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Staff Paper

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Goods: Coffee in Northwest Cameroon.**

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Privatizing Markets for Heterogeneous, Experience Goods: Coffee in Northwest Cameroon.

Abstract

Reform and privatization of administratively controlled marketing parastatals is always a thorny issue. Reform of public coffee parastatals is one of the most fascinating—and trickiest—exercises in free-market development. Coffee, a heterogeneous, experience good, undergoes several processing stages with imperfect quality control, leading to agency problems. Successful privatization must address these problems.

This paper analyzes the reform and partial privatization of the North West Cooperative Association (NWCA) parastatal in Cameroon. A conceptual, principal-agent framework informs the analysis. In an interesting twist, the reforms structured the marketing chain so that farmers are the residual claimants to profits from international sales, in effect making them the principals. As is suggested by the conceptual framework, empirical work confirms that farmers as principals have reinvested in coffee quality. However, the evidence also shows that agency problems still exist at later stages of the marketing chain. This is consistent with the principal-agent framework, since incentive-compatible contracts are not used in this marketing chain. The paper concludes by drawing more general lessons about how incomplete information and incentive structure issues arising from imperfect markets might be handled within the context of market liberalization.

Introduction

The past dozen years have witnessed a change in development paradigms, from one of government intervention to privatization and increased reliance on the free market. Reform

and privatization of administratively controlled coffee marketing parastatals is one of the trickiest--and most fascinating--exercises in free-market development. Coffee is inherently a heterogeneous, experience good whose quality cannot be fully ascertained until the final product is brewed and tasted, but is affected by all agents in the marketing chain, from farmers to processors to roasters. Aggregation of the product to capture economies of scale further obscures the contribution of any agent to product quality. The market price of intermediate products, such as unroasted coffee beans, reflects neither the quality of the intermediate product, since that is unknown at the time of sale, nor the value that the selling agent has added to the product or product quality. Consequently, simple reliance on market price as an information mechanism fails to provide effective vertical coordination or quality control. Can free markets spur development in this situation?

An effective marketing institution must address competing needs: quick aggregation to achieve economies of scale v. maintaining disaggregate product to provide each farmer with specific information on product quality. Simultaneously, it also must address the classical principal-agent issue: how to provide incentive-compatible contracts so that each agent maintains coffee quality. Coffee-parastatal privatization is thus a fascinating exercise in informational and institutional innovation.

This paper analyzes the reform and partial privatization of the North West Cooperative Association (NWCA) in Cameroon. Originating in response to farmer initiatives, by 1991 the NWCA had become the buying agent of an administrative parastatal with little opportunity or incentive to assist the development of the coffee sector, and had degenerated into a bloated and financially unsustainable bureaucracy. Under pressure from domestic budgets and

international donors, between 1991 and 1994 the Government of Cameroon privatized most of the NWCA and eliminated the administrative parastatal. This paper focuses on agency as creating problems with quality control in the case of NWCA coffee, and draws more general lessons about how incomplete information and incentive structure issues arising from imperfect markets might be handled within the context of market liberalization.

The paper is organized as follows. The next section presents background information on coffee, production in the NWCA region, and details on the institutional structure and innovation. The third section quickly develops a conceptual framework for analyzing the problem, based on principal-agent theory. The fourth section uses regression analysis to determine the effect of institutional reform on coffee quality. The final section draws conclusions.

Background.

Coffee Quality

Different coffees bring varying qualities of different characteristics to the table. Arabica coffee exhibits complex and often subtle differences in aroma, taste, flavor, body ('mouthfeel') and acidity, and buyers appreciate and value a range of desirable characteristics (Wrigley, 1988). Coffee is also an experience good. The quality of any shipment can be determined accurately only by tasting the finished product: a brewed cup of coffee, usually evaluated by an experienced taster from an importing country. In the interim, the coffee has been grown, picked, pulped, fermented, rinsed, dried, hulled, graded, sorted, stored, shipped, roasted, and brewed. Each of these intermediate activities affects the quality of the final

product. Since quality can be measured only imprecisely, if at all, at the intermediate stages, the private market's best coordination mechanism—price (Milgrom and Roberts, 1992)—is unlikely to contain information sufficient to provide appropriate quality incentives for farm and intermediate producers (Klitgaard, 1991).

Coffee Production in Northwest Cameroon

Cameroon produces arabica coffee in the highland (1200-1800m) areas of the North West (NW) and West provinces--the only areas of the country that meet the relatively narrow temperature, soil and moisture requirements for arabica production. Arabica coffee is grown on evergreen trees with life spans of about 40 years. As a result of differences in climate, soil characteristics and varieties, buyers often associate distinctive quality attributes with arabica coffee from specific origins.

Cameroonian arabica, although potentially a high-quality coffee, has been plagued by quality problems. Key on-farm determinants of quality include weeding, fertilization, pruning and chemical spraying to control fungi and insects. Harvesting also plays a critical role in determining coffee quality. If the farmer chooses 'unwashed' harvesting, the arabica 'cherries' are left on the tree until they dry and are harvested in a single picking. This reduces harvest costs. However, overripe and dried cherries produce undesirable hard and woody liquors in the cup. A farmer choosing 'washed' harvesting picks beans as they ripen over a period of about two months (within the December to March period in Cameroon). Each picking is washed; washing consists of removing the pulp, fermenting, rinsing and drying the cherries. The tricks in washing are to begin with 24-36 hours after harvesting, and to control

the rate and extent of coffee's natural fermentation process, which requires delicacy and specialized knowledge (Coste, 1992). In Cameroon, washing is an on-farm process performed by thousands of farmers.¹ Poorly washed coffee produces a range of off-flavors and unpleasant tastes that significantly lower quality. Drying that fails to arrest the fermentation process also leads to severe quality problems such as stinker beans--over-fermented beans that are difficult to detect before roasting, and produce a noxious odor during roasting that renders all the beans in that roasting unusable (Pochet, 1990). After washing and drying, the beans remain covered by a parchment skin and a tight, membranous silverskin. Coffee at this stage is referred to as parchment coffee. Although the washing technique is more complex and costly than dry processing, international buyers generally consider unwashed arabica to be of lower quality than properly washed and dried coffee, and price it accordingly.

Properly washed parchment stores well on the farm in low-humidity conditions. Between mid-November and mid-April, Cameroon is in the dry season, and coffee stores well. Humidity levels climb quickly after the rains begin in mid to late April, so transport to hulling facilities before the onset of the rains is important to maintaining coffee quality.

At the milling facilities, secondary processing involves removal of the parchment layer and silverskin from the beans (hulling), grading, sorting, and picking out defective beans. Correct sorting and picking removes many, but not all, of the defective beans that lower cup quality. After secondary processing the beans, at this stage called 'green coffee', are bagged for sale on the international market.

The post-farm processing of coffee is characterized by important economies of scale (Bates, 1989). These economies arise in the transport of coffee from the farmer to the hulling mill, in meeting the scale requirements of mechanized hulling mills, in transport from the mill to the port, and in international shipping. For example, most small farmers produces 120-300 kg of coffee, but a mill needs to process about 500t a year to operate on a cost-effective basis (Agrar und Hydrotechnik, 1985). To realize these economies, coffee is progressively aggregated, or pooled, as it moves through the marketing chain from farm to port to port.

A poor job by any one farmer in producing, harvesting, washing or storing coffee usually degrades the quality of any pooled coffee containing some of that farmer's beans. Consequently it is important to provide each farmer with incentives to produce high-quality beans. However, since cup attributes are often not determined until after aggregation of beans, it is difficult to trace any quality deterioration to specific farmers or activities. Thus, pooling also means that one can't link market prices back to individual farmers, so that the price system may fail to reward individual producers for maintaining high quality.

The institutional challenge is to design a system that maintains economies of scale while providing appropriate incentives to farmers, through innovative pricing mechanisms, cooperative actions, or other means.

Institutional Structure Prior to Reform.

The NWCA is a federation of cooperatives with three tiers: primary societies, which are village-level collectives of coffee farmers; union cooperatives, which are collections of primary societies; and a central administration called the Apex (Figure 1). Between the 1978

and 1991 seasons,² the NWCA operated as a field agent of the National Produce Marketing Board, a centrally administered purchasing and marketing organization that enjoyed legal monopoly powers in the NW province.³ The NWCA objective, as defined by the Marketing Board, was to buy coffee from farmers, and then pass it on to the Board, who sold it to exporters (Figure 1). The NWCA gave little attention to the quality of the coffee it accepted. The Marketing Board determined prices paid at each level of the coffee sector, and had sole claim to any residual earnings, including quality premia, realized from export sales. Profits (or losses) for either farmers or the NWCA did not affect the incentives for NWCA administrators (Galabe and Mallet, 1990).

The centrally administered marketing institutions in existence prior to 1990 failed to generate realistic incentives for farmers and thus were ineffective in controlling quality at the farm level. Three examples highlight the problems:

1. Between 1985 and 1989, the Marketing Board fixed washed and unwashed Arabica prices at 475 and 440 CFAF/kilo respectively; the cost to the farmer of washing was 60-100 CFAF. Consequently, farmers invested little effort in washing (Wyeth, 1990)
2. Marketing Board delays in releasing funds to the NWCA resulted in untimely coffee purchases (Agrar und Hydrotechnik). In 1990 and 1991 the Board was insolvent and provided no money to NWCA; coffee was stored on-farm in poor conditions until late in 1991 when donors stepped in.
3. The proportion of revenues returned to farmers was low relative to successful African coffee producers (Kristjanson et al., 1990) leading the US Agency for International

Development (US AID) to conclude that the “not-so-hidden agenda of the government pricing policy has been to tax the producers of export crops (USAID, 1990).

Institutional Reform, 1991-1994

Over the period 1991-1994, the government of Cameroon instituted several major institutional and policy innovations in a process of market liberalization. We briefly highlight the most relevant changes. Each of these changes reflects an attempt to provide targeted incentives to maintain coffee quality throughout the on- and off-farm production processes.

In 1991 the Marketing Board officially disbanded. The Apex obtained rights to market coffee internationally, including any unsold 1990 crop. Between 1991 and 1993, instead of fixing uniform national coffee prices, the government (the Ministry of Commerce and Trade in consultation with the Ministry of Agriculture) began establishing minimum coffee prices in consultation with cooperatives. The NWCA became responsible for its financial sustainability, and primary societies became the residual claimant to any profits from coffee sales. In 1993 farmers first received bonuses from these residual payments: all farmers received at least a 20 CFAF bonus, with an average bonus of 27 CFAF/kg.

In 1991, US AID established a revolving fund for NWCA using project funds from the Cameroon government and US AID to fill the void left when the Marketing Board and its financing of NWCA collapsed. In 1992, fund levels were sufficient so that NWCA was able to purchase the majority of the harvest prior to the onset of the rainy season (Figure 2). However, cash flow problems were severe during the peak harvest period, raising questions

about farmers' incentives to maintain coffee quality. In 1993 NWCA by-passed the US AID fund and got free credit from Europeans.

Beginning with the 1992 season, NWCA decided to accept, process and market unwashed coffee separately. In the 1993 season, union cooperatives deferred acceptance of unwashed coffee until after all washed parchment had been accepted. Six union cooperatives accepted no unwashed coffee.

In 1994 the government introduced autonomous pricing arrangements within the NWCA hierarchy. Farmers still received a minimum price, and the primary societies remained the claimants to any residual profits realized once the coffee is sold on the world markets. The Apex and the union cooperatives negotiated fees for their services. Primary societies unhappy with union charges could choose not to sell their coffee that year, or sell it to other union cooperatives. There is some evidence that these options are costly (due to high transportation costs) but viable, especially where union spheres of operation overlap.

Analyzing the Reforms in the Principal-Agent Framework

The Principal-Agent Framework

The principal-agent framework is a conceptual tool for analyzing problems in which the quantity or quality of a product depends on unobservable actions of economic agents. The principal is the 'owner' of a firm: she is the claimant to the profits earned in producing some product. Her profits depend, for example, on the quality of the good produced. This quality depends in turn on her employees'—the agents'—characteristics (ability) and actions (effort). The principal cannot directly observe either an agent's ability or effort, although each agent

knows his own ability and effort. The principal's objective is to match high-skill jobs with high-skill employees and/or to prevent employees from putting little effort into the job (shirking) (Milgrom and Roberts).

The solution to the principal's quandary is to write incentive compatible contracts. An incentive-compatible contract is one which provides agents with incentives truthfully to reveal their ability level and not to shirk. The key to writing such contracts is to make the agent's reward depend on the value (quality) of the product in a way that adequately compensates the agent for selecting an appropriate job and for putting forth an 'honest effort'.

Prior to reform, the Marketing Board played the role of the principal. The board had control of the marketing chain, designed contracts for the unions and farmer societies, and was the claimant to any residual profits (although they weren't held accountable for negative profits). The farmers and processors played the role of agents. Their actions affected the quality of the coffee, and hence the price received by the Marketing Board. However, the Marketing Board either didn't know principal-agent theory or saw no need to use incentive-compatible contracts. In particular, farmers were required to join primary societies, who were allowed to sell only to unions, who were allowed to sell only to the NWCA Apex, who was allowed to sell only to the Marketing Board, all at prices determined by the Marketing Board and independent of the quality-dependent price received by the marketing board. Hence, farmers, unions and the Apex had no incentives to maintain or improve product quality.

A Principal-Agent Perspective on NWCA Reform

The proximate consequence of the reform and liberalization of the NW coffee marketing institutions is to provide all participants with greater flexibility and incentives to act as profit-maximizing firms.

The reforms made the primary societies the residual claimants. This essentially puts them in the role of the principal—with the added bit of realism that the principals' actions also influence product quality. The principal-agent intuition is that farmers will now be more concerned about product quality, and will take action to improve quality.

Even though bean quality is difficult to determine at the primary-society level, farmers can take actions to improve quality. For example, drying beans on the ground is cheap and easy, but tends to deteriorate quality as the beans pick up flavors from the ground. Once the beans are picked up, it is difficult to tell where they have been dried until flavors show up in the brewed coffee. After reform, when farmers' payments depend on the quality of their coffee, they have incentives to use drying racks or other methods that preserve coffee quality.

Following reform, the unions and Apex negotiate processing and marketing fees with the primary societies. To the extent that these fees are incentive compatible, the unions and Apex will also take actions to insure product quality. However, these contracts are simply specified in terms of price per unit. Thus, they are not incentive compatible, *per se*. That is, the unions and the Apex receive no additional benefit from maintaining product quality, and so have no incentive to do so. In a competitive market, one could argue that 'voting with your feet' would suffice. However, the Apex has no real competitors in Cameroon, and the union processing plants have local monopolies due to high transport costs. So raw competitive

forces are unlikely to insure coffee quality. The principal-agent intuition is thus that processing will not be conducted in a way which insures coffee quality.⁴

Quality Response

Supply response to institutional change typically consists of quantity and quality responses. Since coffee is a perennial, with trees taking several years between planting and peak harvests, it is too early to conclude much in the way of quantity response. Hence, we focus on quality response. This quality response may occur at the farm level and/or in processing and shipping.

Quality Response: Farmer Actions

The three short-run activities that farmers can undertake to improve the quality of their coffee are tending the coffee tree, including weeding, pruning, etc.; proper washing and drying of the harvested beans; and rapid sale of the beans. Farm-level data are unavailable on tending or replanting, but bean size is roughly correlated with the level of care given to the trees (Coste, Wrigley). Union records provide direct evidence on washing and sales date.

Institutional reform appears to have a positive effect on bean size. Coffee grades A, B, C, D and F categorize the size of the beans, with A being the largest and most desirable grade, and F being the smallest. Cameroon grade A commands a premium relative to grade B, grade C is rarely used, grade D is discounted and F is further discounted. Prior to institutional reform, the only data available on the proportions of the different grades produced are from the period 1979-1984. From 1979-84 the average proportion of grade A

or B beans was 43.3% (Figure 3). At the onset of reform, in 1991, the proportion is 39.1%; this reflects farmer actions taken in the pre-reform regime. From 1992 to 1995, the proportion of grade A or B beans has ranged from 50 to 56.5%, a notable increase over the pre-reform proportion. Field visits indicating substantially better plot cleaning and tree pruning corroborate this finding.

Official statistics place the proportion of unwashed coffee at about 14 percent prior to institutional reform. As noted above, reform consisted of changes in the washed-unwashed price differential to cover the farmer's costs of washing and preferential acceptance of washed beans. NWCA implemented these reforms in 1992, and the proportion of unwashed beans fell to 3.1 %, less than one-fourth of the previous proportion (Figure 4). In 1993 the proportion of unwashed beans doubled to 6.2 %. However, it was not until April 20, 1993 that the government announced the minimum price--after coffee had been harvested and in some cases sold. Given the considerable uncertainty about prices and prior low returns to washing, many producers apparently decided to market their coffee as unwashed. For the 1994 and 1995 seasons, with price differentials in place, the proportion of unwashed beans fell to 2.5 and 3.7 %, respectively.

Farmers and primary societies in the NW province have limited ability to maintain coffee quality if they store it during the rainy season. Thus it is important that farmers deliver the coffee to primary societies and primary societies to union mills during the dry season in which the coffee is harvested. Prior to institutional reform, 40 to 80 percent of the coffee was delivered after the onset of the rainy season (Figure 2). Starting in 1992, 95 percent or more of coffee was delivered to the mills during the dry season in which it was harvested.

Anecdotal evidence attributes this change in farmer behavior to the availability of funds for unions to pay the minimum price at the time of harvest.

This evidence suggests that the reforms had important effects on coffee quality *via* increased farmer washing of picked beans, and more rapid sale of coffee to processors.

The final determination of coffee quality is a cup test. In 1990, buyers and independent consultants evaluated NWCA coffee as poor quality, plagued by stinker beans and unclean cups related to over-fermented beans (USAID communication). In 1991, a British firm noted that some NWCA samples had desirable characteristics such as high acidity and good appearance, but cup tastes revealed musty, earthy and unclean tastes, suggesting that farmers had dried coffee on the ground where beans pick up flavors and humidity from the soil. Cup tests in 1992 revealed unclean tastes associated with “over-fermentation and faulty drying” (Resta, 1992). These problems continued in 1993.

In 1994, the NWCA began quality improvement efforts at the farm level and an emphasis on enforcing parchment acceptance procedures. Visual inspection of intermediate products suggested that quality had improved. Buyer reports were mixed. A British firm reported that samples yielded “clean cups typical of ‘East African’ [high-quality] baskets”, and the color, appearance, body and flavor of the samples were acceptable (NWCA, 1994). A German buyer rated a sample “very good.” However, two buyers rejected 225 t (or 7.2% of production) because of poor cup quality, including potato tastes, and “strong, unclean tastes--even stinkers” (NWCA, 1994). The 1995 season exhibited similar, mixed results. The NWCA reported improved parchment appearance (personal communication), but a Cameroonian cup taste cited foreign odors and flat tastes, with quality claims affecting 9% of

the coffee (NWCA, 1995). One possibility, which we shall examine momentarily, is that NW province farmers improved their washing technique, but that unions imported low-quality coffee from outside the region to capitalize upon economies of scale.⁵

Union Cooperative Acceptance Procedures

The NWCA reform changed the nature of the contract between the union cooperative mills and the societies. After reform, unions must specify to the societies a price for milling services, and are responsible for their own financial solvency. Thus, they have incentives to reduce their per-unit costs by accepting as much parchment as possible (capacity constraints are not binding), regardless of the quality. Current contracting procedures offer no countervailing tradeoff: milling fees are not reduced if unions inadequately enforce parchment acceptance procedures. Thus, farm-level quality improvements may be at least partially offset by a lack of union quality control, leading to limited improvement in the quality of the coffee beans sold on the world market.

One simple way for union cooperatives to increase their utilization rate is to accept coffee from outside the NW province. Prior to reform, the neighboring parastatal paid more reliably and coffee tended to flow out of NW province into the parallel market. The NWCA reform significantly reduced processing costs and raised producer prices in the NW province, providing incentives for West province farmers to export their coffee to NWCA. Union mills wanting to reduce costs through economies of scale had incentives to accept this coffee. Exports from the West to NW province are often handled by politically powerful traders, which may help their coffee receive an inflated quality rating. Field evidence suggests that

primary societies located near the border and known for trading were delivering large amounts of poor quality coffee.

To validate the hypothesis that poor-quality coffee is flowing in from the West province, we examine the throughput of the processors (unfortunately, no direct measures of cross-province coffee trade are available). We classify the union cooperatives as border or interior, depending on their accessibility to neighboring-province farmers. If coffee is flowing from the West to the NW province, we would expect most of this to be processed by border cooperatives. Thus, if the border cooperatives exhibit a large increase in throughput relative to the interior cooperatives, we find support for the hypothesis; if not, we reject the hypothesis. In 1994, when the NWCA price was high relative to prices in the West Province, and provincial imports were legal, the quantity processed by border unions increased an average of 67% (Figure 5), about 4 times the 17% increase seen by interior unions. This difference in quantity growth most likely reflects imports from the neighboring province. In 1995, quantity grew at about the same rate in border and interior unions, indicating that the 1994 increase is the type of one-time, persistent change associated with policy shifts. This evidence corroborates the hypothesis that NW unions are processing coffee harvested outside the NW province.

Summary of Descriptive Evidence

The descriptive evidence is consistent with the hypothesis that making farmers the residual claimants has created incentives for farmers to maintain coffee quality. Evidence that farmers are responding to these incentives includes an increase in the bean size, an increase in

the proportion of coffee washed, and more rapid sale of coffee. Union cooperatives are acting in their own best interest to take advantage of economies of scale by pooling NW coffee with lower-quality coffee from the West province. This issue is not the type of unverifiable asymmetric information issue that typifies principal-agent relationships: whether or not unions are accepting coffee from the West province should be directly verifiable at minimal cost, and penalties for so doing could be written into the primary society/union cooperative contract.

Quality response: Modeling Coffee Price.

Perhaps the ultimate test of the quality of beans sold on the world market is the price they command. This section provides a regression model of NW province coffee prices that accounts for the various institutional reforms discussed above. The regression provides statistical tests of the relationship between quality-improving farmer actions and the price premium received.

The data set contains information on 193 coffee sales of NW coffee to international coffee merchants during 1991-1994, the period of and immediately following the institutional reform. The available information includes price, quantity, grade, buyer, date of contract, month of harvest, and type of pricing. The type of pricing is either an average price for the entire shipment of various grades, or the contract specifies prices for each grade in the shipment (if there is more than one); in the latter case, we count each price specification as a distinct sale. We supplement this contract-level data with annual data on the proportion of unwashed coffee.

The price received by NW coffee on the world market is determined by the ‘world price’, the world coffee market situation, quality premia associated with NW coffee, and a stochastic error. To focus on quality issues, the dependent variable is defined to be the absolute difference between the price received and the New York C (NYC) coffee price.

The explanatory variables include the time elapsed from the beginning of the harvest to shipping; the unwashed proportion of the annual harvest; and dummy variables for coffee grades A, B, D and F; each of these variables represents a measure of coffee quality. The size of the shipment, and whether the contract specifies prices by grades or an average price for the entire shipment are included to represent improvements in the marketing itself. The New York C price is included to represent world market effects. Since coffee demand is relatively stable and inelastic, an increase in the NY C price indicates a shortage of lower-quality coffee. This is hypothesized to have a positive effect on the relative price received for NWCA coffee. Dummy variables representing individual characteristics of the crop seasons are also included. Due to the very small amounts of grade C coffee sold, the coffee grade dummy variables and the intercept are effectively collinear, and so an intercept term is omitted.

The regression equation is thus

$$P - P_{NYC} = \sum_{i=1}^3 \alpha_i Q_i + \alpha_4 AP Dummy + \alpha_5 P_{NYC} + \sum_{i=A,B,D,F} \beta_i GDummy_i + \sum_{i=1}^4 \gamma_i SDummy_i + e$$

where P is the price received, P_{NYC} is the New York C grade price, the Q_i are the quality and economies-of-scale variables (time from harvest to shipping, size of shipment, unwashed

percentage of annual harvest), APDummy is a dummy variable taking on the value one if the contract specifies only an average price, the GDummy are dummy variables representing the grade of coffee sold, the SDummy are dummy variables representing the season in which the coffee is grown, and e is an error term.

Equation (1) is estimated using OLS. Regression diagnostic indicate nice goodness of fit, with an R^2 of 0.84, and a regression F-statistic that is significant at the 1% level (Table 1). All but one of the variables (the 1994 year dummy) have the expected sign, and most are statistically significant.

The time elapsed between harvesting and shipping is statistically significant at the one percent level. The coefficient has the expected negative sign, indicating that more time elapsed lowers the price received, and the magnitude of the coefficient is economically significant. For example, if the elapsed time decreases by six months and 4,000 t are shipped (about the 1993 production), the more rapid shipping translates into revenue increases of over US\$ 300,000.

Premia are paid for larger shipments. Even though the coefficient is statistically significant at the 1% level, the magnitude of the effect is small and of minor economic importance.

The unwashed percentage is statistically significant at the 1% level with the expected negative sign. This is the most economically important variable: a decrease of 10 percentage points in the proportion of unwashed coffee increases the sales value of a 4000 t crop by nearly US\$ 1 million.

Average-price contracts are discounted relative to other contracts, but are not statistically significant. The New York C price is positive as expected and statistically significant at the 1% level. Not surprisingly, this suggests that NWCA benefits from poor coffee crops in other parts of the world. However, most of the variation in the price variable occurs with the rise in prices in the 1994 season; it is possible that the price variable is picking up some market improvement or other effects associated with 1994.

It should be noted that the unwashed percentage, average price, and New York C price variables exhibit some degree of collinearity, so that the confidence intervals associated with these coefficients may not be robust to alternative specifications (although experiments by the authors did not turn up any real surprises, only low t-statistics in some model formulations).

The coffee grade dummy variables show the expected pattern, with grade A coffee receiving a premium and grades D and F being discounted. The coefficient estimate for grade A is statistically significant at the five percent level, coefficient estimates for D and F are significant at the one percent level. Grade B does not generate a statistically significant coefficient: because of the lower overall quality of the NW coffee, there is a close correspondence between the NYC price and the price received for NW B coffee (there is very little NW grade C coffee produced, and the NWCA reserves the C grade for an especially small bean called a peaberry). The premia and discounts associated with higher-grade coffee are potentially important economically—a discount of up to US\$ 0.08 / lb for grade F relative to a premium of US\$ 0.02 / lb for grade A coffee. This could amount to as much as US \$

800,000 for a 4,000 t shipment of grade A v. grade F, but at realized levels bean improvement is more realistically valued at \$50,000 to \$100,000 for a shipment of this size.

The annual dummy variables representing the 1991 and 1992 growing seasons are statistically significant at the 1% level, the 1993 dummy is significant at the 10% level, and the 1994 dummy is not significant. These variables are interpreted relative to the omitted, 1990 season. The 1990 season witnessed the collapse of the Marketing Board, but the Board did not cede marketing rights to NWCA until June, 1991. In a period of general confusion, coffee was sold late, and at relatively poor prices.

The 1991 dummy-variable coefficient is strongly positive. Following Marketing Board inactivity in the previous season, the buyers Rothfos and UNIDAF bid up prices, apparently in strategic maneuvering by Rothfos to maintain market share and by UNIDAF to increase market share and establish the basis for a long-term relationship with NWCA (Table 2).

The defining characteristic of the 1992 season is political instability, including general strikes, road barricades, demonstrations and violence. Following election results that were viewed as fraudulent in the NW province, a state of emergency was imposed on the province between Oct. 23 and Dec. 29, 1992. This may have affected coffee marketing; it certainly disrupted market preparations and the implementation of reforms, and may have worried buyers. The dummy-variable coefficient for this year is strongly negative.

The 1993 season marked the first time that NWCA had a marketing department, and along with a marketing consultant, worked with buyers on preparing samples, improved communication, increased visibility, etc. The positive coefficient shows a price recovery from the low prices of the previous season.

The 1994 season marked the first season of full reform, but the dummy variable is unexpectedly negative and not statistically significant. As noted above, this result may be related to the correlation between that variable and the New York C coffee price variable.

The overall results of the regression model provide evidence that reform has worked to increase the NWCA coffee price relative to the world price, corroborating the idea that reform has improved coffee quality. The biggest economic effect comes from reducing the proportion of unwashed coffee (about \$1 million annually). More rapid handling, processing and sale of coffee between harvest and shipping has an economic effect that is smaller in magnitude (\$300,000) but still important. Improvements in bean size have had a modest positive effect.

Conclusions

This paper has examined institutional reform of the coffee marketing parastatals in Cameroon's North West Province, and farmer, processor and marketer response to that reform. An appropriate framework in which to think about these reforms is the principal-agent framework. Prior to reform, the marketing board had the control of a principal, but was highly subsidized and seemed unconcerned about financial profitability. Farmers and processors were not given incentive-compatible contracts. Coffee quality deteriorated. As part of the reform, local groups of farmers (primary societies) were granted rights to residual profits from international sales of coffee, and processors and marketers were made responsible for their own finances. This essentially puts farmers in the role of the principal, and puts processors and marketers in the roles of agents.

As the principal-agent framework suggests, once the farmers became residual claimants, they worked to improve the quality of their product so that they would earn price premia.

Making processors responsible for their own financial sustainability has contributed to more rapid purchases of coffee from farmers, leading to fewer problems with poor on-farm storage conditions. However, processor contracts are not incentive compatible—they are usually specified on a fee-per-unit basis. There is no quality premium, nor do the processors share any profit. As the principal-agent framework suggests, these contracts do not provide an incentive for processors to maintain quality. The existence of economies of scale provides an incentive to combine coffees of various qualities. In particular, processors near the border of the North West and West provinces appear to be accepting lower-quality coffee from West province producers. This degrades the quality of any North West coffee with which it is aggregated.

Several conclusions emerge. First, the price of Cameroon coffee reflects the quality of the coffee. In particular, regression analysis shows that actions which improve quality generate a higher price premium (lower penalty) on the world market.

Second, farmers responded as expected to the market restructuring and their new role as claimants of residual profits via the primary societies. That is, farmers invested in improving coffee quality. Despite the nearly four decades that have elapsed since Schultz first argued that farmers are efficient, the fact that Cameroon coffee farmers are efficient producers of quality given the incentives and constraints they face this remains an important lesson in bureaucratically oriented Cameroon.

Third, the NWCA experience demonstrates that for a heterogeneous, experience good such as coffee, effective pricing mechanisms are difficult to construct for intermediate products whose quality is costly to determine. In particular, problems with processor acceptance procedures shows that spot-market pricing is not sufficient. At each stage of the marketing chain, it is imperative that handlers are rewarded for putting forth the extra effort it takes to maintain quality. In other words, incentive-compatible contracts are essential to a well-functioning coffee marketing chain.

The last conclusion is applicable to any situation with imperfect markets in which quality is an issue—in other words, a significant proportion of African economies. This is particularly the case when spot-market prices do not provide sufficient information to agents, whose actions affect product characteristics or quality. In these cases it is unlikely that spot market prices will provide the incentives necessary to maintain quality. The principal-agent framework suggests that incentive-compatible contracts are a potential solution to this problem. This is an important consideration for privatization, investment in market information systems, and market development.

An important new example of markets in which principal-agent problems are likely to arise is transgenic plant and animal products. For developing countries, who hope to export agricultural products, reliable certification that a shipment contains no transgenic plant products may command a price premium, or even be *de facto* requirement for export to markets such as the European Union. However, if the local marketers and aggregators have no incentive to segregate transgenic plant products, then it will be difficult if not impossible to earn this premium. The solution arising from the principal-agent framework is to seek

incentive-compatible contracts, so that it is in the best interest of the processors and marketers to undertake this segregation.

More generally, the framework and the results in this paper suggest that principal-agent framework is a useful tool for examining behavior and evaluating policy in the informationally imperfect markets which characterize many developing countries.

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Table 1. Regression Analysis of NWCA-NYC Coffee Price Differential.

| <u>Variable</u> <u>(t-statistic)</u> | <u>Price Differential in US¢/lb</u> |
|---|-------------------------------------|
| Time from harvest to shipping (in months) | -0.578 (-3.815)*** |
| Size of shipment (in tons) | 0.014 (3.565)*** |
| Unwashed % of annual harvest | -1.057 (-5.180)*** |
| Average-price contract dummy variable | -0.585 (-0.293) |
| New York C Price | 0.058 (2.974)*** |
| Grade A dummy variable | 1.914 (2.452)** |
| Grade B dummy variable | -0.304 (-0.376) |
| Grade D dummy variable | -3.042 (-3.712)*** |
| Grade F dummy variable | -7.864 (-9.531)*** |
| 1991 Season dummy | 9.074 (8.224)*** |
| 1992 Season dummy | -6.766 (-5.069)*** |
| 1993 Season dummy | 1.886 (1.846)* |
| 1994 Season dummy | -0.712 (-0.258) |
| Number of observations | 193 |
| Adjusted R-square | 0.840 |
| Regression F | 78.67*** |

Table 2. NWCA-NYC Percentage Price Differentials by Buyer and Grade, 1990-1991.

| Year Buyer (share) | Grade A | Grade B | Grade C | Grade D | Grade F |
|-----------------------|---------|---------|---------|---------|---------|
| 1990 | | | | | |
| Rothfos (92%) | -16.1 | -19.0 | -21.1 | -27.4 | -35.8 |
| UNIDAF (8%) | -25.8 | -28.0 | -28.0 | -30.2 | -34.6 |
| 1991 | | | | | |
| Rothfos (42%) | -3.0 | -5.6 | -5.6 | -8.2 | -13.4 |
| UNIDAF (58%) | -8.0 | -8.5 | -9.2 | -9.9 | -14.8 |

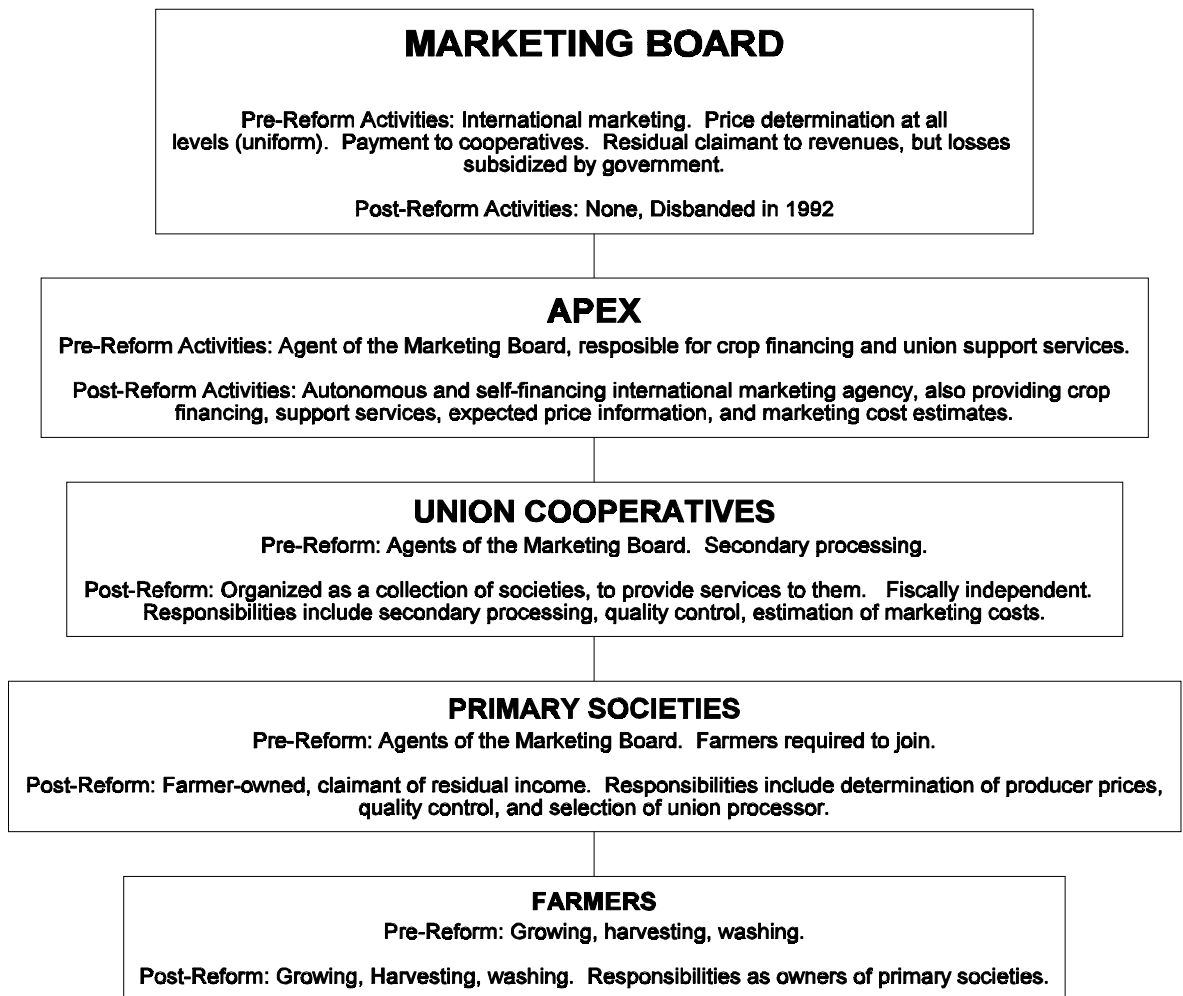


Figure 1. Schematic diagram of coffee marketing institutions and activities, pre and post reform.

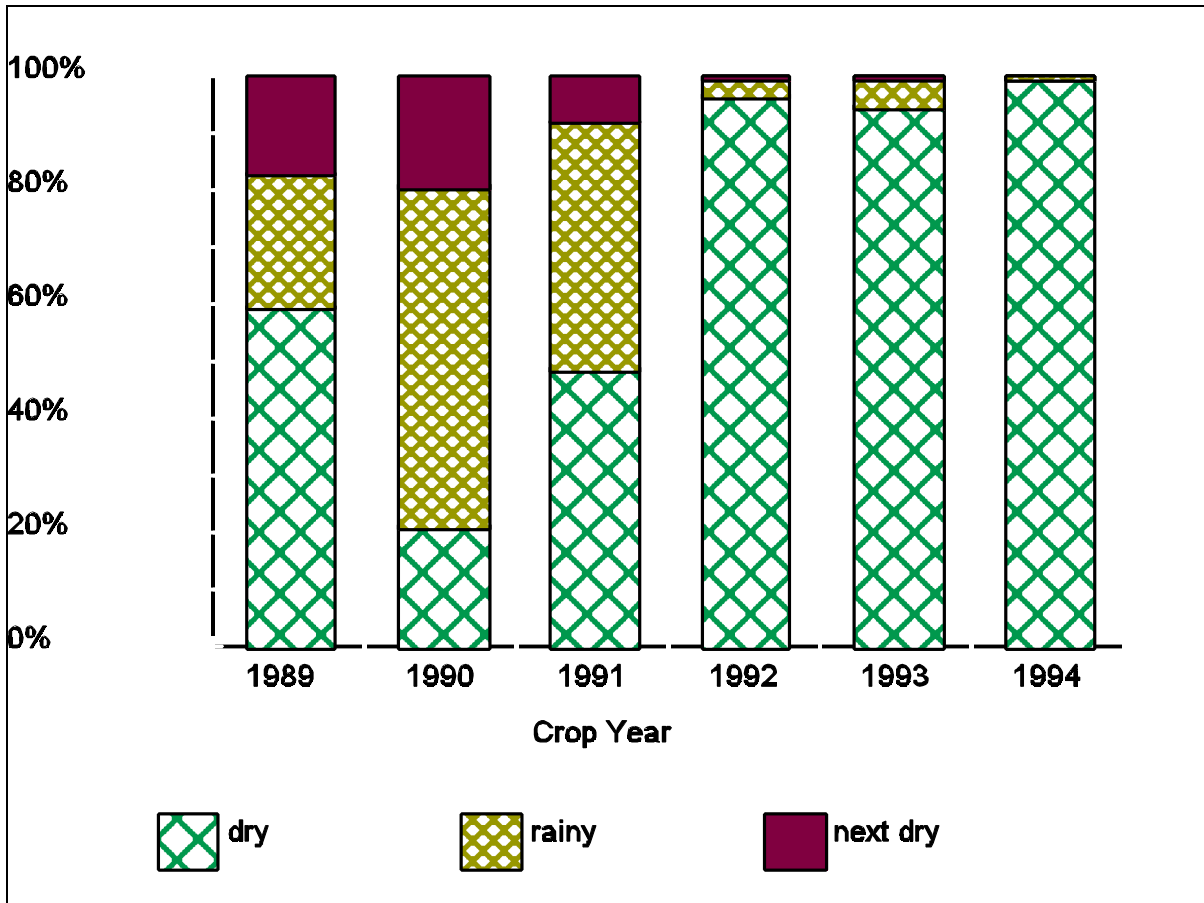


Figure 2. Coffee delivered by season--dry (optimal), rainy or next dry, as a proportion of total deliveries.

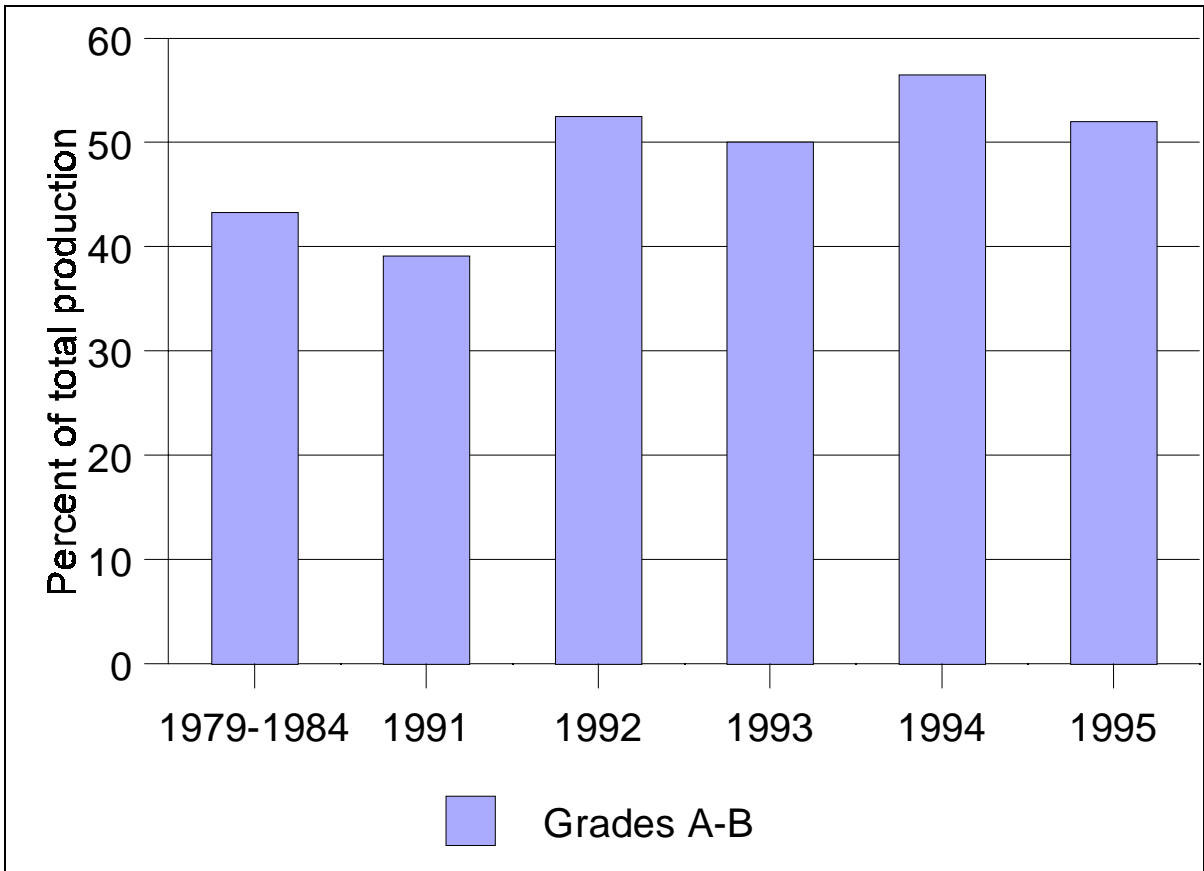


Figure 3. Percent of grade A-B beans in total North West Province production, 1979-1995.

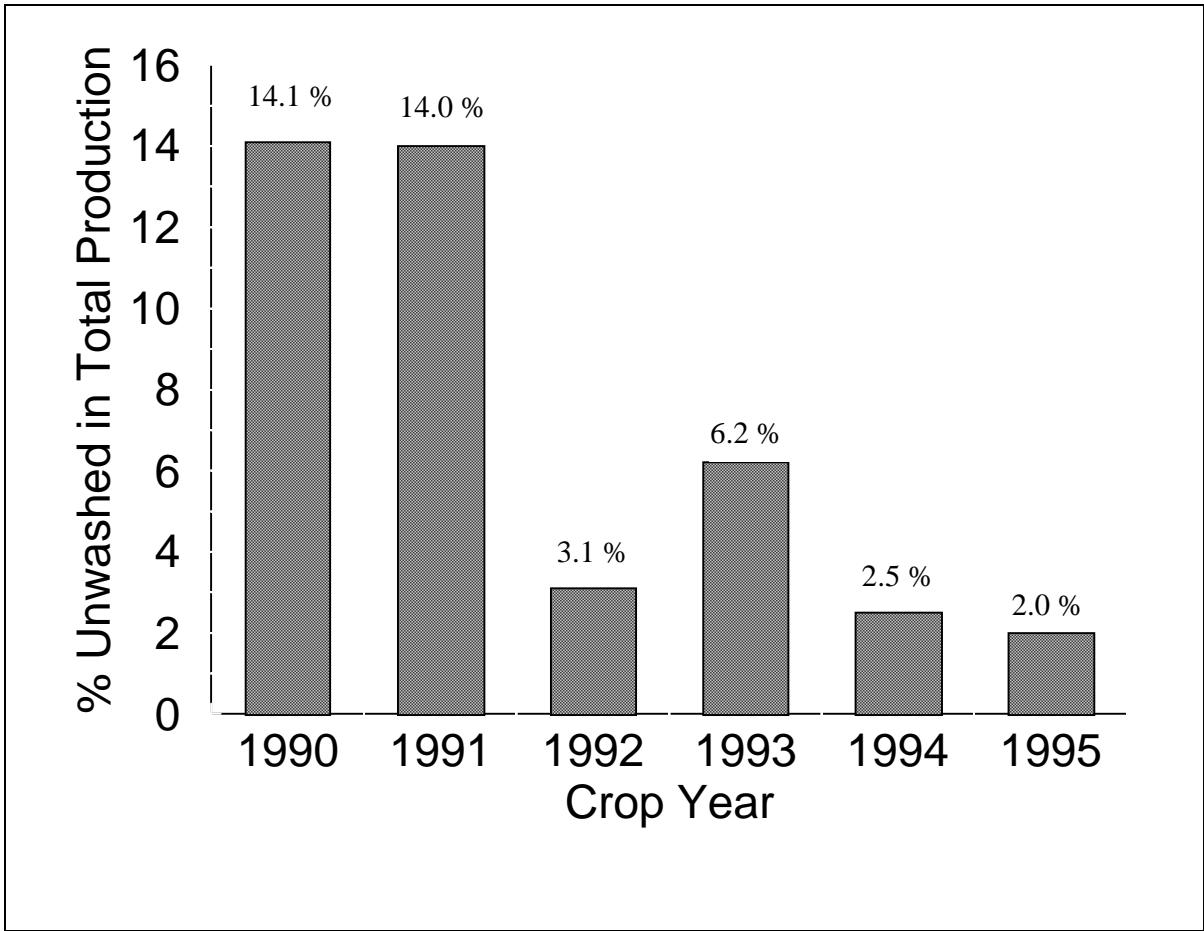


Figure 4. Percentage of unwashed coffee in total arabica production, official NWCA estimates, 1990-1995.

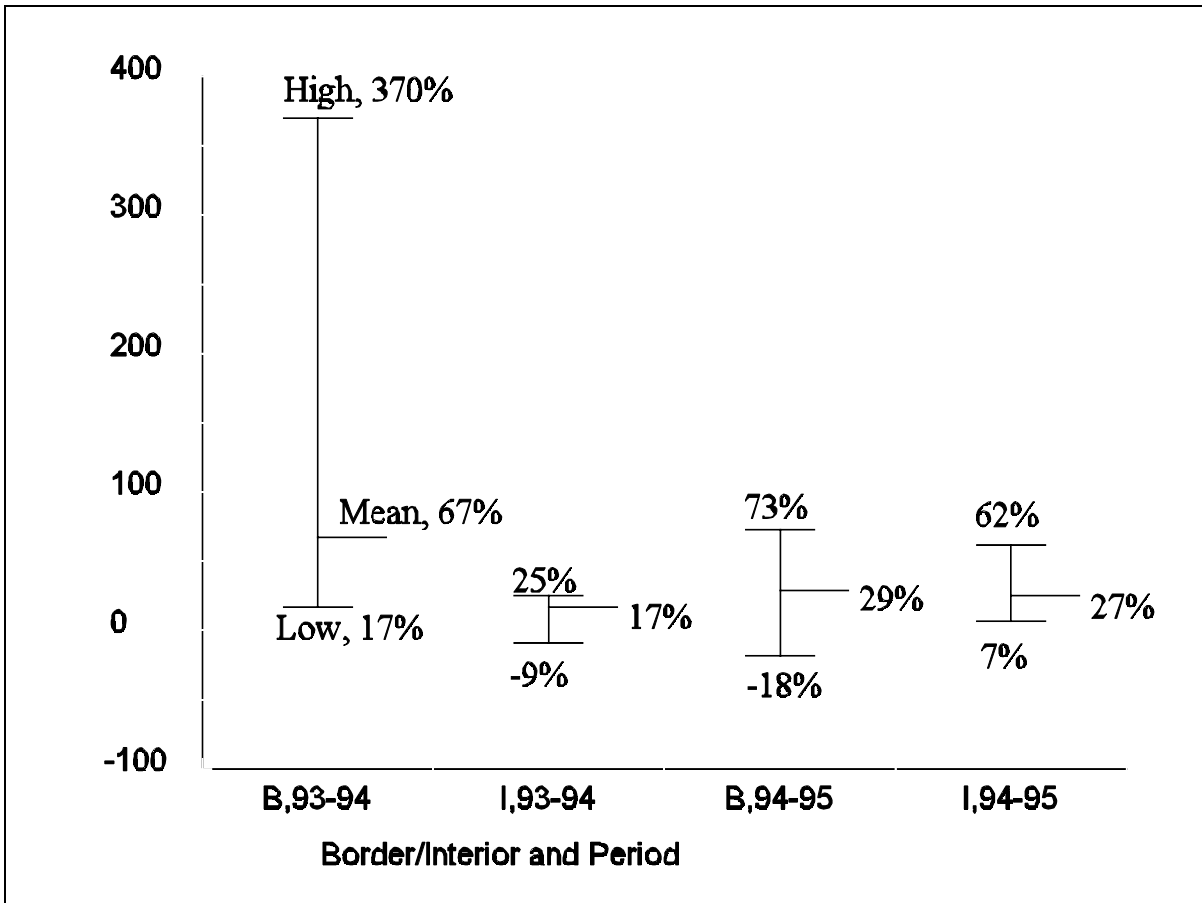


Figure 5. High, low and mean percentage changes in quantity processed, by border or interior location and year.

ENDNOTES

1. Centralized washing in Cameroon is considered infeasible in the near to medium term because of limited access to large water sources, poor transport and farmer unwillingness to carry heavy loads of ripe cherry long distances.
2. The internationally defined coffee marketing year runs from Oct 1 of the prior calendar year to Sept. 30.
3. Legal sanctions were apparently sufficient so that the producer price in the unsanctioned parallel market was typically below that offered by the NWCA.
4. In contrast, most unions have found ways to reduce their costs.