techniques, but cost of production analysis does not provide estimates of the elasticity of responses. Unfortunately, however, there are few situations in tropical agriculture where the data conditions permit accurate estimation of product and factor price elasticities affecting output. Sensitivity analysis of the cost structure can therefore be a useful guide, by providing indicators of the changes in profitability of various techniques under

different price assumptions. As Akiyama has shown in his work on coffee in Nicaragua (World Bank, 1992), cost structure information including investment costs for different technology types can provide the basis for a supply function modelling when econometric evidence of elasticities is inadequate.

In our view, a cost structure approach has another basic advantage over an elasticities approach when it comes to competitivity analysis. An elasticities approach marries well with the "invisible hand" approach to competitivity, whereunder countries seek their comparative advantage through the minimisation of price distortions via agricultural pricing, trade policy and exchange rate reforms. Knowing the supply elasticity or the elasticity of factor demand under a given structure doesn't provide one with any information on how to take actions to change the structural conditions (via research, via relief of credit constraints, via institutional reforms, etc.) A commodity systems approach can shed light on these issues, thereby helping producing countries to identify the strong and weak points at different stages of the system, and to respond to the challenge not only with price policy, but also with interventions which may increase the responsiveness of the sector to the agricultural, trade and exchange rate policies of the invisible hand approach.

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**Table 1. Operating accounts for cocoa production at the farm level, 1991/92, Central & Western Cameroon (in French francs per hectare)**

| | 250 kg/ha system (Central Cameroon) | 450 kg/ha system (Western Cameroon) |
|---|---|---|
| I. Intermediate Consumption | | |
| - fungicides | 120,0 | 240,0 |
| - insecticides | 0,0 | 38,4 |
| - atomiser maintenance | 0,0 | 16,0 |
| - small tools | 30,0 | 30,0 |
| - lime | 16,0 | 16,0 |
| - pulverisers a/ | 24,0 | 48,0 |
| - atomisers a/ | 0,0 | 24,0 |
| Sub-total | 190,0 | 412,4 |
| II. Proceeds from Cocoa | 1100,0 | 1980,0 |
| III. Value Added (II-I) | 910,0 | 1567,6 |
| IV. Operating Costs | | |
| - On-farm labor b/ | | |
| . Farm maintenance: | | |
| -field maintenance | 140,0 | 200,0 |
| -black pod treatments | 60,0 | 120,0 |
| -anti-capsid treatments | 0,0 | 5,0 |
| . Harvesting operations: | | |
| -harvesting | 130,0 | 260,0 |
| -shelling, drying & removal from fields | 100,0 | 140,0 |
| - Interest costs | 0,0 | 0,0 |
| - Direct Taxes | 0,0 | 0,0 |
| Sub-total | 430,0 | 725,0 |
| V. Gross Farm Income (III-IV) | 480,0 | 842,6 |
| VI. Depreciation Costs for Plantation Establishment c/ | 182,6 | 182,6 |
| - On-farm labor | 159,2 | 159,2 |
| - assorted inputs | 23,4 | 23,4 |
| VII. Net Farm Income (V-VI) | 297,4 | 660,0 |

Source: Primary data collected by P. Petithuguenin.

a/ Rather than counting these imported items used for annual farm maintenance under the depreciation category, we attribute a per hectare portion of their cost in intermediate consumption see Freud, et al, 1991, for details).

b/ Family labor valued at market wage : 10 Fr. per day for all activities except land clearing, valued at 16 Fr. per day.

c/ 25 year production cycle assumed, of which 5 years in investment period.

Table 2. Production cost matrix for cocoa commodity system @ 250 kg/ha, Central Cameroon, 1991/92 (in French francs per kg. of cocoa beans)

| | TOTAL | IMPORTS | TAXES | DIRECT WAGES | INDIRECT WAGES | NET FARM INCOME | INDIRECT GROSS INCOME b/ |
|---|---|---|---|---|---|---|---|
| I. Farm Level Operations | | | | | | | |
| - farm preparation | 0,73 | 0,04 | 0,01 | 0,64 | 0,03 | | 0,01 |
| - farm maintenance | 1,56 | 0,53 | 0,02 | 0,80 | 0,11 | | 0,11 |
| - harvesting operations | 0,92 | | | 0,92 | | | |
| Sub-total | 3,21 | 0,58 | 0,02 | 2,36 | 0,14 | | 0,12 |
| Farm-Level sale price | 4,40 | | | | | 1,19 | |
| II. Processing & Primary Marketing Operations | | | | | | | |
| - collection from farms | 0,41 | 0,18 | 0,07 | - | 0,10 | | 0,06 |
| - factory processing | 0,33 | 0,12 | 0,00 | - | 0,09 | | 0,12 |
| - overhead costs (SODECAO) | 0,49 | 0,04 | -0,49 | - | 0,41 | | 0,05 |
| Sub-total | 1,24 | 0,34 | -0,42 | | 0,60 | | 0,23 |
| III. Final Marketing Operations | | | | | | | |
| - transport to port | 0,28 | 0,12 | 0,05 | - | 0,07 | | 0,04 |
| - f.o.b. handling | 0,54 | 0,14 | 0,13 | - | 0,07 | | 0,21 |
| - c.i.f. handling a/ | 0,64 | 0,64 | | | | | |
| Sub-total | 1,46 | 0,90 | 0,18 | - | 0,13 | | 0,25 |
| IV.A. Total Costs (based on farm-level price) | 7,10 | 1,82 | -0,22 | 2,36 | 0,87 | 1,19 | 0,60 |
| IV.B. Total Costs (based on farm-level costs) | 5,91 | 1,82 | -0,22 | 2,36 | 0,87 | 0,00 | 0,60 |
| International Sales Price | 6,00 | | | | | 0,09 c/ | |

Source: Table 1 and SATEC, 1992, "Charges Incompressibles de la Filière Cacao."

a/ Destination Western Europe.

b/ Includes depreciation and interest costs of all agents besides farmers.

c/ Net farm income under assumption of no subsidy to producer price, producer receives residual of international price less costs at stages II and III.

Table 3. Production cost matrix for cocoa commodity system (@ 450 kg/ha, Western Cameroon, 1991/92) (in French francs per kg. of cocoa beans)

| | TOTAL | IMPORTS | TAXES | DIRECT WAGES | INDIRECT WAGES | NET FARM INCOME | INDIRECT GROSS INCOME b/ |
|---|---|---|---|---|---|---|---|
| I. Farm Level Operations | | | | | | | |
| - farm preparation | 0,41 | 0,02 | 0,00 | 0,35 | 0,02 | | 0,01 |
| - farm maintenance | 1,64 | 0,64 | 0,02 | 0,72 | 0,14 | | 0,13 |
| - harvesting operations | 0,89 | | | 0,89 | | | |
| Sub-total | 2,93 | 0,67 | 0,02 | 1,96 | 0,15 | | 0,14 |
| Farm-Level sale price | 4,40 | | | | | 1,47 | |
| II. Processing & Primary Marketing Operations | | | | | | | |
| - collection from farms | 0,41 | 0,18 | 0,07 | - | 0,10 | | 0,06 |
| - factory processing | 0,33 | 0,12 | 0,00 | - | 0,09 | | 0,12 |
| - overhead costs | 0,00 | | | | | | |
| Sub-total | 0,74 | 0,31 | 0,07 | - | 0,19 | | 0,18 |
| III. Final Marketing Operations | | | | | | | |
| - transport to port | 0,14 | 0,06 | 0,02 | - | 0,03 | | 0,02 |
| - f.o.b. handling | 0,54 | 0,14 | 0,13 | - | 0,07 | | 0,21 |
| - c.i.f. handling a/ | 0,64 | 0,64 | | | | | |
| Sub-total | 1,32 | 0,84 | 0,15 | - | 0,10 | | 0,23 |
| IV.A. Total Costs (based on farm-level price) | 6,47 | 1,81 | 0,25 | 1,96 | 0,44 | 1,47 | 0,55 |
| IV.B. Total Costs (based on farm-level costs) | 5,00 | 1,81 | 0,25 | 1,96 | 0,44 | 0,00 | 0,55 |
| International Sales Price | 6,00 | | | | | 1,00 c/ | |

Sources and notes: see Table 2.

Table 4. Some competitivity indicators

| | Case I Central Cameroon | Case II Western Cameroon | Ratio Case I:II |
|---|---|---|---|
| I. Physical Measures | | | |
| yield (kg/ha) | 250 | 450 | |
| man-days/ha A (recurrent costs only) | 43 | 73 | |
| phys.productivity of labor A (kg/day) | 5.81 | 6.16 | 0.94 |
| man-days/ha B (incl. investmt costs) | 56 | 86 | |
| phys. productivity of labor B (kg/day) | 4.46 | 5.23 | 0.85 |
| II. Cost-based measures | | | |
| Total production costs (F/kg) | 5.91 | 5.00 | 1.18 |
| Farm-level production costs (F/kg) | 3.21 | 2.93 | 1.10 |
| Farm-level plus primary marketing costs (F/kg) | 4.45 | 3.67 | 1.21 |
| Commercialisation costs as % of total | 46 | 41 | |
| Net farm income (F/kg) (unsubsidised) | 0.09 | 1.00 | 0.09 |
| Net farm income (F/kg) (incl. subsidy) | 1.19 | 1.47 | 0.81 |
| returns to manday A (F/day) | 14.23 | 18.23 | 0.78 |
| returns to manday B (F/day) | 10.93 | 15.48 | 0.71 |
| additional returns to manday B with subsidy | 4.91 | 2.46 | |
| Local value added (F/kg) | 4.18 | 4.19 | 1.00 |
| Domestic Resource Cost (DRC) | | | |
| DRC at farm-gate | 0.49 | 0.42 | 1.14 |
| DRC after primary marketing | 0.69 | 0.54 | 1.30 |
| DRC total (c.i.f. basis) | 0.98 | 0.76 | 1.29 |

Table 5. Simulation experiments

| 1. Real currency depreciation 30% | Case I (Central) | % change from baseline | Case II (Western) | % change from baseline |
|---|---|---|---|---|
| **1.A. w/ constant nominal farm wages (30% increase cocoa price and imported goods)** | | | | |
| World Price in local currency (F/kg) | 7.80 | 30 | 7.80 | 30 |
| Total production costs (F/kg) | 6.46 | 9 | 5.54 | 11 |
| Farm-level production costs (F/kg) | 3.38 | 5 | 3.13 | 7 |
| Commercialisation costs as % of total | 48 | 4 | 44 | 5 |
| Net farm income (F/kg) | 1.34 | 1393 | 2.26 | 126 |
| returns to manday B (F/day) | 16.50 | 51 | 22.07 | 43 |
| Local value-added (F/kg) | 5.43 | 30 | 5.45 | 30 |
| DRC (total costs) | 0.75 | -23 | 0.59 | -23 |
| **1.B. w/ constant real farm wages (30 % increase in cocoa price, imported goods & farm wages)** | | | | |
| World Price in local currency (F/kg) | 7.80 | 30 | 7.80 | 30 |
| Total production costs (F/kg) | 7.16 | 21 | 6.13 | 23 |
| Farm-level production costs (F/kg) | 4.10 | 28 | 3.72 | 27 |
| Commercialisation costs as % of total | 43 | -6 | 39 | -5 |
| Net farm income (F/kg) | 0.64 | 607 | 1.67 | 67 |
| returns to manday B (F/day) | 16.50 | 51 | 22.07 | 43 |
| Local value-added (F/kg) | 5.43 | 30 | 5.45 | 30 |
| DRC (total costs) | 0.88 | -10 | 0.69 | -10 |
| **2. Increase in farm input prices 30%** | | | | |
| World Price in local currency (F/kg) | 6.00 | 0 | 6.00 | 0 |
| Total production costs (F/kg) | 6.08 | 3 | 5.20 | 4 |
| Farm-level production costs (F/kg) | 3.38 | 5 | 3.13 | 7 |
| Commercialisation costs as % of total | 44 | -3 | 40 | -4 |
| Net farm income (F/kg) | -0.08 | -193 | 0.80 | -20 |
| returns to manday B (F/day) | 10.17 | -7 | 14.43 | -7 |
| Local value-added (F/kg) | 4.02 | -4 | 3.98 | -5 |
| DRC (total costs) | 1.02 | 4 | 0.80 | 5 |
| **3. Decrease in domestic marketing costs 30% (all commercialisation except c.i.f. handling)** | | | | |
| World Price in local currency (F/kg) | 6.00 | 0 | 6.00 | 0 |
| Total production costs (F/kg) | 5.29 | -10 | 4.57 | -9 |
| Farm-level production costs (F/kg) | 3.21 | 0 | 2.93 | 0 |
| Commercialisation costs as % of total | 39 | -14 | 36 | -14 |
| Net farm income (F/kg) | 0.71 | 687 | 1.43 | 43 |
| returns to manday B (F/day) | 17.49 | 19 | 22.79 | 11 |
| Local value-added (F/kg) | 4.36 | 4 | 4.34 | 4 |
| DRC (total costs) | 0.83 | -15 | 0.67 | 1 |
| **4. On-Farm labor productivity increase 30% (reduction in labor needed for maintenance & harvesting)** | | | | |
| man-days/ha A (recurrent only) | 30.17 | -30 | 51.10 | -30 |
| man-days/ha B (incl. investmt) | 43.17 | -23 | 64.10 | -25 |
| phys. productivity of labor B | 5.80 | 30 | 7.02 | 34 |
| returns to manday B (F/day) | 14.21 | 30 | 20.78 | 34 |

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