ALTERNATIVE GROWTH SCENARIOS FOR UGANDAN COFFEE TO 2020

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ABSTRACT

Coffee is the most important export crop in Uganda and an important source of income among smallholder farmers in large parts of the country. The Robusta type dominates coffee production and Ugandan Robusta is demanded by roasters as a component in certain blends due to its special taste qualities. However, a combination of events outside and within Uganda, especially the collapse of world coffee prices in the late 1990s, are eroding farmer incomes and export revenues and threaten the long-term viability of the industry. In this context, the paper first investigates the challenges faced by the Ugandan coffee industry, namely the decline in the world coffee market, changes in procurement strategies among coffee importers, the rapidly expanding market for high quality and specialty coffees, and the spread of the coffee wilt disease and other farm-level productivity constraints. This leads us to examine possible development strategies for Ugandan coffee production: area expansion, quality improvement, and productivity increase. Using IFPRI's Dynamic Research Evaluation for Management (DREAM) model, different scenarios for each of these strategies are evaluated to show their potential impacts on Ugandan export prices, export revenues, and producer benefits. The simulation results show that Uganda would benefit relatively more by enhancing farm productivity and improving coffee quality. The economic benefits of increasing production through area expansion, on the other hand, would be significantly eroded by the negative effects on export prices, especially if other countries followed suit and accelerated their own growth in coffee production. These analyses focus on the potential benefits of alternate changes in Ugandan coffee production, while devoting less attention to how and at what costs such changes may be effected. Finally, it is suggested that because the world coffee market is so important to the Ugandan economy, and being the third biggest Robusta producer in the world, Uganda has a high stake and important role to play in international coordination efforts to raise and stabilize world coffee prices.

Key Words: coffee production, commodity exports, quality, DREAM, development strategy evaluation, producer benefits, Uganda.

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ALTERNATIVE GROWTH SCENARIOS FOR UGANDAN COFFEE TO 2020

Liangzhi You[1] and Simon Bolwig[2]

1. INTRODUCTION

Coffee is the most important cash crop in Uganda. The Uganda Coffee Development Authority (UCDA) estimates that 500,000 households distributed over two-thirds of the country depend on coffee production as an important source of income (COMPETE 2002). Coffee production creates employment for an even larger number of people, as hired farm labor and in businesses such as processing, input supply, trading, and transport. In the coffee market year ending in September 2001, at historically low world market prices, Ugandan coffee exports generated 104.8 million US dollars (UCDA 2001). Coffee's share of total export revenues has declined dramatically in recent years, from 66.8% on average in 1991-95 to 31.2% in 2000, because of the world coffee price slump and, to a lesser extent, the growing importance of nontraditional exports such as fish products, cut flowers, cattle hides, and electrical current (UBOS 1999 & 2001). Coffee is mainly grown by smallholders with an estimated average coffee farm size of 0.58 hectares (UCDA 2000). Uganda produces both Robusta and Arabica coffees, with Robusta accounting for 85% of export volumes and 76% of export revenues in 2001. Domestic consumption is estimated at less than 5% of production. Uganda produces around 3% of the world's traded coffee and 9.1% of all Robustas (ICO export data from 2001). Ugandan Robusta is important in the world market because of its neutral flavor, which is mainly the result

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of being grown at higher altitudes than most other Robustas in the world, combined with high volumes (Ponte 2001:15; CFC 2001b). It is especially demanded by European roasters and commands a considerable premium over the world Robusta reference price (the 'LIFFE').

However, a combination of events outside and within Uganda, especially the collapse of Robusta world market prices, has put the Ugandan coffee industry under tremendous pressure during the last five years or so. These events are seriously eroding farmer incomes and export revenues, and may even threaten the long-term viability of the industry. In this context, this paper examines possible development strategies for the Ugandan coffee industry: area expansion, productivity increase, and quality improvements. Using the Dynamic Research Evaluation for Management (DREAM) model, different scenarios for each of these strategies are evaluated to show their different potential impacts on Ugandan export prices, export revenues, and producer and consumer benefits. These analyses focus on the potential benefits of alternative changes in Ugandan coffee production while devoting less attention to how and at what costs these changes may be effected.

2. CHALLENGES FOR THE UGANDAN COFFEE INDUSTRY

DECLINING WORLD MARKET PRICES

The most serious challenge to the Ugandan coffee industry is the dramatic drop in world coffee prices, which reached a 40-year low in 2001. The decline started around 1990 and accelerated after 1997 and was only temporarily offset by climate-induced low harvests in Brazil in 1994/95 and a speculative Arabica price hike in 1997 (see Figure 1). The immediate cause of the price slump is a chronic oversupply due to a rapid expansion of world coffee production,

especially Robusta, combined with a low and stable growth in consumption of about 1% per year in 1987-97 (Ponte 2002a). The major underlying cause was the ending in 1989 of the International Coffee Agreements that had regulated coffee exports and world prices since 1962 (Ponte 2002a). In this situation, through technical innovations and new plantings, world coffee production grew from 101.6 to 112.4 million bags between 1991 and 2000, causing stocks to rise in the consuming countries (Ibid; ICO 2002). Importers' stocks reached 638,000 tonnes in the beginning of 2000 (CFC 2001a), or 12% of world exports that year. The expansion of production was encouraged and partly financed by bilateral and multilateral donors, and has occurred mainly in Vietnam which increased Robusta production from 1.31 to 14.8 million bags during this period. Most analysts forecast that in the medium term the world coffee price will continue to be low or even decline further, driven largely by Robusta production in Brazil and Vietnam (COMPETE 2002). Because coffee consumption tends to increase with rising incomes but levels off at the highest income levels, the greatest increase in the demand for traditional industrial blends is – and will be – coming mainly from Asia and Eastern Europe (Ibid.). The increase in consumption of Robusta is around or slightly below zero percent in North America and Western Europe where the trend is towards increasing consumption of Arabica and specialty coffees (COMPETE 2002; Belling 2002).

Figure 1--Monthly Average Prices for Robusta and Arabica Coffee

(a) Robusta
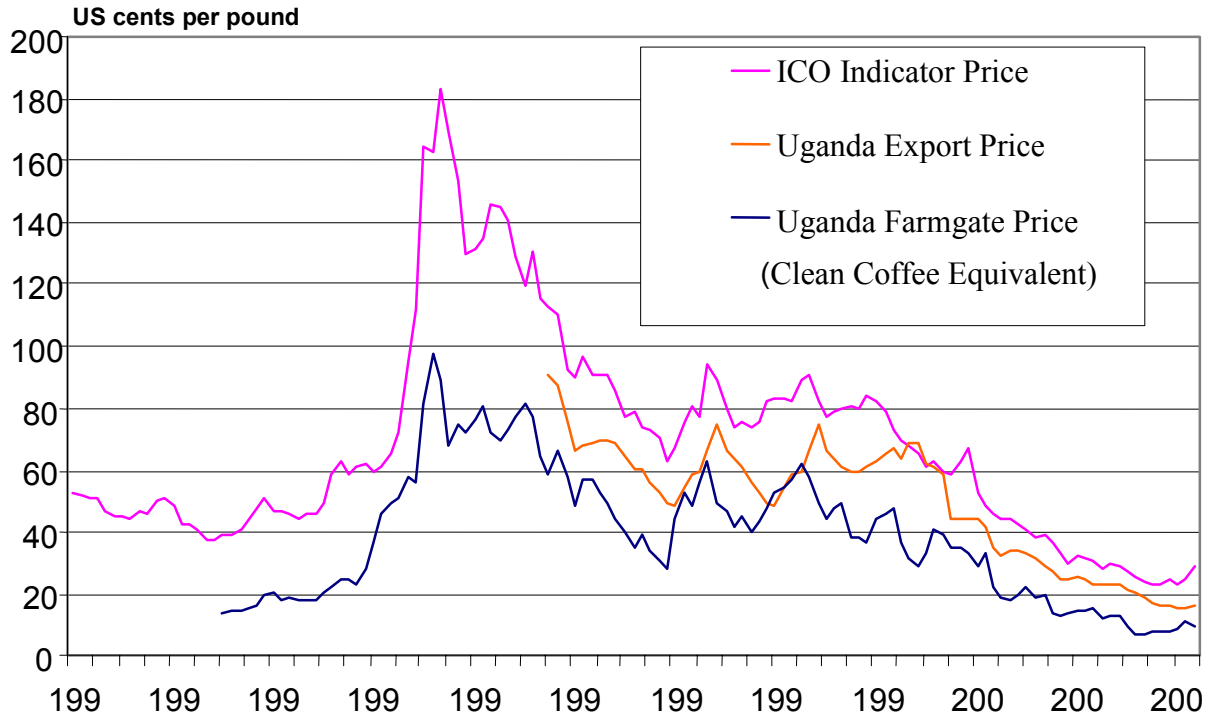
(b) Arabic
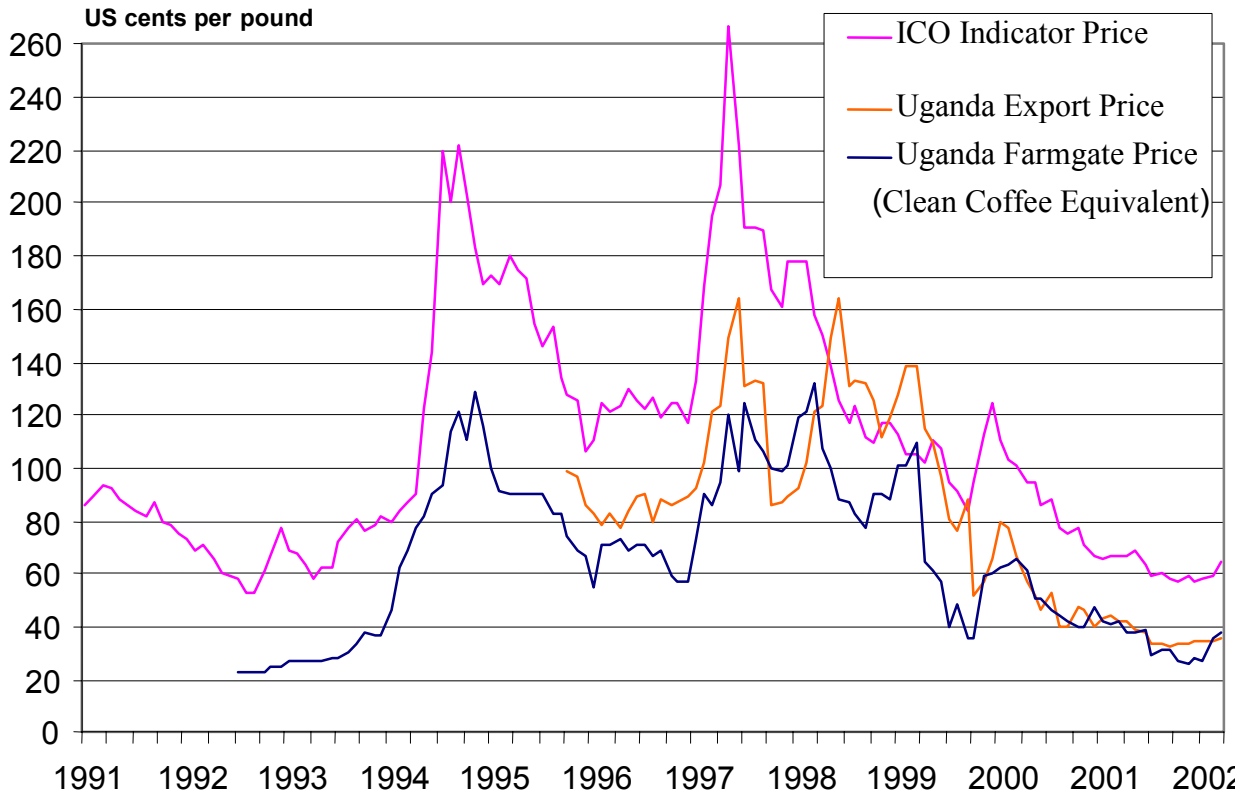
Ugandan export prices[3] follow closely the world market price (Figure 1). In the market years ending in 1987-89, before the breakdown of the ICA, the weighted average export price for Ugandan coffee was US$1.91 per kg. In 1990-93, it fell to US$0.92 per kg, rising to US$1.72 per kg in 1994-98, but then dropped to US$1.11 per kg in 1999-2000 before plunging to US$0.57 per kg in the 2001 market year (US$0.51 and 0.91 per kg for Robusta and Arabica respectively). In the first half of the 2002 market year, it ranged between US$0.43 and 0.52 per kg (UCDA, annual and monthly reports). As a result, the value of Ugandan coffee exports declined from US$283 million in 1999 to 104.8 million in 2001. In volume terms, Uganda exported on average 164,564 tonnes of coffee per year between 1965 and 1999, rising to above 200,000 tonnes in the mid 1970s and mid 1990s, and falling below 120,000 tonnes in the late 1970s and early 1990s. In 1999-2001 average annual exports were 192,800 tonnes. The average production growth rate in 1990-2000 was a stunning 6.8% per year due to favorable world market prices in the mid 1990s, increases in farmers' share of the export price (following liberalization), and an initial situation of relatively low production in the early 1990s.

The export price slump has had dramatic consequences for farm gate prices and hence smallholder coffee incomes, especially for Robusta. The average farm gate price for unhulled Robusta (*kiboko*) fell from UGX 647 to 263 per kg between 1999 and 2001, and to below UGX 200 per kg in December 2001. The farm gate price for Arabica 'parchment' (coffee beans pulped and dried by the farmer before delivery) has declined much slower in recent years, from an average of UGX 1830 per kg in 1999 to UGX 1200 per kg in 2001, reflecting the higher demand for higher-quality coffees. As shown in Figure 1, farm gate prices[4] closely followed Uganda

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[3] Free on Truck (FOT) or Free on Rail (FOR).

[4] Farm gate prices are "green coffee equivalent" in US cents per pound. They were calculated based on: monthly Arabica 'parchment' and Robusta *kiboko* farmgate prices (simple averages of price data collected monthly by

export prices in the last six years for which data exist. Our calculations show that Ugandan farmers' share of Robusta export prices rose from 71% to 85% between 1996 and 1998 and then declined to 53% in 2001 (Table A1). Farmers' share of Arabica export prices, in contrast, increased from 67% in 1999 to 95% in 2001, suggesting increased competition for Arabica among domestic traders.

CHANGING STRATEGIES AMONG ROASTERS OF UGANDAN ROBUSTA

New technologies and market strategies among the big roasters challenge Ugandan coffee producers and exporters with respect to maintaining the premium on dry processed Robustas (Ponte 2001). Due to its intrinsic taste qualities this coffee is demanded as a component in certain blends, especially espressos and instant coffee. But roasters are generally becoming more flexible in their choice of coffee types for their blends, which means that they can now more easily substitute Ugandan Robusta for hard Arabicas or combinations of lower grade Robustas and mild Arabicas.[5] Fortunately for Uganda producers these are not perfect substitutions in terms of price and quality. Roaster will therefore still prefer Ugandan Robusta (and pay the price premium), but only as long as the industry can maintain a stable supply of good quality beans in high volumes. This strategy is currently threatened by several factors, however. These include: the coffee wilt disease, which since 1993 has infected 40% of the original coffee trees and caused the destruction of 15.2 million trees (UCDA 2001 & pers. comm.); ageing trees and slow replanting rates; low ability to prevent crop losses caused by pests and droughts; and low and

UCDA's 25 field agents); an estimated out-turn after processing of 54% for Robusta *kiboko* and 80% for Arabica 'parchment'; and monthly exchange rates (Bureau Middle Rates) reported by Bank of Uganda.

[5] The new steam cleaning techniques adds to this flexibility by increasing the quality of lower grade coffees by removing some of the physical defects of the coffee bean, but it cannot significantly change its intrinsic taste qualities.

volatile domestic coffee prices which discourage farm investments, squeeze marketing margins, and make forward sales by exporters risky (Ponte 2001). High volume is the focus of the Government of Uganda's 2001 Strategic Export Plan, which sets a goal of increasing the current 3.6 million bags of coffee to 12 million bags by 2006. This goal appears unrealistic and undesirable, however, in light of the low producer prices and persistent oversupply of Robusta coffee in the world market. Instead, as our DREAM analysis will suggest, the industry should focus more on improving the quality of Robusta coffee. Increased flexibility by roasters also means that Uganda must maintain or (increase) its price competitiveness by enhancing farm productivity and lowering processing and marketing costs. We shall return to these issues below.

3. EMERGING MARKETS FOR HIGH QUALITY AND SPECIALTY COFFEES

Quality is a key factor for Uganda's access to the world coffee market and for the price obtained for its coffee. The price paid for different coffee qualities depends on the type of coffee (Arabica/Robusta), bean size (screen), processing (dry/wet), color, taste (cup), and the reputation of the country of origin (Belling 2002). In addition, Western consumers are increasingly willing to pay a higher price for coffee produced in socially and environmentally responsible ways, and in reputable localities or 'appellations'. Obtaining a price premium thus depends as much on the ability to "sell a story" as on the intrinsic qualities of the coffee (Ponte 2001).

A spectacular growth in the specialty coffee niche markets in North America and Western Europe in the 1990s (Ponte 2002b) provides the Ugandan coffee industry with an opportunity to increase its revenues from this market segment and so partly compensate for revenue losses in the industrial blends markets. 'Specialty coffee' here includes all coffees that are not traditional industrial blends, notably single-origin and high-grade Arabicas, coffee grown

in certified, environmentally friendly ways (organic, shade-grown, bird-friendly), and coffee sold through Fair Trade organizations, which guarantee a higher compensation to producers and workers (Ibid). The North American specialty coffee market is expanding by around 20% per year in retail sales terms and similar growth rates are observed in Europe (COMPETE 2002, Ponte 2002b). Globally, sales of so-called sustainable coffees (certified organic, fair trade, and shade-grown coffee) currently represent slightly less than one percent of the coffee market (Ponte 2002b). The global retail values of certified organic and fair trade coffees have been estimated at US$223 and US$393 million, respectively, in 2000 (Ibid).

All specialty coffees command a significant price premium in the market. Suppliers of sustainable coffees in North America fetch average premia of US$0.59 per pound for organic, US$0.62 for fair trade, and US$0.53 for shade-grown; yet these premia are not necessarily fully transferred to producers (Ponte 2002b). In Uganda, the *potential* increase in the export price of Organic and Organic Fair Trade coffee has been estimated at 72 and 489 percent, respectively, compared with conventional coffee, while the farm gate price could increase by as much as 80 and 747 percent (Belling 2001). In 2001, Uganda's best mild Arabica coffee (Bugisu) was exported at twice the price of the highest grade Robustas (Screen 16-18); yet at US$104 per kg Bugisu still commanded a lower price than the Arabicas produced by for example Kenyan smallholders (Ponte 2002a; COMPETE 2002). This makes the expansion and improvement of Arabica production an attractive option for Uganda, where Arabica according to one estimate is currently grown on less than 9% of the land with the biophysical potential (COMPETE 2002). The development of specialty coffee requires considerably more financial and human resources, and complex organizational arrangements, than is the case for conventional coffees, especially for marketing and distribution. This form of production is therefore likely to be limited to a

relatively small number of producers and to require intensive local support from development organizations and private companies (e.g. through various contractual arrangements).

Specialty coffee here also refers to conventional coffee qualities, which in the consuming country are added flavoring, packaged in special ways, or sold in special cafés and coffee shops to enhance the 'consumption experience' (Ponte 2002a). These ways of adding value are becoming increasingly common but do not necessarily imply higher producer prices. Increased value addition in Uganda may be achieved by developing in-country capacity to produce and export instant coffee (UNIDO 2000), and by roasting and packaging fresh Ugandan coffee for sale in the specialty markets (UCDA pers. comm.). The latter options appear increasingly viable due to advancements in packaging technologies and the recent improvements in Uganda's transport and communication infrastructure, aided by an enhanced in-country expertise in the handling and marketing of other perishable food products. Increasing the consumption of high quality coffee among Uganda's urban elite may be a good way of gaining the experience needed to develop such coffee products for export markets.

Price gains may also be made by improving the intrinsic quality (properties) of Robusta and Arabica coffee used in traditional industrial blends. Wet processing enhances the taste of both Arabica and Robusta. In 2001, Ugandan washed Robusta was exported at almost twice the price (US$0.95 per kg) of other Robustas, although in very small quantities. A relatively large share (46% in 2001) of Ugandan Arabica coffee is dry processed ('drugar') and obtains a price which is 26% lower than the best wet processed qualities (Bugisu). Larger beans attract a higher price and may be attained through improved farm practices and planting of Clonal coffee varieties. In 2001, the export price of the highest screen (18) was 51% higher than the lowest (12) but accounted for only 9.4% of volume (up from 6.5% in 1999). Quality attributes such as

aroma, taste, cleanness, and so on may be improved through proper production and processing methods. Systematic pruning of coffee trees is a good example of a low-cost method, which can improve bean size and taste, while also reducing pests and diseases and prolonging the productive life of the tree (Belling 2002:12). Except for wet processing, these quality improvement methods do not require complex technologies or institutional arrangements, something that place them within reach of resource-poor farmers.

While there are many technical possibilities of raising the intrinsic qualities of coffee beans, the transmission of quality-based price incentives to the producer remains a major constraint to a general improvement in quality. Quality regulation at the local level is expensive due to weak infrastructure and low output per producer, among other factors. The dry processing method further hinders effective quality control at the farm level since it implies that the dry pulp covers the bean at the time of delivery (Ponte 2001). Given such constraints, for quality regulation to be cost-effective small producers must sell their coffee collectively (horizontal integration), something which they are reluctant to do after the poor performance of cooperatives in the past (Ibid; UCDA, pers. comm.). This may be combined with contract farming-type arrangements whereby the exporter or roaster controls both production and handling conditions (vertical integration). Establishing these forms of integration is severely constrained by the weak legal system at the local level, however (IITA & NRI 2002). On the positive side, it is noteworthy that quality control is less important in the Robusta than in the mild Arabica market, and that the neutral taste of Ugandan Robusta, related to the high altitude of cultivation, is by far its most important intrinsic quality (Ponte 2001). As for the latter, because dry processing is relatively easy (compared to wet processing), it is more difficult to ruin a natural Robusta bean than a mild Arabica bean.

4. PRODUCTIVITY CONSTRAINTS AND OPPORTUNITIES AT THE FARM LEVEL

Given that Uganda is a small player in the world market, investing resources in improving farm productivity in the short and medium term to reduce unit costs might make sense even in a situation of low world market prices. Coffee farmers can increase productivity by increasing yields and reducing the cost of production per unit output using improved technologies and practices, although it should be recognized that increasing yields may also reduce quality. This will raise farm incomes unless of course gains at the farm level are siphoned off by domestic traders and exporters through reduced farm gate prices. For Uganda as a whole the greatest productivity gain can be made by replacing wilt-affected trees with resistant genotypes and replacing old plants with younger and more productive ones (COMPETE 2002; Belling 2002; UCDA 2000).[6] Producing Robusta from improved Clonal varieties can reduce the cost of production to around 75% of growing traditional varieties, mainly due to higher yields, while also improving quality through larger average bean size and reducing the risk of wilt infection (Belling 2002). Yet as coffee yields increase, farmers must invest more resources in soil nutrient replenishment, which is currently done in a rudimentary fashion. More and better research and extension is needed to further develop and effectively disseminate such improved varieties and technologies. In the short term, a more rapid multiplication and distribution of wilt resistant genotypes should have highest priority (COMPETE 2002) together with other measures that contain the spread of the disease, to ensure that current production levels are maintained.

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[6] Between 1993 and 2000/01 farmers had planted an estimated 80 million new trees, assisted by Uganda Coffee Development Authority and other organizations (UCDA, pers. comm.).

In summary, given the challenges outlined above we find that the coffee industry in Uganda might potentially pursue three types of strategies to sustain or increase coffee producer and export earnings.

1. Area Expansion:

    - Increase production of Robusta and Arabica through expansion of the cultivated area.

2. Enhance Quality:

    - Robusta and Arabica coffee for traditional industrial blends: larger beans; better processing, storage, and grading methods – especially wet processing of Robusta.

    - Specialty coffee for niche markets: single-origin and fine coffees; coffees grown in certified, environmentally and socially responsible ways.

3. Increase Farm Productivity:

    - Reduce the cost of production to increase farm incomes and ensure supply in the face of low producer prices.

    - Increase yields: develop, multiply and replant farms with younger, more productive, and wilt-resistant (Clonal) varieties; improve farm practices.

To these strategies in-country roasting and packaging may be added, but it is beyond the scope of this paper, whose main focus is coffee production, to further discuss that particular strategy. In the following section we use the DREAM model of the International Food Policy Research Institute to do a comparative welfare analysis of alternative coffee growth scenarios based on the three strategies just outlined.

5. DREAM WELFARE ANALYSIS OF ALTERNATIVE COFFEE GROWTH STRATEGIES

THE DREAM MODEL

The baseline simulations were undertaken using the Dynamic Research Evaluation for Management (DREAM) model (Alston et al. 1995; Wood et al. 2000). DREAM is designed to measure economic returns to commodity-oriented research under a range of market conditions, allowing price and technology spillover effects among regions because of the adoption of productivity-enhancing technologies or practices in an innovating region. Linear equations are used to represent supply and demand in each region with market clearing enforced by a set of quantity and price identities. It is a single-commodity model without explicit representation of cross-commodity substitution effects in production and consumption. DREAM treats the commodity as tradable between regions (although a spectrum of possibilities from free trade to autarky can be represented). The supply, demand and market equilibrium are defined in terms of border prices, which will differ from the prices received by farmers (or paid by consumers) because of costs of transportation, transactions, product transformation, and so on that are incurred within regions between the farm and the border. Alston and Wohlgenant (1990) showed that changes in benefits estimates from comparatively small equilibrium displacements of linear models provides a reasonable approximation of the same shifts with various other function forms. Small shifts have the added virtues that the cross-commodity and general equilibrium effects are likely to be small (and effectively represented within the partial equilibrium model), and that the total research benefits will not depend significantly on the particular elasticity values used (although the distribution of those benefits between producers and consumers will). Even with all these simplifications, which make the DREAM model tractable, significant effort is

needed to parameterize and use the model to simulate market outcomes under various scenarios (Wood et al. 2000; Alston et al. 2000).

The primary parameterization of the model's supply and demand equations is based upon a set of demand and supply quantities, prices, and elasticities measured in a defined "base" period. DREAM also allows for exogenous shifts in supply and demand, thereby allowing for a sequence of yearly equilibrium prices and quantities to be generated in "without research" scenarios. These "without research" outcomes can be compared with "with research" outcomes, which are obtained by simulating a sequence of supply curve shifts attributable to research, incorporating research-induced supply shifts. The research-induced supply shifts are defined by combining an assumption about a maximum percentage research-induced supply shift under 100 percent adoption of the technology in some future year, with an adoption profile representing the pattern of adoption of the technology over time. Finally, measures of producer and consumer surplus are computed and compared between the "with research" and "without research" scenarios, and these are discounted back to the base year to compute the present values of benefits. In those cases where we know the costs of the research that are responsible for the supply shift being modeled, DREAM will compute a net present value or internal rate of return (IRR).

DREAM has been developed into a computer software package. It has a menu-driven, user-friendly interface that hides the complex computation to allow the user to focus on methodology, data collection and policy interpretation. DREAM explicitly includes four market types: horizontal multi-market (including a local or innovating market and an arbitrarily defined number of other markets linked by trade or technology), three-level vertical market (multiple markets vertically across stages of production or among factors of productions), small open

economy, and closed economy. The region in DREAM can be any spatial unit, either a geopolitical region such as a country, province, or county, or an agroecological zone (e.g., humid or arid). DREAM allows users to specify technology shifts, adoption, elasticities, and exogenous growth rates that change over the simulation period, and it provides a framework for exploring various kinds of policy, technology, extension and trade issues (Alston et al. 1998; Alston et al. 2000).

6. BASE DATA FOR DREAM MODEL SIMULATIONS

Regional aggregation is one of the fundamental factors in the DREAM model. In this paper the regional focus is Uganda and we are interested in the overall impact on Uganda rather than variations within the country. Because a very large share (over 95%) of Uganda's coffee production is exported, the world coffee market is important in the analysis of Ugandan coffee growth scenarios. Our DREAM regions are therefore Uganda and the Rest of the World (ROW). The variation in coffee quality within each region is also very important, so we divide both Uganda and ROW into two regions separated by product quality. We thus end up with four DREAM regions: Uganda High-Quality, Uganda Low-Quality, ROW High-Quality, and ROW Low-Quality. Table 1 shows the overall structure of the present DREAM simulation. The base year is 2000, which is the latest year of available data. The simulation period is 21 years, from 2000 to 2020. The following market conditions are defined for the base year and described below in detail: initial quantities of production and consumption, initial region-specific market prices, and exogenous growth in supply and demand.

Table 1: Overall structure of coffee simulations

Model Parameters	Value	Remarks
Scenario Constants		
Base year	2000	1998-2000 average.
Simulation period	21 years	2000 to 2020 (21 years).
Real discount rate	3%	Used to calculate present values.
Market		
Initial price	--	Border prices.
Price transmission elasticity	1.0	Reflects imperfect transmission of price change effects.
Supply		
Initial quantity	--	1998 - 2000 domestic/regional production for all commodities and regions.
Elasticity	1.0	
Exogenous growth	--	1990-2000 production growth rate.
Tax/Subsidy	0	
Demand		
Initial quantity	--	1998-2000 domestic/regional consumption for all commodities and regions.
Elasticity	0.5	
Exogenous growth	--	Derived from projected population and income growth for each region.
Tax / Subsidy	0	
R&D Parameters		
Probability of success	100%	
Gestation lag	1 year	Technology will be available after 1 year.
Adoption profile		
Time to ceiling	3 years	Maximum adoption after 3 years.
Ceiling level	100%	Maximum adoption level.
Functional form	Sigmoid	Sigmoidal from technology available to maximum adoption, no disadoption.
Spillover		
Spillover coefficient	0	Technology spillover from innovating region to others.
Spillover lag	0 years	Time lag for technology available to spill-in region.
Supply shift		
Supply shifts k	1~10%	Percentage of innovating region's producer price, or of quantity or quality change.

PRODUCTION AND CONSUMPTION

For Robusta and Arabica coffee production in Uganda we use disaggregated data

obtained from the Uganda Coffee Development Authority (UCDA). We take production to be

the sum of export and domestic consumption, since UCDA's export data are more accurate than

their production ('procurement') data. Both the International Coffee Organization (ICO) and FAOSTAT report domestic coffee consumption without disaggregating Arabic and Robusta types. Assuming that consumption follows the same pattern as production, we break total consumption into Robusta and Arabica coffees according to their shares of production. For ROW, we do not have disaggregated production data. ICO reports the shares of Robusta and Arabica coffee in total production for its producing member countries. By calculating these shares weighted by their production, we estimate the approximate share of Robusta in world coffee production to be 0.328. We define high-quality Robusta coffee in Uganda to be beans of Screen 15 and larger, as well as wet processed and organically grown coffee (no official production data exist for Fair Trade coffee). High-quality Arabica is defined as Bugisu coffee of grade AA, A, B, and PB. According to these classifications, the proportion of high-quality Robusta in Uganda in 1999-2001 is 0.67, and 0.32 for high-quality Arabica (see Appendix B, based on UCDA and UCTF Annual Reports 1999-2001). Without quality-specific data for ROW, we assume, simplistically, that one half of production and consumption is low quality and the other half high quality.[7]

MARKET PRICE

All commodities in DREAM are tradable, so the relevant price is the border price (FOB). Based on current price – quality relationships for non-specialty coffees in Uganda, we estimate the price of high quality coffee (P_H) to be 50% higher than the price of lower quality (P_L) in the case of Robusta, and 40% higher in the case of Arabica (Appendix B). Since the Uganda coffee market is well integrated into the world market, we assume that the price differences due to

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[7] The world market spectrum of high to low coffee quality includes, in order, Colombian Milds, Other Milds, Brazilian Natural Arabica, and Robusta.

quality in ROW are the same as in Uganda. The observed price is in fact the unit value of coffee

obtained by dividing total export value by export quantity. That unit value is the average price of

all coffee with different quality levels (P_{AV}). Since we have assumed that the volume of high-

quality coffee is α percentage of total production, then the average price is

$$\alpha P_H + (1 - \alpha)P_L = P_{AV}$$

The 2000-2001 average quality coffee prices (P_{AV}) are: Robusta in Uganda: 28.45 US

cents/lb = US$627/tonne, Arabica in Uganda: 47.28 US cents/lb= US$1042/tonne, Robusta in

ROW: 36.01 US cents/lb = US$794/tonne, Arabica in ROW: 77.16 US cents/lb =

US$1701/tonne. The price data are shown in Table 2.

EXOGENOUS SUPPLY AND DEMAND GROWTH

Exogenous demand growth is projected for each region using the projected growth rate of

population, $n_{j,t}$, as well as the projection of growth in per capita consumption arising from

income growth. The per capita consumption growth rate is estimated on the basis of the growth

rate in real income, proxied by the 1990-2000 growth rate of GDP per capita, g_j, and the crop-

specific income elasticity of demand, μ_i. Therefore, we can calculate the growth rate of demand

for crop i in region j and year t

$$\pi^C_{i,j,t} = n_{j,t} + g_j \mu_i$$

Since the major coffee consumption countries in the world are the OECD countries, we

choose OECD to represent ROW. In addition, we distinguish the demand growth rates of low

quality coffee from high quality coffee by using a higher income elasticity for high quality coffee

(1.0) than for low quality coffee (0.5). (These are estimates; the calculation of actual income

elasticities was not possible with the available data.) The growth rate for high-quality coffee will therefore be greater than for low-quality coffee.

We assume the exogenous growth rates for coffee supply to be equal to the average annual production growth rate in 1990-2000, which for ROW was 2.20%. The growth rate during this period for Uganda was 6.8% per year, but it is very unlikely that Uganda can maintain such a high growth rate over the next two decades, given the low world market prices and local-specific constraints to coffee production. It is therefore set to be equal to that for ROW, i.e. 2.2%. Table 2a and 2b show the baseline values for the simulations.

Table 2a: Base data for DREAM simulation: Robusta coffee

Region Group	Regions	Supply	Demand	Prices	Elasticity Supply	Demand	Income	Growth GDP/capita
		(tonnes)	*(tonnes)*	*(US$/tonne)*				*(% p.a.)*
Uganda	Uganda Low-Quality	57,992	1,580	470	1.0	0.5	0.5	2.55
	Uganda High-Quality	117,740	3,206	705	1.0	0.5	1.0	2.55
Rest of World	ROW Low-Quality	1,068,884	1,154,357	635	1.0	0.5	0.5	1.50
	ROW High-Quality	1,068,884	1,154,357	953	1.0	0.5	1.0	1.50
World	Total	2,313,500	2,313,500					

Table 2b: Base data for DREAM simulation: Arabica coffee

Region Group	Regions	Supply	Demand	Prices	Elasticity Supply	Demand	Income	Growth GDP/capita
		(tonnes)	*(tonnes)*	*(US$/tonne)*				*(% p.a.)*
Uganda	Uganda Low-Quality	18,175	487	924	1.0	0.5	0.5	2.55
	Uganda High-Quality	8,553	229	1,293	1.0	0.5	1.0	2.55
Rest of World	ROW Low-Quality	2,356,553	2,369,559	1,418	1.0	0.5	0.5	1.50
	ROW High-Quality	2,356,553	2,369,559	1,985	1.0	0.5	1.0	1.50
World	Total	4,739,834	4,739,834					

## 7. DESIGN OF ALTERNATIVE COFFEE GROWTH STRATEGIES

The DREAM model is designed for comparative static analysis and calculates productivity benefits as the difference between "with research" and "without research" scenarios. In this sense, DREAM provides a platform for performing a welfare analysis of the three alternative coffee development strategies outlined earlier:

1. *Increase production through area expansion:* in DREAM terms, the supply and demand shifts are only from exogenous growth.

2. *Enhance quality*: improve the quality of Ugandan conventional coffees and/or target the specialty markets. This is equivalent to reducing the average coffee price difference between Uganda and the Rest of the World (ROW).

3. *Increase farm productivity*: increase the factor productivity of Ugandan coffee growers by increasing yields or reducing the cost of production through the introduction of improved technologies and practices. In DREAM, this is reflected in the assumed productivity (dis)advantage of Uganda compared to ROW.

Figure 2 illustrates the different development strategies simulated in our DREAM scenarios, and some combinations of these. Uganda now probably locates in the upper left quadrangle, with a lower average productivity and higher average quality than ROW. Area expansion will move Uganda towards the front along the 'volume of Uganda coffee production' axis. Improving Uganda's productivity advantage by say 5% via technology innovation or production cost reduction will move Uganda horizontally to the right, and also towards the front if the volume also increases due to improved yields. The move towards the upper right represents a situation where Ugandan producers combine relative increases in prices, due to marketing or quality improvements, with relative increases in productivity. In all these scenarios, the DREAM

simulations calculate a time-series of production, consumption, and prices, as well as the size of

the discounted benefits or losses to both producers and consumers (relative to the baseline).

Figure 2: Coffee Development Strategies for Uganda
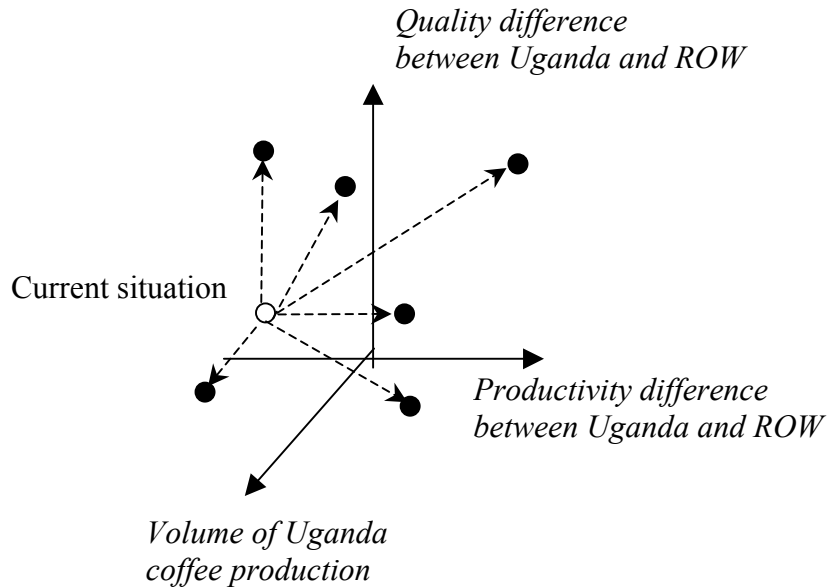
8. EVALUATION OF DREAM MODELING RESULTS

The following evaluation of the DREAM modeling results refers mainly to Robusta

coffee. The same type of data exists for Arabica coffee but the stories they tell are very similar.

Where there are significant differences we show the results for both Robusta and Arabica.

INCREASE PRODUCTION THROUGH AREA EXPANSION

The area expansion scenarios assume that Uganda maintains its current productivity

levels and increases coffee production by enlarging the area planted with coffee. Changes in

prices, production, and consumption result entirely from the exogenous growth in demand and

supply, In Scenario 1, which is also our baseline scenario, both Uganda and ROW keep the

current production growth rate (2.20% per year for both regions)[8]. In Scenario 2, Uganda gradually reduces its production growth rate from the baseline level of 2.20% to zero percent in 2020, while ROW maintains a 2.20% growth rate. Scenario 3 simulates the Government of Uganda's 2001 Strategic Export Plan, in which total coffee production increases from the current 3.5 million bags to 12 million bags in 2006, and then keeps the baseline growth rate of 2.2% per year.

Figure 3 shows for each scenario the trends in Ugandan Robusta export prices and reven+ues for the 2000-2020 period. In the first scenario, the price declines throughout the period because the growth rate for production is higher than for consumption (Figure 3a). The price of low-quality coffee suffers a larger decline than the high-quality price (5% and 3%, respectively), reflecting a higher growth rate in the demand for high-quality coffee. Uganda's export revenues (in constant 2000 US$) also decline throughout the period. Robusta export revenues fall from US$107 million in 2000 to US$84 million in 2020 (Figure 3b) despite increasing export volumes, reflecting the devastating effects of falling coffee prices on revenues.

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[8] The 2.2% baseline annual growth rate in Uganda does not include the effects of technology improvements (productivity and quality) because we will impose technology improvement in the simulations. This makes it lower than the observed growth rate in Uganda (6.8%).

Figure 3: Trends in Ugandan Robusta Export Price and Export Revenue for the Area Expansion Scenarios

(a) Uganda Export Price - Robusta
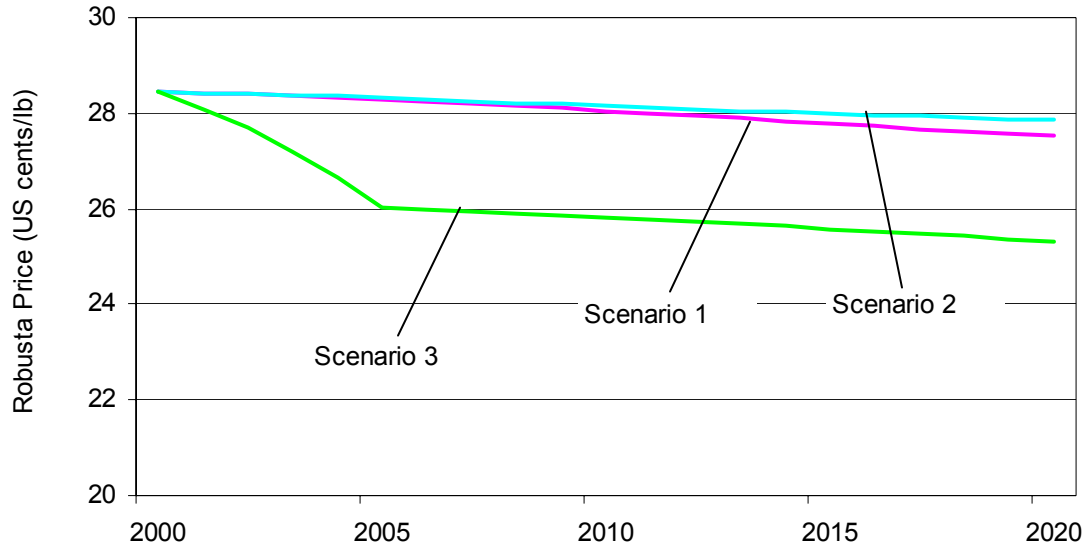
(b) Export Revenue - Robusta
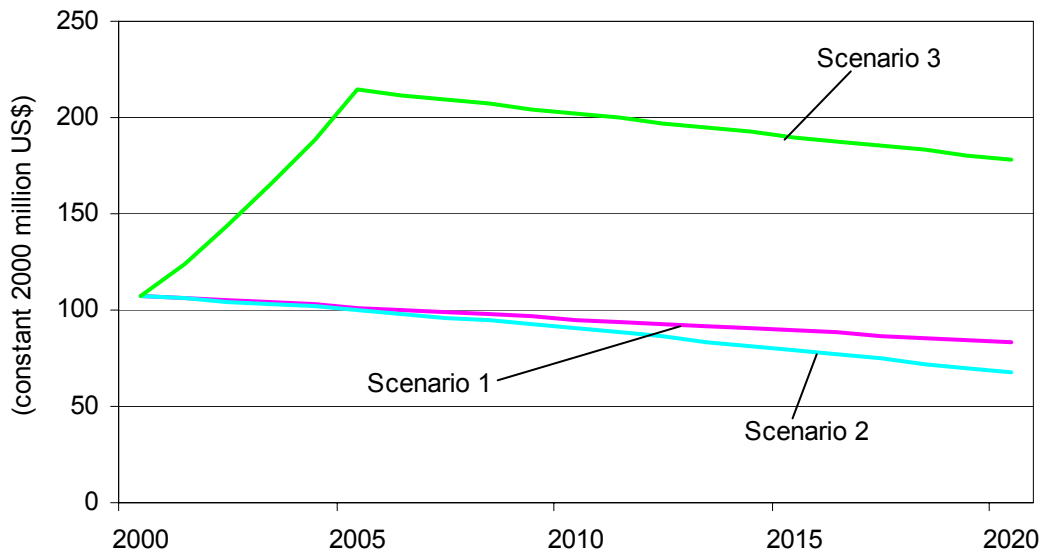
The results for scenario 2 show that because Uganda is a small player in the world market for Robusta, it cannot prevent the coffee price from declining by unilaterally reducing production. In Scenario 2 the Ugandan Robusta export price also falls throughout the period, although slightly slower than in Scenario 1. The value of Ugandan exports also fall and the total loss in revenues is even greater than in Scenario 1. Scenario 3 in Figure 3 shows the effects of aggressively increasing Ugandan Robusta production to 12 million bags in 2006, which requires a stunning growth rate of 22% per year until 2006, and then maintaining a baseline growth rate of 2.2% per annum. The Ugandan Robusta coffee price falls sharply until 2006 and then decreases slightly, becoming almost parallel to the baseline price due to similar production growth after 2006. Export revenues peak in 2006 at around US$214 million because of increased coffee exports, but then declines to around US$178 million in 2020. This is just 66% more than the export value in 2000 despite the fact that coffee production has more than tripled. Thus, even if the Government of Uganda reaches its production goal in 2006, the negative price effect of the oversupply in the world coffee market, to which this policy would contribute quite significantly, is likely to erode the economic benefits of these investments. The erosion in benefits would be even greater if competing countries followed suite and accelerated their own rates of growth in coffee production. In fact, it would be relatively easy to create scenarios in which all coffee producing countries suffer net revenue losses as a result of such "race-to-the-bottom" production strategies.

ENHANCE QUALITY

The area expansion scenarios showed that simply increasing coffee production could engage Uganda in a "race-to-the-bottom" competition with other producer countries. In contrast,

there appears to be more economic room for improving the quality of Ugandan coffee, which in DREAM terms means reducing the current (negative) price difference between Uganda and ROW. DREAM models quality enhancement with a short-cut method using economic surplus within a multiple-market framework. Different qualities of a commodity are defined as different commodities (e.g., high-quality coffee and low-quality coffee are treated as two separate commodities), and a technical change that leads to a change in quality is modeled as compensating shifts in the supply of the commodities in question. DREAM can approximate the returns to quality change by specifying an upward shift in the supply of higher quality coffees. It must be acknowledged, however, that there may be errors in the welfare measure due to cross-commodity effects, which DREAM cannot account for (Alston et al. 1995; Brennan et al. 1989).

As mentioned earlier, in the current DREAM setup we distinguish between high-quality and low-quality coffees, where the price for high-quality Robusta is 50% higher than for low quality. There are three quality scenarios: 10%, 25% and 50% quality improvement, which in the model means producing 10%, 25%, and 50% more high-quality coffee while reducing the low-quality coffee in Uganda by the same amount. These changes are gradually implemented from 2000 to 2004 as specified by the adoption profile in Table 1. The percentages simulate the combined effects of different quality enhancement options. These options could be, for example, to increase the share of washed Robusta coffee, whose average export price is currently 78% higher than dry-processed Robusta (see Appendix B), or to produce coffee of a higher grade (e.g. larger beans) by replanting farms with clonal coffee varieties and improving farm management. Producing coffee for the specialty market may also be part of a quality enhancement strategy. Again, the simulations do not take into account the resources and costs involved in implementing

the different quality enhancement strategies and therefore do not help us to assess their feasibility

and profitability.

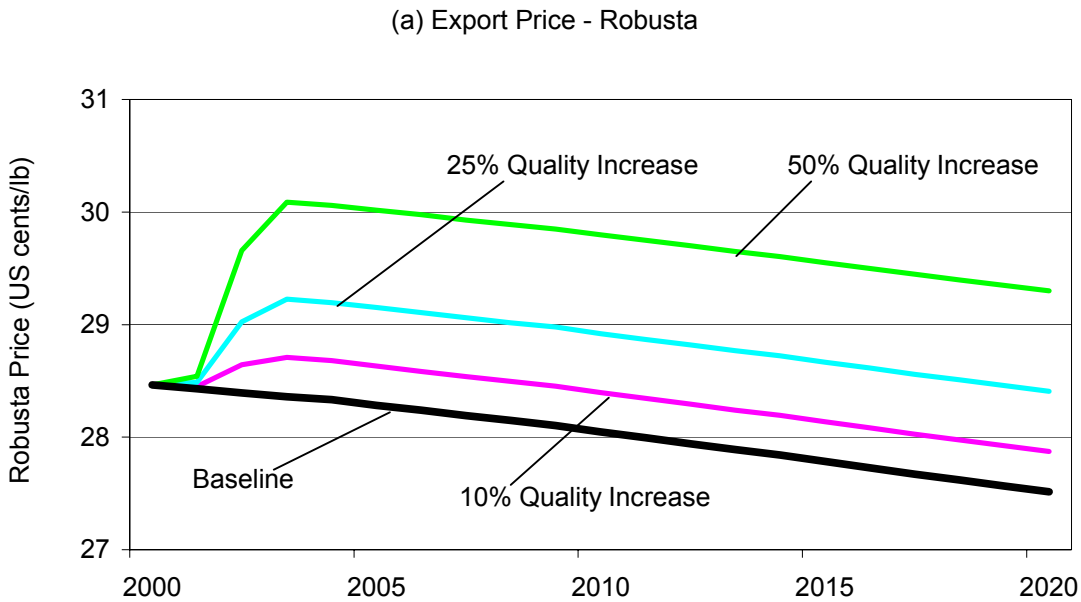**Figure 4a--Trends in Ugandan Robusta export price and export revenue for the quality enhancement scenarios**

(a) Export Price - Robusta

Figure 4b--Trends in Ugandan Robusta export price and export revenue for the quality enhancement scenarios
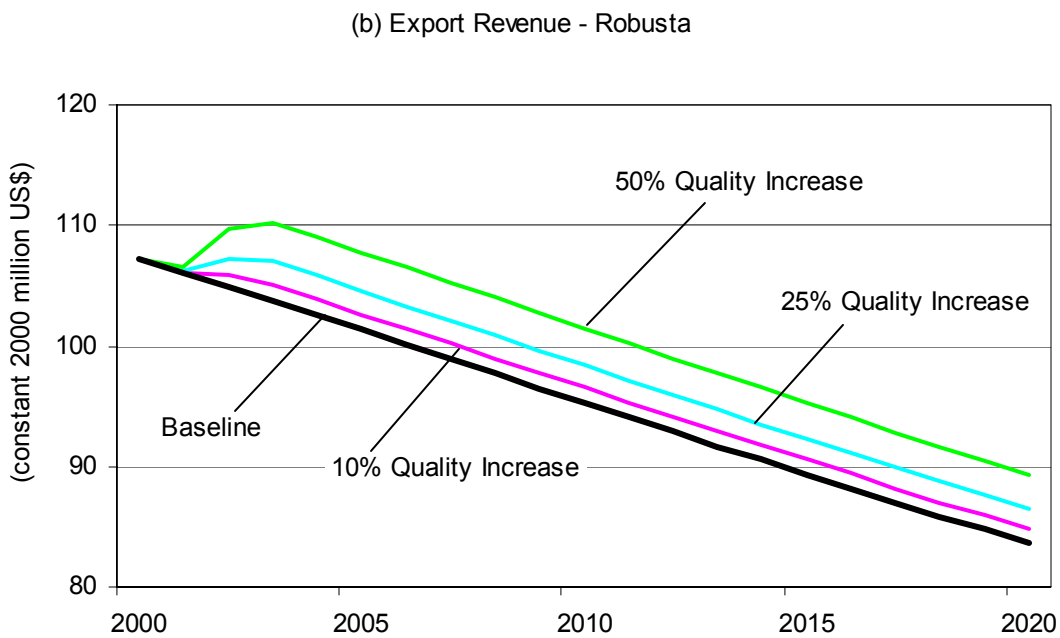
(b) Export Revenue - Robusta

**Table 3--Total benefits to Uganda in 21 years for the Coffee Quality Enhancement
Scenarios**

Coffee type	Percentage of production to increase quality		
	10%	25%	50%
	Total Benefits[b] (1000 US$)[a]		
Robusta	26,730	80,976	209,809
Arabica	16,593	61,783	191,166

Notes: [a]All values are in constant 2000 US$. [b]Producer and consumer benefits combined, of which producer benefits account for more than 99% of total benefits.

Figure 4 shows the trends in the Ugandan Robusta export prices (a) and export revenues (b) for the three quality enhancement scenarios, and for the baseline scenario (Scenario 1). In all three quality enhancement scenarios, the Robusta export price increases in the first four years because of farmers' adoption of quality improvement technologies, but then declines due to the oversupply of coffee in the international market. For example, in the 50% quality improvement scenario, the Robusta price peaks at 30 US cents/lb in 2003 (6% higher than in the baseline), and then declines to 29 US cents/lb in 2020 (7% higher than in the baseline).

The export revenues for all three scenarios also increase in the first four years and then decline thereafter at rates comparable to the baseline scenario. Using 2000 (the base year) export revenues as the benchmark, increases in quality of 10%, 25% and 50% increases lead to peak export earnings that are 2% lower, unchanged, and 3% higher, respectively. The peak is reached in 2003 in the 10% and 25% scenarios, and in 2006 in the 50% scenario. Compared to the baseline scenario, the three quality improvement scenarios generate US$1.2 million, US$2.9 million, US$5.8 million more export revenues per year on average in the 2000 – 2020 period, while the total benefits to Uganda for the 21 years would be US$27 million, US$81 million and US$210 million, respectively (Table 3). Improving coffee quality is thus a good policy no matter what will happen in the world coffee market.

INCREASE PRODUCTIVITY

Increasing the factor productivity of coffee production raises farmers' incomes by increasing yields and/or reducing the cost of production. Since farmers enjoy different levels of productivity, a general increase in productivity is also likely to increase the number of farmers who can produce coffee as a livelihood strategy at a low world market price. How much Uganda gains from productivity improvements depends on its initial productivity level compared to the Rest of the World and on the changes in productivity in ROW. This is because most of Uganda's coffee is exported and because the world market price is influenced by the cost of production in the producing countries. In our simulation we therefore assume different levels of productivity improvements in both Uganda and ROW: 0%, 1%, 2% and 5% downward supply shifts due to the adoption of productivity-increasing technology.

Table 4 shows for Robusta and Arabica the total producer and consumer benefits to Uganda relative to the baseline situation (no productivity increase). Since Ugandans drink or process very little coffee, the share of consumer benefits in total benefits is negligible. Negative benefits are shaded for clarity of exposition. Predictably, Uganda suffers negative benefits if its productivity grows at a slower rate than in ROW, and gains in the opposite situation. (For example, Uganda would gain US$1.11 million per year if it improves productivity by 1% while ROW has no productivity gain. Conversely, if ROW has a 1% productivity improvement while Uganda has none, Uganda would lose US$837,000 per year.) If the change in productivity is the same for Uganda and ROW, Uganda will gain in the case of Robusta and lose in the case of Arabica. (For 1%, 2% and 5% productivity increases in both ROW and Uganda, the gains to Uganda are US$269,000, US$539,000, and US$1,355,000 per year, respectively, in the case of Robusta, and for Arabica the losses to Uganda are US$4,000, US$8,000, and US$19,000 per year, respectively.) This is because Uganda's productivity currently is at the same level as ROW

for Robusta, while it is lower than ROW in the case of Arabica. For Robusta, both Uganda and ROW therefore gain from equal productivity increases. For Arabica, Ugandan producers must increase their productivity faster than ROW in order to benefit from these increases. In summary, increasing the productivity of Robusta and Arabica coffee production in Uganda is an attractive policy option in terms of raising producer incomes (assuming that the costs of increasing productivity are lower than the derived benefits). Moreover, because of the negative effects on export prices of productivity improvements in the Rest of the World, Ugandan coffee producers must continuously increase productivity in order not to suffer a decline in incomes.

Table 4--Total benefits to Uganda for different coffee productivity increase rates

ROBUSTA – Benefits for 21 Years

		Percentage Productivity Increase in ROW		
		0%	1%	2%	5%
		(1000US$ total)			
	0%		-12,904	-25,705	-64,486
Percentage Productivity Increase in Uganda	1%	17,179	4,151	-8,773	-46,925
	2%	34,515	21,364	8,315	-30,207
	5%	87,467	73,944	60,525	20,889

ROBUSTA – Benefits per Year

		Percentage Productivity Increase in ROW		
		0%	1%	2%	5%
		(1000US$/year)			
	0%		-837	-1,668	-4,183
Percentage Productivity Increase in Uganda	1%	1,114	269	-569	-3,044
	2%	2,239	1,386	539	-1,960
	5%	5,674	4,797	3,926	1,355

ARABICA - Benefits for 21 Years

		Percentage Productivity Increase in ROW		
		0%	1%	2%	5%
		(1000US$ total)			
	0%		-4,369	-8,687	-21,326
Percentage Productivity Increase in Uganda	1%	4,354	-62	-4,426	-17,207
	2%	8,753	4,290	-122	-13,044
	5%	22,217	17,612	13,059	-287

ARABICA – Benefits per Year

		Percentage Productivity Increase in ROW		
		0%	1%	2%	5%
		(1000US$/year)			
	0%		-283	-564	-1,383
Percentage Productivity Increase in Uganda	1%	282	-4	-287	-1,116
	2%	568	278	-8	-846
	5%	1,441	1,143	847	-19

Notes: (1) All values are in constant 2000 US$. (2) The total benefit is the present value of gross annual research benefit over 2000-2020. The total benefit is composed of producer and consumer benefits, of which producer benefits account for more than 99% of total. (3) Annual benefit is calculated by annualizing the total benefit over a uniform cash flow from 2000 to 2020. (4) Negative values are shaded for presentational purposes.

Table 5 summarizes the results of the DREAM comparative analysis for the three major

coffee development strategies in the case of Robusta, in terms of their relative effects on export

prices, export revenues, and total benefits[9]. The values are annual averages for the 21-year period

and refer to the difference between each scenario and the baseline scenario (in which it is

assumed that Uganda and the Rest of the World (ROW) will both increase production at of 2.2%

per annum). The results suggest that the quality enhancement strategy would be the most

Table 5--Summary of Robusta coffee development scenarios and welfare effects

Development Strategy	Development Scenarios	Change Relative to Baseline[a]		
		Export Price (US cents/lb)	Export Revenue	Total Benefits[b]
			(million US$/year)	
	2.2% Growth Rate (Baseline)			
Area Expansion/Contraction	Decreasing Growth Rate	< + 0.4	-6.1	-1.3
	Gov. of Uganda Export Plan	*app.* - 2.0	70.0	9
	10% Quality Enhancement	0.35	1.2	1.7
Quality Enhancement	25% Quality Enhancment	0.85	2.9	5.2
	50% Quality Enhancement	1.75	5.8	13.6
	1% more than Rest of World	-0.02	0.9	1.1
Productivity Increase	2% more than Rest of World	-0.04	1.7	2.2
	5% more than Rest of World	-0.08	4.4	5.7

Notes: [a]Annual averages for the 2000 – 2020 period (in constant 2000 US$). The values are approximate due to changes in the technology adoption process and market situations from year to year. [b]Producer and consumer benefits combined, of which producer benefits account for more than 99% of total benefits.

effective in increasing Uganda's export prices. A productivity improvement strategy would have

little impact on Uganda's export prices, while simple production increases attained by area

expansion would lead to reductions in export prices, the size of which could become quite large

if competing countries were also to follow "race-to-the-bottom" production strategies. The

quality and productivity improvement strategies also lead to significant total benefits and large

increases in annual export earnings. The area expansion strategy shows mixed results. If Uganda

shows restraint and reduces its own area growth to zero, this will benefit other countries more

than Uganda, with export earnings and producer benefits both falling. On the other hand, if

Uganda aggressively expands its coffee production through area increases to 12 million bags by

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[9]Uganda producer and consumer benefits combined, of which producer benefits account for more than 99% of total benefits. We therefore refer to them as producer benefits.

2006, then export prices would fall sharply. If other coffee producing countries do not accelerate their own production then Uganda would sell sufficient coffee that its export earnings would be larger despite the lower prices. But this gain would be eroded over time, and could fall sharply if other countries joined in such a "race-to-the-bottom" strategy.

It is important to note that our analysis does not take into account the investment costs required to achieve each strategy; we have only estimated gross benefits. Since some strategies would require higher investment costs than others, then the relative net benefits attainable from each strategy could conceivably change.

Figure 5 further summarizes the total (producer and consumer) benefits (present values) to Uganda of the different Robusta development scenarios, accumulated over the 2000 – 2020 period. Quality enhancement would move Uganda upward along the vertical axis while productivity increase (decrease) relative to ROW moves Uganda toward the right (the left) along the horizontal axis. A strategy that increases both quality and productivity would move Uganda towards the upper-right quarter of the diagram, while a combination of area expansion, quality enhancement, and productivity increase would move Uganda's position towards the front, upper right quadrangle. These positions are shown by the dotted circles.

Figure 5--Summary of Robusta coffee development scenarios and their accumulated benefits to Uganda 2000 - 2020
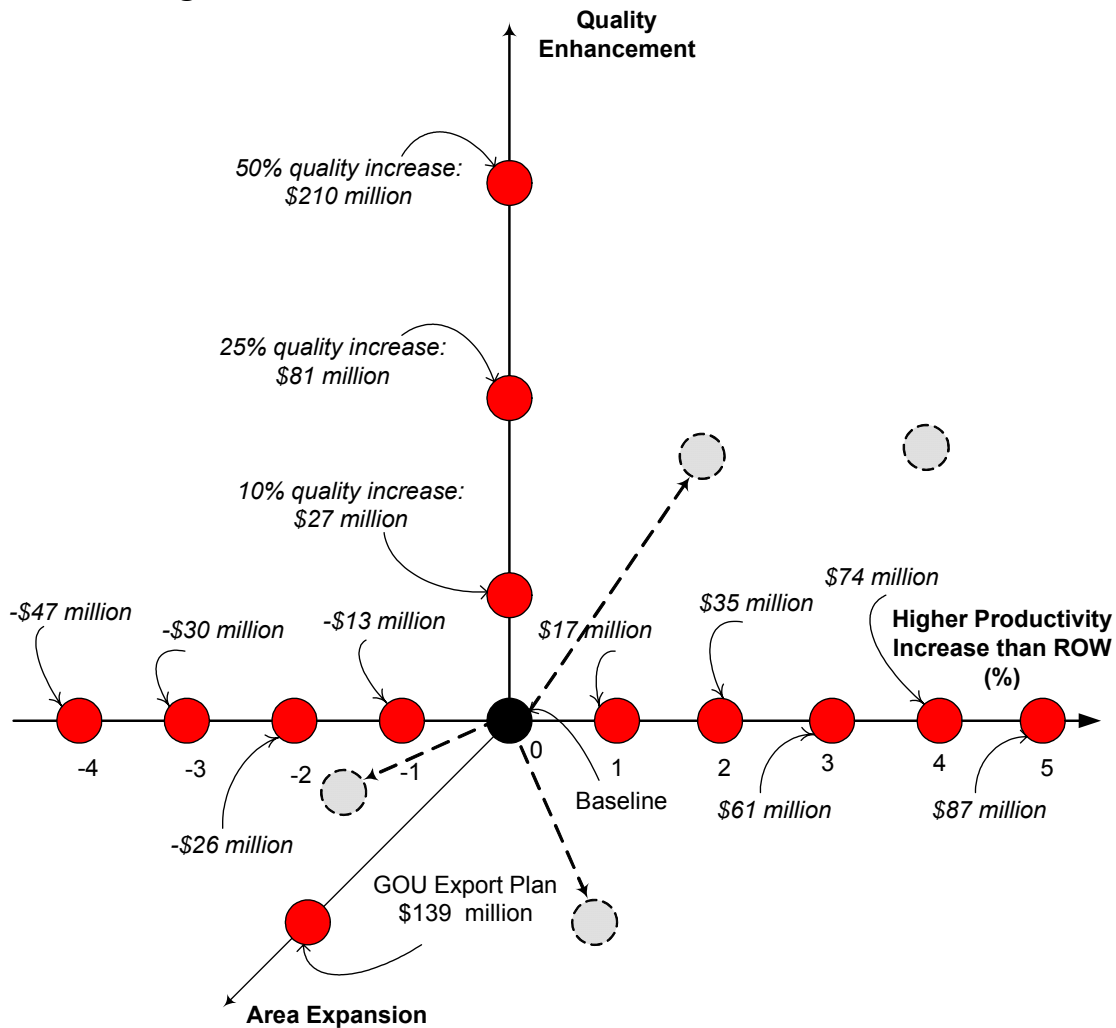
Note to Figure 5: the benefits are present value of gross research benefits over 2000-2020.

9. CONCLUSION

In the current situation of low and falling world coffee prices, it is tempting for a country like Uganda, which depends so much on coffee for its export earnings, to expand production to make up for the short fall in revenues. However, because oversupply of low quality coffee is the root cause of the coffee price collapse, this strategy would engage Uganda in a 'race-to-the-

bottom' competition with other poor producer countries. Instead, this and other studies (e.g., COMPETE 2002; Ponte 2001 & 2002a; CFC 2001b) suggest that Uganda would gain more (or lose less) by enhancing quality and farm productivity, while ensuring that it maintains its competitive advantage in the Robusta market through a reliable supply of 'neutral' flavored Robusta in large quantities. At the farm level, emphasis should be on improving the skills and economic incentives to produce better quality coffee and raise the productivity for mainstream Robusta coffee. This strategy should be supplemented by carefully targeted support to the production and marketing of specialty coffees – including washed Robusta.

It is beyond the scope of this paper to suggest more specific types of interventions and to assess their relative profitability, but it is clear that the implementation of both productivity and quality enhancing strategies would necessitate a higher level of organization in the industry: horizontally among small producers (IITA & NRI 2002), and vertically among producers, traders, roasters and consumers. The proper design and geographical targeting of such interventions will depend on better information about the spatial distribution of coffee production within Uganda, and on a better understanding of what constrains more effective forms of organization in the industry, especially at the local level. Cost – benefit and feasibility studies are also needed to identify the most profitable interventions, including the 'best' balance between productivity and quality enhancing investments. These analyses should take into account the different and potentially conflicting national development goals, e.g. total income growth, poverty alleviation, and the conservation of ecosystem services.

Finally, because the world coffee market is so important to the Ugandan economy, and being the third biggest Robusta producer in the world, Uganda has a high stake and important role to play in international coordination efforts to raise and stabilize world coffee prices. An

important initiative in this regard is the ICO Coffee Quality Improvement Program, which was established in February 2002 (Ponte 2002b). The overall, short-term goal of the Program is to reduce the supply of exportable coffee through the imposition of minimum export quality standards, thereby raising prices. In the long term, the aim is to raise the overall quality of coffee exports. A major constraint to the success of the program is that the largest consuming country (the United States) is not presently a member of ICO, and that the US at the same time allows the import of large quantities of very low quality coffee (Ibid).

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APPENDIX A:UGANDAN FARMERS' SHARE OF EXPORT PRICE

Table A1--Ugandan farmers' share of export prices

	Robusta			Arabica		
Coffee Year	Farmgate Price *(US cents/lb)*	Export Price *(US cents/lb)*	**Price Share**	Farmgate Price *(US cents/lb)*	Export Price *(US cents/lb)*	**Price Share**
1995/96	51	71	**0.71**	69	86	**0.80**
1996/97	45	59	**0.76**	90	117	**0.76**
1997/98	51	59	**0.85**	101	117	**0.86**
1998/99	38	63	**0.61**	74	110	**0.67**
1999/2000	26	37	**0.68**	53	57	**0.93**
2000/2001	12	24	**0.53**	38	40	**0.95**

Source: Authors' computations of data collected by Uganda Coffee Development Authority.

Notes to Table A1: Farmgate prices are "green coffee equivalent" in US cents per pound. They were computed based on: monthly Arabica 'parchment' and Robusta *kiboko* farmgate prices (simple averages of price data collected monthly by UCDA's 25 field agents); an estimated out-turn after processing of 54% for Robusta *kiboko* and 80% for Arabica parchment; and monthly exchange rates (Bureau Middle Rates) reported by Bank of Uganda. Export prices are simple averages of monthly weighted average FOT prices received by Ugandan exporters (according to the latter's' confidential reports to UCDA). The source of all price data is the Uganda Coffee Development Authority. UCDA has also computed Ugandan farmers' share of coffee world prices (UCDA, 2000:9). As the farmgate price UCDA uses Robusta FAQ, i.e. the price paid by exporters (according to their reports to UCDA) for hulled, ungraded Robusta, which includes domestic traders' profits. As the world export price, UCDA uses the price of Screen 1500 at the LIFFE, converted into Uganda shillings (more than 60% of Ugandan Robusta exports fall in this category). According to UCDA's calculations, farmers' share of the world price increased from 45% in 1991/92 to 78% in 1995/96 (after liberalization) and then declined to 70% in 1999/2000. In 1998/99-1999/2000, their price-share figures for Robusta are higher than ours, while they are similar in 1995/96-1997/98.

APPENDIX B--POTENTIAL PRICE GAINS BY IMPROVING COFFEE QUALITY IN UGANDA

The following assessment of price – quality relationships is based on the price differentials between different types and qualities of coffee exported by Uganda in 2000/2001, including wet processed Robusta. We do not consider specialty coffees such as organically grown and Fair Trade coffees. These types are as yet only scantily grown in Uganda and the obtained prices are poorly documented. All price data used in the below calculations refer to FOT export prices and were obtained from the Uganda Coffee Development Authority.

QUALITY IMPROVEMENT OPTIONS

(1) Increasing Robusta bean size (Screen): The price differentials between screens are much higher in 2000/2001 than in the previous years, and increases with the general decline in price levels. The gain from going from Screen 15 to 18 is 30%, from Screen 12 to 15, 15%, and from 12 to 18, 51%. **(2)** Wet processing of Robusta (2000/2001): Washed Robusta sold in 2001 at US$0.95 per kg against US$0.51 per kg for nonwashed (all grades) Robusta, or 78% higher.

(3) Improving Arabica quality: The best four grades of Arabica (Bugisu AA-PB) sold in 2001 at US$1.10 per kg against US$0.87 per kg for ungraded small-bean washed Arabica ('wugar'), or 28% higher, and against US$0.81 per kg for dry processed Arabica ('drugar'), or 36% higher.

(4) Switching from Arabica to Robusta: The best four grades of Arabica (Bugisu AA-PB coffee) sold in 2001 at US$1.10 per kg against US$0.65 per kg for the best Robustas (Screen 16-18), or 41% higher. For all grades of Arabica and Robusta, Arabica sold in 2001 at US$0.91 per kg against US$0.51 per kg for Robusta, or 78% higher.

Table B1--Price gains (differences) when increasing the Screen

	15 → 18	12 → 15	12 → 18
2000/2001	30%	15%	51%
1999/2000	18%	9%	29%
1998/99	8%	8%	17%
1998/99	6%	3%	9%

DISCUSSION

The differentials (potential price gains) for the different options range from 30% (increase bean size by 3 Screens: 15-18) to 78% (wet processed Robusta and switching from Robusta to Arabica). Most gains are in the 30-50% range. For DREAM analysis, a conservative estimate is that the price for high-quality coffee is 50% higher than for low-quality coffee – for example a case of bean quality improvements within each of the Arabica and Robusta types (30-40% price increase) combined with a moderate increase in the amount of washed Robusta and average Arabica at the expense of average Robusta (both 78% price increase). An optimistic estimate, not applied here, is a 75% price increase - for example the scenario that 10%/25%/50% of production switches from average Robusta to average Arabica, or from average Robusta to washed Robusta, or both. Switching to specialty coffees promises an even higher potential price gain, possibly 100-150% on average, but the quantity is likely to be low for a long time ahead. Therefore, for our DREAM analysis we set the price of high-quality Robusta to be 50% higher than low-quality, while for Arabica the price gain is 40%.

LIST OF EPTD DISCUSSION PAPERS

01   *Sustainable Agricultural Development Strategies in Fragile Lands,* by Sara J. Scherr and Peter B.R. Hazell, June 1994.

02   *Confronting the Environmental Consequences of the Green Revolution in Asia,* by Prabhu L. Pingali and Mark W. Rosegrant, August 1994.

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