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Smuggling and Supply Response: Coffee in Ethiopia

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Summary

During the 1980s substantial smuggling of coffee has been taking place in Ethiopia. The recent devaluation has raised hopes that substantial quantities of coffee will flow back to the official channels. Data on the incentives to supply to the different channels is collated. A model of official supplies is formulated which nests an empirical test between the smuggling models by Bhagwati and Hansen (1973) and by Pitt (1981). The econometric results favour the latter, and show a small but significant effect of the premium in the black market and a positive total supply response, relative to the main competing crop, chat. The results imply that the increases in export earnings from the devaluation will be quite limited.

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1. Introduction

Devaluations, as part of structural adjustment programmes, are usually accompanied by hopes for a revival in exports. Ethiopia is no exception to this. Its exports are dominated by coffee, accounting for more than half of total exports. Evidence from many other countries suggest that supply responses to price increases do exist even though they are usually relatively small (Askari and Cummings, 1977; Bond, 1983; Binswanger, 1990). Ethiopian policy makers do not just hope for a production response from coffee. High black market exchange rates and export taxation have created incentives for a very active black market in coffee. Coffee smuggling routes exist to the Sudan, Kenya and Djibouti. The removal of at least some of the premium in the exchange rate market and the reduction of export taxes raise the prospect of the return of substantial quantities of coffee into the official channels. This paper tries to assess empirically whether official supplies of coffee are likely to increase substantially after the devaluation, both via a production response and via a reduction in smuggled quantities.

The analysis of smuggling and black markets has received substantial attention in recent years (for a survey see Bhagwati, 1987, Roemer and Jones, 1991, and Devarajan, Jones and Roemer, 1989). The theory of supply to black markets was initially developed by Bhagwati and Hansen (1973). Central to this approach is the specification of a risk-of-detection function, which was assumed to depend only on the amounts sold in black markets. Pitt (1981) extended this analysis to allow for the risk function to depend also on official supplies: the latter provide a useful cover for black market activity and therefore reduce the risks involved in smuggling. In section 2, we will derive predictions on the empirical form of an official supply function under smuggling, nesting both models.

Empirical estimations of smuggling functions for agricultural commodities are rare¹. An underlying problem with the empirical analysis is the near impossibility of obtaining reliable information on farmgate prices in the black market, let alone smuggled quantities. However, since coffee is an internationally traded good, border prices and black market exchange rates can provide the basis to establish the changes in the incentives to enter into smuggling. In Ethiopia, contrary to most other African countries, farmgate prices for the official channels are also not readily available. In section 3, the methodology to obtain the relevant price indexes will be described. The actual outcome for farmers is a consequence of a combination of exchange rate, marketing and taxation policies. To understand the evolution of farmgate prices, they are decomposed into these constituting factors. This section will be preceded by a discussion of the nature of the coffee market and the reform programme in Ethiopia.

The price data will then be used to estimate the supply function for the official market. The production response within the model will have to take into account the relative incentives of the main competing crops. In Ethiopia, the most important one is chat (*q'at*): a mild stimulant, substantial quantities of which are presently exported

¹An exception is Pitt (1981) on Indonesian coffee. Azam and Besley (1989) test some general equilibrium implications on prices and exchange rates from the presence of smuggling of agricultural commodities in Ghana.

to neighbouring countries. The econometric results are then assessed to understand the likely effects of the devaluation. Section 5 concludes.

2. Modelling Official Coffee Sales with Smuggling

A substantial body of literature exists on the modelling of parallel markets (see, among others, the contributions in the special issue of World Development on parallel markets (Jones and Roemer, 1989) and Roemer and Jones (1991)). On the supply side, the specification of the risks of detection and punishment of selling in parallel markets is an important issue. The basic model involved was developed by Bhagwati and Hansen (1973). It starts with the premise that the risk of smuggling and the penalties on being caught are exclusively a function of the quantities sold in the parallel market. With increasing industry-level marginal cost, this implies that total supply decisions will be made on the basis of the controlled price only. The smuggling price and the related premium will affect only the choice of the supply channel.

An important extension model is that of Pitt (1981) which, as opposed to the earlier model, specifies the risk in smuggling as a function of both the quantities supplied in the official market and the quantities supplied in the parallel market. The underlying argument in this model is that sales in official channels provide a cover for dealings in the parallel market and hence help reduce the risk of smuggling. The marginal revenue of selling a unit of the good in the official market is therefore higher than the official price of the good by the amount of cost the agent avoids by reducing the risk of selling in the parallel market. The implication is that production would be a function of both the official price and the smuggling price as well as the risk and costs of smuggling. Extensions in other directions exist as well. Azam and Besley (1989) provide a general equilibrium analysis in which smuggling exports is explicitly linked with smuggling imports, in which the former reduce the risk costs involved in the latter. Sheikh (1989) introduces, among other issues, risk preferences in the analysis of smuggling. Bevan, Collier and Gunning (1989) introduce information costs about smuggling.

It would seem preferable to construct a parsimonious empirical model which encompasses all these extensions. Given the nature of the data available, however, we will confine ourselves to an analysis of smuggling through focusing on the effect of a premium on the black market on the supply in the official market. For this purpose we will try to derive a supply function in the official channel which nests both the model by Bhagwati and Hansen (1973) and by Pitt (1981), using a price control version of their models, as was developed in Devarajan, Jones and Roemer (1989).

In this model a representative farmer will be facing a cost function C , which is characterized with rising marginal costs. The output price p_c is controlled by the government, but a smuggling outlet is available with a higher price p_u . The decision problem faced by the farmer is a production decision ($Q = Q_c + Q_u$) and a choice of the channel(s) in which it will sell its production which maximize expected profits. Smuggling involves costs of detection and fines. In Pitt's model we can write the risk of detection as being a decreasing function θ of official supplies ($\partial\theta/\partial Q_c < 0$) and increasing in smuggled quantities ($\partial\theta/\partial Q_u > 0$). The fine f , payable when detected,

is an increasing function of the quantities actually smuggled ($\partial f/\partial Q_u > 0$). The problem can then be written as:

$$(1) \quad \begin{aligned} \text{Max } E \Pi &= p_u Q_u + p_c Q_c - C(Q_c + Q_u) - \theta(Q_u, Q_c) f(Q_u) \\ \text{s.t. } Q_c &\geq 0; Q_u \geq 0 \end{aligned}$$

For an interior solution ($Q_c, Q_u > 0$), the following conditions are valid:

$$(2) \quad p_c - \frac{\partial \theta}{\partial Q_c} f = \frac{\partial C}{\partial Q_c}$$

$$(3) \quad p_u - \frac{\partial \theta}{\partial Q_u} f - \frac{\partial f}{\partial Q_u} \theta = \frac{\partial C}{\partial Q_u}$$

With increasing marginal costs and since $\partial \theta/\partial Q_c$ is strictly negative, equation (2) shows that production will take place at a marginal cost level higher than p_c . There will therefore be more production with prices p_c than if no smuggling channel existed. Combining equations (2) and (3) shows that supply in each channel will occur until the marginal benefits of supplying in the respective markets are equalized. Official and black market supply could be calculated from (2) and (3) as functions of official and black market prices, but since the supply in each market is interdependent via the risk reducing effect of official sales, it is not possible to derive explicitly without specific assumptions about the parameters of the model.

Note however that if the risk of detection only depends on Q_u , then $\partial \theta/\partial Q_c = 0$ in (2), and the Bhagwati and Hansen model is obtained. In that case, farmers will produce until the marginal cost of production equals the price in the official price, whatever the level of the smuggling price. Production is made on the basis of official prices only, and not on the basis of both prices as in the Pitt model. Only after the production decision has been made will information about the smuggling price be used to determine the channel: supply in the parallel market will occur until its marginal return equals the official price.

Both models have important different consequences for modelling in the official market. In the Bhagwati and Hansen model, the production (or total supply) response can be found using official prices only, while the decision on the choice of channel can be found via an effect on the premium involved in supplying in the official market. In the Pitt model such distinction becomes impossible: total supply is also a function of the premium in the parallel market, and within an official supply function the channel choice effect and the total supply response effect are convoluted.

These issues will become clear via a parameterisation of the cost and the risk function in (1)². The insights obtained are not strictly dependent on the specification itself, but illustrate more generally the consequences of each model for empirical

²Devarajan, Jones and Roemer (1989) also use a parameterisation to illustrate the price responsiveness of *total* supply. They used particular parameters in their model to illustrate the possibility of a *perverse* supply response on the official price. However, they failed to notice that, just as in our parameterisation, the parameter values required for a perverse response would violate the second order conditions for a maximum. All the other results derived here apply to their example as well.

analysis. Let the marginal cost function $C'(Q_c + Q_u)$ be linear and equal to $c \cdot (Q_c + Q_u)$ ($c > 0$). Let the fine payable in case of detection be proportional to the amount smuggled, $f(Q_u) = k \cdot Q_u$ ($k > 0$). Further, let the risk function be specified in an additive separable way as:

$$(4) \quad \theta(Q_u, Q_c) = a \cdot Q_u - b \cdot Q_c$$

in which a is strictly positive and b non-negative. Using (2) and (3), total supply can be found as a function of prices:

$$(5) \quad Q_c + Q_u = \frac{2ka + kb}{2ck(a+b) - k^2b^2} p_c + \frac{kb}{2ck(a+b) - k^2b^2} p_u$$

Written in this way, it can be seen that total supply is a function of both the level of the official and of the parallel market price. The second order conditions imply that the denominator in equation (5) will have to be positive for a maximum³. In that case, the response to both an increase in the official price and in the parallel market price will always be positive. However, if b equals zero, ie. in the Bhagwati and Hansen model, the parallel market price is irrelevant: total output only depends on the price in the official market, and parallel market prices can be ignored. This is a result that can be tested empirically: if the production supply response is a function of both official and black market prices, then this would point to a rejection of the Bhagwati and Hansen model, and may point to the use of official supplies as a cover for smuggling.

In most cases, as in this paper, data will only be available on official supplies, and not on smuggled quantities. Official and parallel market prices are more commonly available. Equation (6) shows the official supply function in the example considered:

$$(6) \quad Q_c = \frac{2ka + kb}{2ck(a+b) - k^2b^2} p_c + \frac{kb - c}{2ck(a+b) - k^2b^2} (p_u - p_c)$$

Supply in the official market is a function of both the official price and the premium in the parallel market. The effect of the official price is always positive. However, an increase in the parallel market price may *increase* official supply if kb (the marginal

³The second order conditions are:

$$\begin{aligned} 2ck(a+b) - k^2b^2 &> 0 \\ c &> 0 \end{aligned}$$

reduction in risk costs from an increased supply as cover) is larger than the marginal cost of production. This is caused by the joint function of official supplies: as an output earning return p_c and as a cost reducing input in the supply in the parallel market. If b equals zero, then the response to increases in the premium is always negative: quantities will be switched away from the official to the parallel market. Therefore, an empirical finding exhibiting a positive effect in response to increases in the premium would suggest that the Pitt model, rather than the Bhagwati and Hansen model applies. Furthermore, when b equals zero, the effect of the official price is exactly equal to the total supply response, in all cases with and without smuggling. Consequently, in this case the total supply response can be correctly identified from the official supply function. If b is not equal to zero, then the total (production) supply response in response to increases in the official price *can* be identified from the *official market* supply function, at least in this specification. But as was noted before, this supply response is different from the supply response which would exist if the premium in the official market were to disappear. Furthermore, the production responsiveness to parallel market price increases can not be identified from an estimated official supply function. So the supply increases following increases in prices in all channels can not be identified.

In general, both the Bhagwati and Hansen model and the Pitt model predict, under price controls, that official supplies will be a function of the premium in the black market and the official price⁴. However the different possibilities of signs and magnitudes on these terms in empirical work may allow us to test which model is not consistent with evidence. They also have other policy implications. First, the production supply response to official price increases may be identified on the basis of official market supply function only. This is, however, only useful for policy predictions about the consequences of exchange rate unification and removal of premium in black market in the case of the Bhagwati and Hansen model. If the Pitt model applies, the supply response is different from what would have applied if no price controls and smuggling option existed. Secondly, the relative supply response to changes in the premium in each outlet can be identified in each equation. However, in the Bhagwati model it will always be negative, while under certain parameterisation and parameter values the Pitt model would show a positive sign. In section 4, the official supply function will be estimated, which will allow us to test these predictions. First, however, the available data will have to be discussed and manipulated to allow these tests to take place.

3. Coffee in Ethiopia

The economic and political landscape of Ethiopia has been thoroughly transformed in recent years. During the 1980s the civil war intensified, but it was brought to an

⁴While official supplies always will be a function of official and smuggling prices in both models, the predictions discussed will only be valid for those circumstances in which supply can be written as a separable function of the premium and of the official price. Otherwise these effects may become impossible to identify in empirical work. Non-separability may follow from risk functions which are non-separable, or fine functions depending on prices as well as smuggled quantities.

end with the defeat of the Mengistu-government in 1991 by a coalition of opposition forces, led by Tigrayan guerrillas. In 1990, the beleaguered government instigated some market reforms including the liberalisation of grain markets. The present transitional government has extended these reforms, embracing IMF-backed stabilisation and structural adjustment. These reforms are characterized by the rapid reversion of a strict economic control system to a free market economy. The aim is to provide incentives to all sectors to reverse a long period of economic decline. At the macroeconomic level, stimulating growth, and a reduction of the fiscal and trade balance deficits are high on the agenda. One purpose of this paper is to discuss the effects of the reform programme on coffee, the single most important export commodity in the country.

The start of the reform programme can be dated back to September 1992, with a large devaluation of the dollar exchange rate from 2.07 birr per dollar to 5 birr. Since then, at least some of the consequences have been remarkable. Consumer prices have not increased substantially. In fact, the 12 months following the devaluation were characterized by negative inflation⁵. Another, probably linked, observation is that the black market exchange rate did not move up substantially remaining at about 7.5 birr per dollar ever since. During 1993, a harmonization of the two exchange rate markets has started with regular foreign exchange auctions typically yielding rates between 5.5 and 6 birr per dollar.

One of the main aims of the exchange rate policy is to stimulate exports. The trade balance has consistently been negative in the 1980s. During the last five years, exports covered less than half the import bill. Besides the devaluation, a liberalisation of coffee marketing has also started. The devaluation and liberalisation are expected to stimulate coffee production, the most important foreign exchange earner. A more immediate effect which is hoped for is the reversal of the large flows of coffee into the parallel channels, both in the domestic and the export market. No estimates are available of the quantities involved, but they are thought to be very substantial⁶. The gradual harmonization of the official and the parallel exchange rate markets is hoped to bring these large volumes of trade back into the official circuit, thereby helping to increase official foreign exchange earnings.

Coffee is mainly grown in five regions: Sidamo, Keffa, Wellega, Illubabor, and Hararghe. The first three account for more than 70 percent. Smallholders account for the largest share of production. Some commercial farms used to exist, but they were nationalised in the mid-1970s. Since the 1960s, three distinct periods can be considered with respect to the marketing structure⁷. During the imperial government

⁵Collier and Gunning (1992) have provided a plausible explanation for this. Very few consumer transactions on tradables passed via the official channels but, instead, via the parallel market where prices reflected the parallel market exchange rate. Devaluation of the official exchange rate would not affect these prices, especially since the official and black foreign exchange markets were relatively segmented with very little possibility nor incentive for cross-trade. The negative inflation figures are slightly misleading because of the exceptionally good harvest in 1992/93. However, correcting for this effect, inflation figures remained very low and remarkable.

⁶Officials at the Ethiopian Coffee Marketing Co-operation suggested a figure of about 40% of total marketed supplies in the 1980s went via the parallel market.

⁷For an overview of coffee marketing, see Akalu Negewo (1993).

(until 1974), the marketing structure was market-based. Coffee was bought by traders at various levels of the marketing chain, some of which would reach the terminal markets at Dire Dawa and Addis Ababa where auctions in which exporters participated took place. Government intervention was limited to some regulation and quality control.

After the revolution, the Military Government aimed at taking over coffee marketing at all levels. The socialisation of production was also started with the setting up of producer co-operatives, even though more than 90 percent of coffee production continued to come from private smallholders. Private traders were condoned, but were severely constrained via price controls at all levels of the marketing chain. A government agency, the Ethiopian Coffee Marketing Cooperation (ECMC) took on substantial responsibilities in the marketing of coffee, and soon controlled more than 80 percent of officially handled supplies. Private traders could not freely sell coffee in the domestic markets either, even though substantial domestic demand for coffee exists. Auctions continued to take place in Addis Ababa and Dire Dawa, but prices at the 'auctions' were in fact fixed by the Ministry of Coffee and Tea Development. Taxes on coffee were raised substantially, and included surtax, transaction tax, export duty and coffee cess, and became about half of the fob export prices. Taxes were also variable: being higher at higher world prices. This strict and high-tax control regime created strong incentives to sell and buy coffee in parallel markets which emerged and flourished. Coffee was smuggled into Djibouti and Kenya; substantial amounts were also brought to the Sudan.

Smuggling coffee was not without risks and occasional arrests were made. There were severe penalties for failing to sell in the official channels. Furthermore, in most rural areas, farmers were organised in peasant associations which were under quite close political control. Inputs were usually only available via these structures, which also performed primary marketing functions via official channels. This may well have forced farmers to supply at least some coffee in the official channels.

The Transitional Government reversed most of these measures in recent years. Co-operatives have been disbanded, and coffee marketing has been freed. Coffee traders can sell and buy as they wish, even though licenses are still required and are relatively expensive. Taxes have come down, but mainly because of the very low international prices. The auction is allowed to function properly and all price controls have been removed. However, the ECMC offers farmers and traders floor prices. Parallel markets are, nevertheless, thought to continue to attract substantial flows.

The coffee supply data on quantities cover obviously only the official channels. Consistent data are available only for the coffee brought to the two terminal markets, Addis Ababa and Dire Dawa and the coffee exported. The former can give us an impression of the total official domestic plus export supply, and will be used throughout this paper. The ECMC, and at present also private traders, use low quality coffee, rejected for export at the auction, as their main source of 'official' domestic market supply. In coffee areas, it was always legal for licensed traders to sell directly to consumers, and this coffee will not be included in the statistics. All other domestic and export sales are in fact 'parallel' market transactions, and are therefore also excluded from the statistics.

Figure 1 shows the quantities channelled through the official market since 1961/62⁸. Supplies increased gradually throughout the 1960s until 1972/73. With the revolution during 1973/74, a collapse can be observed, with further low levels until 1976/77. Then a recovery came, but at levels lower than those before the revolution in 1974. Since then, there is apparently a decreasing trend, with substantial variability. Very low levels were obtained in 1984/85 (the drought and famine year) and 1991/92 (the year of the fall of the Mengistu government). It is likely that the low levels in these two years are related to these occurrences. Finally, a recovery can be noticed in 1992/93, even though to a level close to the earlier trend.

In the rest of this section, the evolution of coffee prices in Ethiopia is assessed since the beginning of the 1960s. In particular, we will discuss the consequences of implicit and explicit taxation — such as overvaluation, export taxation and possibly excessive margins — on farmgate prices. Also, we will try to provide some measure of the price farmers could expect to receive from supplying coffee on the black market for domestic use or export.

Farmgate coffee prices are hard to come by in Ethiopia. Before 1974, pricing was free, and no prices were systematically recorded. During the military government, prices were controlled at all levels, but, contrary to most East-African coffee producing countries, they were not pan-territorial. Instead, a complex system of deductions relative to the auction and world price was used, implying different prices at each different location and for each type of transaction. Constructing a representative 'farmgate price' series is therefore quite a haphazard undertaking. The ECMC supplied us estimates of the regional average coffee prices at the farmgate level since the coffee year 1984/85 for washed and unwashed coffee. Using quantities supplied to the auction from the various regions for each year, average prices could be established for unwashed coffee for the country as a whole⁹. Before 1984/85, no data were available on farmgate prices. Nevertheless, auction prices are available from before 1960. Assuming that the proportion taken for marketing costs from the farmgate up to delivery at the auction has remained constant at roughly the average proportion between 1984 and 1992, we estimated farmgate prices for the pre-1984 period as:

$$(7) \quad FGPBO_i = \left[\frac{1}{9} \sum_{j=1984}^{1992} \left(\frac{FGPBO_j}{APB_j} \right) \right] \cdot APB_i$$

where $FGPBO_i$ is the (nominal) farmgate price in birr in the official channel in year i and APB_i is the auction price in year i . The average ratio between the farmgate and the auction price between 1984 and 1992 was 81 percent.

If anything, it may be thought that the rigidity of parastatal coffee marketing in a system that was gradually crumbling and collapsing (as the Ethiopian economy

⁸Data are for coffee years, ie. from October to September.

⁹These estimates exclude the Hararghe data, to allow a direct comparison with the auction prices in Addis Ababa. Hararghe coffee is supplied to the Dire Dawa auction and is of a far higher quality, fetching better prices. Including them would not change fundamentally the results, but would be misleading with respect to the average marketing margins between the farmgate and the auction prices.

was) implied that marketing costs became higher on average in the 1980s than what they were either before the revolution or in the first few years afterwards. Consequently, it is likely that the estimated farmgate prices are somewhat biased downwards. The real farmgate price, a measure of the incentive price for coffee (RFGBO), were calculated by deflating the nominal prices by the consumer price index (CPI), recalculated to reflect coffee years¹⁰. To assess the consequences of the exchange rate policy, taxation and of marketing margins on the coffee prices a series of other price indexes are also calculated. The approach taken is described in Dercon (1993). Table 1 summarizes the formulas used.

A measure of the world price for Ethiopian coffee is the unit export value index for coffee. The difference between the export price, expressed in Ethiopian birr, and deflated by the CPI, (RPCB) and the farmgate price (RFGPBO) will give a measure of the total domestic margin for coffee. This margin is, however, divided between the government, via taxation, and the domestic marketing agents. By calculating the unit export value price for coffee excluding export taxes (RPCBAT) and comparing it with the farmgate price (RFGPBO) an estimate of the marketing margin can be obtained. Finally, a measure of the overvaluation of the exchange rate can be obtained by expressing the unit export value index in terms of constant US dollars, (RPC\$) using the official exchange rate and the Manufacturing Unit Value index (as calculated by the World Bank) as a deflator. This provides a measure of the international terms of trade for coffee. In this way, we can assess to what extent the exchange rate has not adjusted to domestic inflationary pressures relative to the international level. If the international real price has increased relative to the domestic real price, then domestic terms of trade have not kept up with international terms of trade - incentives for coffee production have been reduced because of overvaluation. To assess the incentives for smuggling coffee, first, the unit export value price for coffee in US dollars was converted into birr using the parallel market exchange rate (Cowitt, various years, and Ministry of Planning and Economic Development, 1993).

Next, an estimate of the farmgate price for smuggled coffee (RFGPBS) was obtained by first assuming that in a base-year, 1970/71, there was no incentive to smuggle coffee, such that the coffee prices in the official system were the same as in the 'parallel' system at the farmgate level. Furthermore, we assume that the proportion the farmer received from the smuggling border price in this year is the same proportion as in all years (about 52 percent). This may seem arbitrary but the resulting smuggling farmgate price provides, if anything, a downward biased measure of the actual smuggling price. First, the assumption of proportional marketing costs will reduce the calculated farmgate price in the latter years of the period considered, when in the parallel market the dollar was trading at premiums of 200 percent and more relative to the official exchange rate. The construct implies

¹⁰Consumer price indexes under systems of price controls and black markets may be poor indicators of actual prices if statistical offices concentrated on the official prices. In Ethiopia, however, the data collection procedures at the Central Statistical Authority may have avoided this problem since it always collected most of its data at the open market. Furthermore, for most consumer goods official prices were set for rationed sales at the government retail outlets, while it remained legal for private retailers to sell consumer goods at market prices. It is therefore unlikely that the CPI has been systematically and considerably underestimating the actual cost of living. Nevertheless, in some years, underestimation may have occurred, although no obvious alternative exists.

furthermore that in the base-year 1970/71 the risk-premium involved in trading in the parallel market is exactly equal to the gain from using the parallel market exchange rate and evading the export taxes. Consequently, the incentives for farmers to enter in the parallel market in other years, implied in the estimated farmgate prices, are given relative to the incentives in the base-year. Note that smuggling prices are given relative to the parallel market exchange rate. The deviation of the parallel market exchange rate from the official market exchange rate is related to overvaluation. Because of overvaluation, exchange controls are binding and this causes a premium between the official and the parallel market exchange rate to develop. This does not necessarily mean that the parallel market exchange rate is the 'counterfactual' exchange rate 'if no overvaluation were present'. Consequently we did not use the parallel market exchange rate to construct a measure of taxation because of overvaluation.

These points can be illuminated by showing how these price indexes are related to each other. In particular, defining the real exchange rate against the dollar as $r = E \cdot \text{PMV}\$/P$, and m as the proportional marketing margin in the official market, then the real farmgate price for coffee in the official channel can be rewritten as:

$$(8) \quad RFGPBO = (1-t).(1-m).r.RPC\$$$

In words, the real price received by the farmer is obtained by subtracting from the international terms of trade for coffee (the world price for coffee deflated by the MUV index) proportions for marketing margins, export taxes and overvaluation.

For the real price received by the farmer from smuggling a similar formula can be obtained as:

$$(9) \quad RFGPBS = (1-m_s).r_b.RPC\$$$

in which r_b is the real *parallel* exchange rate ($r_b = \text{EBM} \cdot \text{PMV}\$/P$), and m_s is the proportional marketing margin in smuggling, which has been kept constant at the 1970/71 level. In words, the real price received by the farmer from smuggling is obtained by multiplying the international terms of trade for coffee with real parallel exchange rate, allowing for a marketing margin. From (2) and (3), and defining z as the premium in the parallel market exchange rate (expressed relative to the latter), it follows that the relative incentive to supply coffee to the different channels can be defined as:

$$(10) \quad \frac{RFGPBS}{RFGPBO} = \frac{(1-m_s)}{(1-m)(1-t).(1-z)}$$

in which $\text{EBM}(1-z)$ equals E . Since the incentive for selling to the parallel market and to the official channel is assumed to be the same for the base year 1970/71, it follows that (10) can also be written as:

$$(11) \quad \frac{RFGPBS}{RFGPBO} = \frac{(1-m_{70})(1-t_{70})(1-z_{70})}{(1-m).(1-t)(1-z)}$$

The subscript 70 refers to the value in the base year. This shows the point that by construction, the relative price incentives to supply officially or in the parallel market are determined relative to the base year.

To compare these series, scaling them as index numbers is necessary, if only because the real dollar price can otherwise not be compared with the other prices, expressed in Ethiopian birr. The base-year chosen was again 1970/71 and the real unit export value (RPCB) and the real dollar price index (RPC\$) were both put equal to 100. This assumes that all overvaluation in the other years has to be considered relative to the existing overvaluation in the base-year¹¹. The export price after tax (RPCBAT), official farmgate price (RFGPBO) and the smuggling farmgate price (RFGBS) were all converted to an index proportional to the unit export value index, by deflating each of these prices by the real unit export value in 1970.

In particular, both the smuggling and the official farmgate price were in 1970/71 56 percent of the unit export value index, while the after-tax unit export value index was 77 percent of the export value index. Consequently, smuggling and official farmgate prices were put in an index with 1970/71 equal to 56 and the after-tax index has been scaled to the 1970/71 value of 77. The implication is that the differences between the different series reflect the true (relative) margins between the prices.

Figure 2 shows the results. First, the unit export value index in dollar prices reflects the evolution in the world price for coffee. Prices gradually declined in the 1960s, but they suddenly surged up during the coffee boom years in the mid-1970s. Afterwards, prices declined again, but quite high levels were reached again around 1985/86. Since then, world prices have slumped to all time lows. The Ethiopian birr unit export value index follows this pattern. In the 1960s and early 1970s, it stayed somewhat above the dollar price index, suggesting some undervaluation relative to the levels in the base-year 1970/71. From late 1970s up to 1980, the two prices were virtually identical, but then overvaluation set in. The overvaluation became large by the mid-1980s, though it declined for a while afterwards; it started growing again from 1990 onwards. Finally, the devaluation of September 1992 went beyond what was needed to restore the terms of trade of coffee in domestic currency, relative to the international terms of trade — at least compared to what they were in 1970/71 — resulting in the 1992/93 index ending much higher than the dollar price index. In other words, the devaluation created possibilities to increase incentives to coffee growers, beyond what was needed to keep up with international market incentives for coffee production.

In fact, the exchange rate policy did not create very high implicit taxation, at least compared to the direct taxation via export taxes (in various forms). Total taxes went up with higher world prices, resulting in a much flatter index of unit export value prices after taxes. As a percentage of the unit export value price, nearly a

¹¹At the time the parallel market exchange rate was about 2.50 birr for a US dollar, compared to 2.30 in the official market.

quarter was paid in taxes between 1970/71 and 1975/76, rising after the revolution to 44 percent in the latter half of the 1970s, and 40 percent between 1981/82 and 1985/86. With declining world prices, rates dropped to about 25 percent between 1986/87 and 1989/90. The further decline in world prices and the start of gradual economic reforms brought the tax rate down to about 4 percent in 1990/91 and 1991/92. By 1992/93, taxes as a percentage of the unit export value index were very small.

The farmgate prices are heavily affected by these export taxes. In fact, they were calculated relative to these prices, with deductions at the various levels of the marketing chain. Recall that the farmgate prices from 1984/85 onwards are the actual prices where as those before this date are calculations relative to the auction price in Addis Ababa, an important part of the marketing chain. Despite a lot of political and economic upheavals in the 1980s, the marketing deductions did not change dramatically as figure 2 confirms. Consequently, the estimated farmgate prices for the earlier period may well be quite reasonable approximations. The series consistently mirrors as one would expect the unit export value series after tax. The implication is that the series reflects the declines of the world prices, but has not been allowed to benefit from the boom in the mid-1970s nor from the mini-boom in the mid-1980s. Ever since the revolution in mid-1970s, prices have declined. The first recovery came only after the devaluation. Note however that the increase is far less than the increase in the after-tax unit export value index.

Finally, the smuggling price needs to be considered. Note that this price is calculated with moderate assumptions about marketing margins so that it will mainly reflect the effects of the parallel market exchange rate and the high coffee taxes. Incentives to smuggle must have been low in the 1960s, according to these estimates. A first jump came in the early 1970s when the parallel market rate for currency moved up with increased policy uncertainty before the revolution. The high taxation during the coffee boom and further rise in parallel market exchange rates more than doubled the smuggling price for coffee in just two years. Even though it declined with declining world prices in the first part of the 1980s, it shot up again in the mid-1980s, staying at high levels despite lower world prices by virtue of further depreciation of the birr in the parallel market. Even after the devaluation, a large premium remained in 1992/93 in the parallel market, implying that the smuggling price at the producer level has remained substantially higher than the official market price: strong incentives to smuggle coffee remain.

Table 2 summarizes the effects on the coffee price of the various implicit and explicit taxes, with 1970 referring to the coffee year 1970/71. It gives the percentage increase in the real coffee price which could have been possible if a particular explicit or implicit tax had been removed. The total effect of export taxes and exchange rate overvaluation is particularly large in the period since the mid-1970s. Between 1976 and 1980 prices could have increased by more than 130 percent if virtually all export taxation were abolished. Between 1981 and 1985, this went up to 176 percent, with increasing implicit taxation through the overvaluation of the birr exchange rate. Since then, lower world prices gave less possibilities to increase producer prices, but still more than 70 percent higher prices could have been paid between 1986 and 1991, increasingly due to increasing overvaluation. Devaluation has rectified the taxation of coffee, as the figures for 1992 show, relative to the 1970/71 levels. Ignoring any

effect of the marketing margin, prices now would have only been a quarter of the present coffee producer prices if devaluation had not taken place.

This result is, however, somewhat misleading. It assumes that the marketing margin in each year including 1992/93 has been reflecting real marketing costs under efficiency. If the marketing margin had stayed exactly at its 1984/85 level (in real terms), in most years of the 1980s, prices could have been somewhat higher. However, by 1990/91 and 1991/92, margins seem to have been squeezed, allowing the coffee prices paid to farmers not to drop by a further 28 percent. After the devaluation, margins became in real terms 46 percent higher than that in 1984/85. This may be a reflection of somewhat higher marketing costs - the CPI used may not appropriately reflect the effects on fuel prices and other transport costs; in other words, the factors important for marketing costs. Still, the large increase in margins for the marketing agents seems to be excessive, and the result was that despite an increase of close to 150 percent in the birr/dollar exchange rate, farmers' prices are only about 60 percent higher in real terms than those before the devaluation (ie. the net effect of devaluation and increased margins is that removing both effects would reduce prices by a quarter). Marketing agents have taken the lion share of the effects of the devaluation. Note further that the increase in farmgate prices in 1993/94 is unlikely to have reversed this fundamentally.

The premiums which farmers would get, on top of the official price, from smuggling coffee are also shown in table 2, expressed as the percentage of official farmgate prices farmers participating in the parallel market would have got. Since the latter part of the 1970s smuggling allowed large rents to farmers, with parallel market farmgate prices which may well have been up to 4 times the official price by the end of the 1980s. With the gradual removal of export taxes and the reduction of official margins, smuggling premiums started to decline in the beginning of the 1990s. The devaluation erased most of the premium, even though a 50 percent premium in parallel market exchange rates initially remained. The increased margins in the official market meant that coffee prices in the parallel market were estimated to be still 70 percent higher than the official prices¹². Note that these parallel market prices for coffee are calculated as national averages, using conservative estimates of marketing margins. However, some additional risk premium may need to be deducted. But this risk premium is in many areas not likely to be very large, since a lot of coffee is grown in areas with easy access to neighbouring countries.

4. An Empirical Analysis of Official Coffee Supplies in Ethiopia

In principle, it ought to be possible to estimate a supply function for the official channel and implement a test about the applicability of each of the models. Data on prices are available from 1963/64 until 1992/93. Given the nature of the commodity involved and the particular situation of Ethiopia during this period, some further considerations have to be taken into account. First, coffee is a perennial crop, and

¹²Since then the premium has declined further through a further, gradual devaluation of the official exchange rate.

substantial lags (3 to 7 years) exist before a harvest can be obtained from any newly planted coffee trees. This means that farmers will have to base their planting decisions (and therefore supply) on their expectations about future prices. By lack of data on expectations, lagged prices are included to account for the lags in production responses¹³.

Secondly, standard supply response models are only valid in general if no markets are missing or are imperfect. For example, if rationing exists in the goods market, perverse supply responses are possible (Bevan, Bigsten, Collier and Gunning, 1987; Azam and Besley, 1991). During the period under consideration, rationing is likely to have occurred in some areas, and this would affect supply response. Nevertheless, most main coffee areas are relatively close to the main smuggling routes, both out and into the country (Sidamo close to the Kenyan route; Hararghe on the Djibouti route). The coffee areas are likely to have had comparatively reasonable supplies, albeit via the parallel market.

Thirdly, supply response may be limited if certain factor markets are missing. For example, if new land can not be acquired to plant coffee on, then increases in coffee production can only come from intensification or from taking land away from other crops. This may well have been very important in Ethiopia: land transactions were made illegal during the 1970s and 1980s. Land allocations across households was controlled by the local peasant associations which were required by the government to give land on the basis of factors such as household size. Very little scope for other land acquisition existed, especially since indigenous institutions such as forms of sharecropping, widely used in Ethiopia, can not be applied to perennial crops. Consequently, increases in coffee areas are therefore most likely to happen via reducing areas devoted to other crops.

Some competing crops could be identified. A typical alternative for coffee is *enset* (false banana) in Ethiopia. *Enset* is highly valued as a food crop. As a cash crop, it has its limitations, since the market for it is confined to specific ethnic groups and since it is bulky to transport. Most coffee producers would intercrop coffee with *enset*, but reliance on the latter for cash earnings is rather rare. In some areas, (such as in Kembata), farmers have started to grow avocados, other vegetables or tobacco as alternatives to channel new investment into. Fruit trees have also been introduced in larger numbers. However, by far the most popular alternative for coffee appears to be *chat*, (*Q'at*), the mild stimulant increasingly popular throughout Ethiopia and in the surrounding countries (Djibouti, Somalia, Yemen and other Arab countries). Even though it has been made illegal in most Western countries, its consumption is fully legal in Ethiopia and the neighbouring countries.

Even though its optimal growing conditions are not exactly the same as for coffee, in most coffee growing areas it has become a highly valued alternative crop. Indeed, during field trips, we found *Chat* being grown for sale not just in its traditional areas in Hararghe, but also in Jima, Shashemene (Southern Shoa), Sidamo, Kembata, Gurage and even as far afield as Debre Libanos (Gojjam), though with very

¹³This does not mean that short-run responses are not possible: farmers may respond to increased incentives by increasing their own labour supply on the crop or by increasing the use of fertilisers, pesticides, etc. Production can still increase in the short-run, even without new plantings. This short-run effect is however likely to be smaller than the long run response.

little success in the latter. Chat is a perennial crop, just as is coffee, but it can be harvested already after a few years. The young leaves can in principle be harvested gradually throughout the year, but after harvesting, they need to reach the market still fresh to keep its value. Consequently, most peasants seem to wait before harvesting until itinerant traders pass nearby. Transport and marketing is entirely controlled by private traders, and government intervention is minimal. Chat is moved to the markets by trucks and other vehicles, but also by chartered planes to Djibouti and to the Arab world.

Figures 3 to 5 illustrate the attraction to enter into chat production. Figure 3 gives the unit export value index, deflated by the CPI, since the beginning of the 1960s, data availability permitting. Trade statistics for some years have been repressed, since by the 1960s it was considered too sensitive to publish information on chat, since it has all the characteristics of a soft drug. Export taxation has consistently been minimal (close to 4 percent on average), so this index will give an indication of the changing incentives to produce the crop, assuming that farmgate prices are directly related to export prices (which is likely since it is a tradable, not liable to controls). The real dollar price index, calculated using the official exchange rate and the manufacturing unit value index, gives the unit export value index in dollars, which is the international terms of trade of chat, and avoiding a bias because of overvaluation in the former index, as before. Finally, an export unit value index in birr is presented using the parallel market exchange rate, to show incentives to smuggle the commodity. All figures are scaled to 1970/71 equal to 100. (Note that the calculations are similar to the one for coffee presented earlier.) The figures show that world chat prices experienced a temporary slump in the 1970s, but since the mid-1970s they have been rising to reach double of their world price levels of 1970/71. The devaluation has meant that even at the official exchange rate, prices are about 3 times the 1970/71 levels, and double the levels of the mid-1980s. The rise in the parallel market exchange rate has meant that incentives to smuggle the commodity have consistently been rising: levels are close to 4 or 5 times the 1970 level, and 10 times prices of the mid-1970s. The main reason for the rise in world prices is the rapidly expanding demand in the Arab world.

Figure 4 shows the prices of coffee and chat, using the unit export value indexes of both products, reflecting the relative incentives on the world market. This implicitly gives the relative incentives in the parallel market or the relative incentives if the coffee market were liberalised and taxes were abolished. A second index gives a relative price index of the official coffee market price and the export unit value index for chat at the parallel exchange rate. The latter will be directly related to the parallel market farmgate price for chat. Since no control mechanisms on the export of chat existed (such as price fixing, trade restrictions, high export taxation and other government interventions), there would have been little incentive to use 'official' channels for exporting the commodity. Given the large premiums involved in the parallel exchange market, it appears that the parallel market chat price would best reflect the incentives to grow chat. Consequently, the index in figure 4 will therefore show the relative incentives to grow chat or to grow coffee for the official market.

The pattern of the indexes of international or domestic prices is initially similar, even though the taxation in the coffee market has meant that relative farmgate prices declined well before the fall in world prices for coffee and the increase in world chat prices. During the coffee-boom, the relative coffee/chat prices

were 6 times higher than that in 1992/93, even ignoring the overvaluation effect. This is unlikely to be a temporary change, it is rather part of a longer cycle of relative prices.

Figure 5 gives relative unit export value indexes since 1944. Chat prices did not follow the commodity boom periods near the Korea-war and in the 1970s. Nevertheless, the increase in chat prices relative to coffee goes much beyond any relative price level in the post-war period. These graphs show that, during the last decade, chat prices have risen very substantially. The increases are largely demand-led, and the substantial habit formation involved in its consumption are likely to make these increases to persist in the medium run. It provides strong incentives for farmers to invest into this crop rather than planting new coffee. It may not be the only alternative to coffee in Ethiopia, but the large relative price increases have made it very attractive. In the supply function official coffee prices relative to parallel market chat prices will be used to capture the changes in relative incentives. The missing data for some years in the 1960s for chat were reconstructed using linear interpolation. Next, weather and other exogenous shocks could cause important fluctuations in production and in official supplies. Ideally, rainfall data should be included in any empirical model of agricultural supply. However, coffee is produced in many different areas hundreds of miles apart, each with a somewhat different weather history. Furthermore, rainfall data were not available for many years in the period under consideration and could therefore not be included.

However, in the specification we allowed for a temporary disruption in supplies to the official market in three periods. First, between 1973/74 to 1976/77, to account for the effects of the revolution, followed by the uncertainty over land ownership until the land reform in 1976. The 1976/77 figures reflect the first full coffee year after this disruptive period. Given the turmoil and substantial uncertainty in rural areas, official market supplies are likely to have collapsed independent of responses to prices. Secondly, a dummy was introduced for the worst year of the drought and the famine in 1984/85. The famine disrupted not just the main (Northern) famine areas, but the effects were felt throughout the country on production and through transport bottlenecks and migration disrupting food and other trade. Finally, we allow for an effect of the last year of the Mengistu regime and the take-over by the new government in 1991. War considerably disrupted movement in that year, and Addis Ababa was effectively closed off for a few months, implying difficulties to deliver coffee to the capital. The introduction of these dummies may seem arbitrary, but their main effect has been to increase the efficiency of the estimation. Virtually exactly the same but less significant results were obtained if they were dropped, suggesting that their combined effects on supplies have little correlation with the actual movement of relative prices.

One of the purposes of the analysis is to try to distinguish empirically between the Bhagwati and Hansen (1973) and the Pitt (1981) model. Besides the possibility of a negative effect on the premium between the parallel and the official market, the Pitt model allows also for a different production supply response when smuggling is occurring, compared to the situation when no price controls existed. It is unlikely that much smuggling of coffee has been occurring in the period until the turmoil of the early 1970s. This may allow us to test the prediction of a changing supply response, as a way of distinguishing between the two models. We therefore considered the period until 1972/73 as a situation without a parallel market and allowed the supply

responsiveness to be different compared to the later period. If the responsiveness is significantly different then this would contradict the Bhagwati and Hansen model.

$$\begin{aligned}
 \ln Supply_t = & \alpha_0 + \alpha_1 \ln \frac{P_{smug,t}^{cof}}{P_{off,t}^{cof}} + \alpha_2 \ln \frac{P_{off,t}^{cof}}{P_{smug,t}^{chat}} + \alpha_3 \ln \frac{P_{off,t-i}^{cof}}{P_{smug,t-i}^{chat}} \\
 (12) \quad & + \alpha_4 \ln \frac{P_{off,t}^{cof,60s}}{P_{smug,t}^{chat,60s}} + \alpha_5 \ln \frac{P_{off,t-i}^{cof,60s}}{P_{smug,t-i}^{chat,60s}} \\
 & + \alpha_6 \cdot dummy_{74-76} + \alpha_7 \cdot dummy_{84} + \alpha_8 \cdot dummy_{91}
 \end{aligned}$$

All these variables were included in a log-linear specification of total official supply (equation (12)). The premium was expressed as the ratio between black and official market prices for coffee ($P_{smug,t}^{cof} / P_{off,t}^{cof}$), and the coefficient is expected to be positive if the Bhagwati model applies, while in the Pitt model the sign is undetermined. Note that no lagged price is included: one is likely to be able to switch between markets relatively fast. To capture supply response to increases in official market prices from an estimation of the official supply function, the ratio between official coffee prices and its main competing crop, chat ($P_{off,t}^{cof} / P_{smug,t}^{chat}$) is included. We included the same price series again for the sixties, setting its values zero after 1972/73, to capture the potentially different supply response in each period. Consequently, the short run supply response in the 1960s can be found as $(\alpha_2 + \alpha_4)$, while in the later period it is only α_2 . The long run supply response will be found as $(\alpha_2 + \alpha_3 + \alpha_4 + \alpha_5)$ in the 1960s, while from the 1970s it is $(\alpha_2 + \alpha_3)$. An issue to be resolved is the choice of the lag structure for prices. Since it takes at least of few years before any newly planted chat or coffee can be harvested, some experimentation was done. The (absolute) minimum number of years needed before any newly planted coffee or chat can be harvested is about 3 years, even though for coffee trees it takes longer to mature fully. The estimates were quite similar when we used 3 or 4 lags, so in order not to lose too many degrees of freedom, three years lagged prices were included to capture the long-run planting effects on chat and coffee.

A few remaining issues need to be resolved. First, the empirical model specified does not allow for an aggregate supply response, ie. increases in coffee production not at the cost of other crops. Given the land tenure restrictions in Ethiopia, this would seem an appropriate assumption. Nevertheless, in the 1960s these restrictions did not exist. Consequently, an aggregate supply response may still be possible. It will therefore be necessary to test whether we can find any evidence on the existence of an *aggregate* supply response. These tests will be implemented. Secondly, for ordinary least squares estimation to be correct, all explanatory variables in the equation need to be (weakly) exogenous. While for official prices this is unlikely to be a problem, black market prices may vary endogenously with changes in total official supply. In particular, since coffee is the main export crop, lower official supplies may reduce the supply of foreign exchange in the official market, increasing the demand for foreign exchange in the black market. The parallel market exchange rate may increase and this will increase the premium on smuggling coffee. To test whether this endogeneity problem would invalidate the use of ordinary least squares, a Wu-test (as in Hausman, 1978) was performed, which involves testing the significance of predicted values for the endogenous variables. If this predicted value

is significantly different from zero (using a t-test), then exogeneity has to be rejected. The variables involved are both the relative coffee and chat price (since the latter is the black market price) and the relative parallel and official market price for coffee. Official prices, lagged supply and lagged values of the potentially endogenous variables were used as instruments.

Table 3 shows the results of the log-linear OLS regression of official supply (1970/71=100)¹⁴. First, endogeneity of the smuggling price is unlikely to be a problem: either Hausman-test is not significantly different from zero. The fit and the errors of the regression also seem quite reasonable. Secondly, a significant negative effect can be detected on the relative prices in each market: a ten percent increase in the black market coffee price relative to the official price will reduce supplies in the official market by 1.1 percent. This is clear evidence for switching on the part of farmers from supplying in the official channel to supplying in the black market in response to the increasing premium during the 1970s and 1980s. Thirdly, a significant long-run supply response to increases in official market prices (α_3) can be detected for the period as a whole, but also a significant additional short-run effect for the 1960s (α_4). No short-run effect can be detected for the later period (α_2), nor any extra long-run effect for the 1960s (α_5). These effects have to be interpreted with caution because of the insignificance of the latter terms.

Table 4 summarizes the implications of the production response estimates. If we ignore the insignificant terms (ie. put them equal to zero, as the test results would not discourage us from doing so), then the short-run elasticity since the 1970s has been virtually zero, but the long-run elasticity is 0.10 percent. In the 1960s, the elasticities both in the short-run and in the long-run were higher, 0.17 percent and 0.27 percent. The latter estimates are quite in line with estimates for coffee in other countries (Askari and Cummings, 1977). If the insignificant estimates are included as well, then the results are somewhat different, but again, the estimates in the 1960s are higher than afterwards. In fact, the elasticities may even have been negative in the short run and zero in the long run.

Some further tests were performed on the presence of an *aggregate* supply response, by including official coffee prices in real terms. Missing variable tests were performed by adding these variables in various combinations and performing F-tests under the null hypothesis that the additional variables were jointly equal to zero. An F-test of adding present and lagged (3 lags) coffee prices for the entire period and for the earlier period was insignificant ($F(1,17)=0.620$), not rejecting the null that they were irrelevant. Other combinations of these variables, such as testing whether they matter only in the 1960s, or only in the short run, or only in the long run, also did not suggest that they were missing variables in the regression. Consequently, no evidence exists to suggest that an aggregate supply response existed in coffee, neither in the 1960s nor later. The only supply response is relative to other, competing crops. A note of caution is due, however. If the CPI has been measured with error due to price controls, then this result may not be robust¹⁵. Nevertheless, the result is

¹⁴No obvious problems with the error structure could be detected in this regression. Lagrange multiplier higher autocorrelation tests proved insignificant, as did χ^2 -test for non-normality of the errors and a Reset test for adding the squared predicted values.

¹⁵See note 10.

consistent with expectations, especially since 1970, given the restrictions on land, labour and other markets.

The evidence in this equation seems to suggest that the Bhagwati and Hansen model needs to be rejected: the estimated supply response during the 1960s (without smuggling) is significantly different from the later period. (The effect on the relative prices between black and official markets does not help to support that view: its negative sign is both consistent with the Bhagwati and Hansen model as with the Pitt model.) Farmers are likely to have been selling some part of their harvest to the official channels to reduce their risks of being detected while trading in the black market. Given the Ethiopian circumstances, this seems very acceptable as a result: the presence of politically motivated organisations at the grassroots level, such as the farmers associations and co-operatives, may well have forced farmers to be cautious about not supplying anything to these organisations. This caution may also be responsible for the relatively small switching effects observed in the regression.

This conclusion ignores the fact that other factors may well have convoluted the supply response during the 1970s and 1980s. The restrictions on factor markets for land and labour, rationing in input and in consumer goods markets, and a generally unfavourable investment climate would contribute to little resource mobility and insignificant responses to changing incentives (de Janvry, Fafchamps and Sadoulet, 1991). The lower responsiveness detected for the period after 1972/73 may well be explained by this. Also, the absence of any positive short-run response in the later period compared to the 1960s may be explained in this way. In the 1960s, it was possible to increase production in the short run by switching resources and inputs between competing crops, while later on factor mobility may have become far more limited during a period of controls over labour, fertiliser and pesticide markets.

Even though the production response found in the model is broadly consistent with those in other coffee producing countries and in line with expectations, the relatively low significance urges us to be cautious about the interpretation of the results. The estimated coefficient on the relative smuggling and official price of coffee — the switching effect — seems more robust¹⁶: increases in the premium caused quantities of coffee to switch from the official market to the black market. From these figures, and assuming that in the beginning of the 1970s the black market did not exist, it is possible to quantify the volumes of coffee which were smuggled. A counterfactual official supply series was calculated, assuming that parallel market prices relative to official market prices had remained at their 1970/71 level. This counterfactual series was then subtracted from the actual official supply series. Table 5 summarizes these results.

The estimates suggest that during the period 1976–91 about 10 to 15 percent of total marketed production was switched from the official channel into the black market. Since the devaluation, the black market may have contracted by about half. This ignores any supply response from increases in black market prices relative to the competing crop, chat, which exists according to the Pitt model, but can not be identified from the official supply function. However, it is not likely that this

¹⁶The robustness of this coefficient was tested by the changing lag structure of the other variables and by including and dropping dummies for particular periods. Estimated values consistently remained between 0.075 and 0.12, and significant.

response is very large during this period, just as official price supply response. Furthermore, during most of the period the incentives moved gradually against coffee, even in the black market, and in favour of chat. Consequently, if anything, it is likely that a supply response to the decreases in black market coffee prices relative to chat prices would have meant decreases in total black market supply in this period. Therefore, the estimates in table 5 may well be on the high side.

The estimates do not account for the additional effects captured by the dummies in the regression. While the 1984-dummy additional negative shock is mainly related to the drought and famine, some of the negative effects on the official supplies in the immediate period after the 1974 revolution (Dummy₇₄₋₇₆) and the fall of the Mengistu-government (Dummy₉₁) may have involved additional quantities sold in the parallel market. Note however that the 1992/93 estimated share of the parallel market is unaffected by this: even if in 1991/92 substantially higher quantities went into the black market, by 1992/93 the black market share after the devaluation is still about 6 percent.

Unfortunately, there is very little scope to cross-check these estimates with published statistics¹⁷. Statistics from the Sudan or Kenya on their coffee exports, or at any point of the marketing chain do not distinguish between Ethiopian or local coffee. Djibouti is a different case: since it produces no coffee itself, all the coffee exported is Ethiopian coffee. Even though Djibouti's trade statistics are often decades out of date, the ECMC obtained some data on coffee exports, and which can be cross-checked with its own statistics. In particular, data could be obtained on Harar coffee, a particular, high quality coffee variety, only cultivated in the Haraghe region. This particular quality is only exported via Djibouti, and is virtually not sold for domestic consumption (in Ethiopia and in Djibouti), since it is sold at a high premium at the world market. Consequently, total marketed production for this variety is close to the total exports from Djibouti. From these data and from the data on official coffee supplies to the ECMC of this coffee quality, it was found that average exports from Djibouti during the period 1984 and 1991 for this variety was about 4180 tons per year, of which 3470 tons on average could be accounted for by the ECMC as official exports from Ethiopia, suggesting that about 710 tons came from coffee smuggled from Ethiopia. Since no other destination is likely to exist for this particular coffee variety, given the location of the only production region, this leads us to find an estimate of the black market share in total marketed coffee production of this quality of about 17 percent. This estimate is slightly higher than what was found from the

¹⁷The Central Statistical Authority is responsible for most data collection on production and yields for agricultural production. Their sample survey programme only focused on annual food crops, and no coffee statistics can be found in their publications. The FAO produces coffee area, yield and production statistics in its annual yearbooks on all countries of the world. The source of their data is unclear. Until the end of the 1980s their statistics follows closely the pattern of the series of official supplies, with the exception of a few years. In 1984/85 (the year of the drought), FAO reports an unlikely record harvest, returning afterwards to the earlier trend. From 1990 the series becomes suddenly much higher than both the official series and our estimated total marketed production series. The FAO production increase coincides with a sudden jump in yields from between 400 and 470 kilogrammes per hectare in the 1980s to between 600 and 730 kilogrammes since 1990. Such yield increases were quite impossible in Ethiopia at the time, suggesting the unreliability of production and yield data. The same applies to the data on areas harvested: from 1991 the series suddenly show of decline by one-third. The series had previously been revised downwards by almost half in 1986.

econometric analysis. However, the area involved is notorious for its traditions of smuggling and contraband trade, and government control in that region was very weak during that period. In some other areas smuggling is likely to have been far more difficult, so the estimates from the econometric model may be realistic for the country as a whole.

These estimates of black market activity imply that the benefits to be expected from the reform programme and the devaluation may not be very large, at least with respect to encouraging the return to the official channels of the black market coffee exports. The black market in coffee is likely to disappear and the quantities may flow back to the official market. However, the gains to be expected from the disappearance of the black market in the short run may not be more than about 12 million US dollars of extra export earnings at 1992 prices, or about 2 percent of the trade deficit in 1992.

5. Conclusions

This paper attempted to analyze coffee pricing and its consequences in Ethiopia since the 1960s. Taxation, overvaluation and high marketing margins contributed to the development of black markets for coffee in this period. During the second half of the 1970s, export taxation was the most important factor for the low official market prices. In the first half of the 1980s this effect was compounded through increasing overvaluation. Just before the fall of the Mengistu government, taxation became down, but overvaluation increased. In 1992 the trend was reversed with a substantial devaluation. Nevertheless, increased marketing margins reduced the net increase in coffee prices. These forms of implicit and explicit taxation resulted in substantial premiums in the black market, of around 200 percent and more in the 1980s. After the devaluation, a 70 percent premium has remained.

To construct an empirical model of coffee supplies in the official market under the possibility of smuggling, two competing models were assessed. In the model due to Bhagwati and Hansen (1973), total production is only affected by official prices, and the premium in the parallel market will determine the channel in which it is supplied: under a higher premium less will be supplied in the official market. Consequently, official supplies are a function of both the official price and the premium. The alternative model, due to Pitt (1981), assumes that official supplies reduce the risk of detection of smuggling. The consequence is that a supply response to parallel market prices also exists. Official supplies are affected by official prices and the premium. But the response to official prices will be different from the situation in which no smuggling is possible: the production responsiveness is affected by the option to smuggle. Furthermore, under certain circumstances, the response to increases in the black market premium may be negative: more could be supplied to the official market as a consequence.

Testing the responsiveness to the premium is proved straightforward, since lags are unlikely to be relevant. A negative effect was found, consistent with both models. Higher black market prices resulted in quantities to be switched to the black market. It is estimated that these quantities resulted in a decline in foreign exchange

earnings in the official market equal to between 20 and 40 million dollars per year between 1976 and 1991.

With respect to the production response, only evidence for an effect relative to its main alternative, chat, could be found. Nevertheless, the estimation was hindered by the perennial nature of coffee, with substantial lags between planting and harvesting. Furthermore, the results are likely to have been convoluted by other factors, such as the repression of factor markets during most of the period, and other policy factors. Nevertheless, a small, but significant long run effect could be detected since the 1970s (0.10 percent following a one percent price increase). For the 1960s, a significant additional short run supply response (0.17 percent) could be detected, and by implication a larger long run supply response (0.27 percent). This could be evidence in favour of the Pitt model, since supply responses during the period of smuggling differ from the earlier period. However, other policy factors during the period after the revolution could also account for this difference.

An implication of the results is that the black market may not have been as large as is sometimes thought. During the period 1976 to 1991, the share of total marketed production which went to the black market is estimated at about 10 to 15 percent. While this is significant, and even if the recent reforms and further devaluations will succeed in making the black market become unattractive, the effect of the reforms on coffee exports and on the trade balance will remain relatively small.

The recent strong price increases of chat have made this crop a very attractive alternative. The elasticities suggest that switching between crops has been taking place, and will continue if supply responses are restored to the levels found in the 1960s in response to the reforms. However, since the black market exchange rate will have been reflected in the farmgate chat prices, the increases in the official market coffee prices following devaluation will contribute to some strengthening of the position of coffee production relative to chat. The recent strong increases in coffee prices following world price movements will help, at least temporarily. Nevertheless, given the possibly secular rise in chat prices, policy makers may be fouled by believing that coffee production expansion will be at the root of strong improvements in the trade balance.

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Table 1:
Price indexes used in the analysis

PCBO	= $PC\$*E$
RPCBO	= PCB/CPI
RPC\$	= $PC\$/PMV\$$
RPCBAT	= $(RPCB)(1-t)$
RFGPBO	= $FGPBO/CPI$
PCBS	= $PC\$*EBM$
RPCBS	= $PCBS/CPI$
RFGPBS	= $(FGPBO70/PCBS70).(PC\$*EBM)/CPI$

with:

PCBO	= Export price for coffee in birr (current prices)
RPCBO	= Export price of coffee in birr (constant 1970 prices)
P	= domestic CPI (1970=100)
PC\$	= Export price coffee in dollars (current prices)
E	= Nominal exchange rate against the dollar, official
PMV\$	= Manufacturing unit value index (in dollars) (1970=100)
RPC\$	= Export price coffee in dollars (constant 1970 prices)
RPCBAT	= After tax export price of coffee (constant 1970 prices)
RFGPBO	= Real official farmgate price
FGPBO	= Nominal official farmgate price, birr
t	= Export tax rate
PCBS	= Export price coffee, in birr, smuggling channel (current prices)
RPCBS	= Export price coffee, in birr, smuggling channel (constant 1970 prices)
RFGPBS	= Real smuggling farmgate price
EBM	= Parallel market exchange rate against the dollar
FGPBO70	= Official farmgate price in birr in 1970
PCBS70	= Export price in birr, smuggling channel, in 1970.

Table 2:
Effects of taxation

	percentages with which real official market coffee producer prices could have increased if taxation were removed						
	63-69	70-75	76-80	81-85	86-89	90-91	92
Effect of tax (1)		43%	128%	111%	65%	6%	3%
Effect of overvaluation (2)	-11%	-22%	5%	64%	14%	70%	-75%
Total effect of overvaluation and tax (3) = (1)+(2)		21%	133%	176%	79%	76%	-72%
Effect of margin kept at 1984/85 level (4)				15%	13%	-28%	46%
Total effect of overvaluation, tax and margin 1984/85: (5) = (4)+(3)				191%	92%	47%	-26%
Premium on smuggling (% relative to official producer price)	-9%	45%	173%	195%	273%	216%	70%

Table 3:
OLS-regression of logarithm of official supplies

Dependent variable: Ln(Supply)
sample 1966/67 to 1992/93

Variable	Coefficient	t-value
Constant	4.59	(124.23)**
$\ln(P_{\text{smug},t}^{\text{coff}}/P_{\text{off},t}^{\text{coff}})$	-0.11	(-2.21)**
$\ln(P_{\text{off},t}^{\text{coff}}/P_{\text{smug},t}^{\text{chat}})$	-0.10	(-1.11)
$\ln(P_{\text{off},t-3}^{\text{coff}}/P_{\text{smug},t-3}^{\text{chat}})$	0.10	(1.62)
$\ln(P_{\text{off},t}^{\text{coff},60s}/P_{\text{smug},t}^{\text{chat},60s})$	0.17	(1.97)**
$\ln(P_{\text{off},t-3}^{\text{coff},60s}/P_{\text{smug},t-3}^{\text{chat},60s})$	-0.06	(-0.40)
Dummy ₇₄₋₇₆	-0.23	(-3.43)**
Dummy ₈₄	-0.38	(-6.24)**
Dummy ₉₁	-0.41	(-5.65)**

$R^2 = 0.77$ $DW = 2.10$
joint significance $F(8, 18) = 7.46^{**}$

Hausman-test for endogeneity

-adding predicted value of $\ln(P_{\text{smug},t}^{\text{coff}}/P_{\text{off},t}^{\text{coff}})$: t-value = 1.098
-adding predicted value of $\ln(P_{\text{off},t}^{\text{coff}}/P_{\text{smug},t}^{\text{chat}})$: t-value = 0.908

**= significant at 5% *= significant at 10%

Table 4:
Supply response estimates

Effects of 1 percent change in coffee prices relative to chat black market prices on official supplies (ignoring insignificant estimates)

	Short-run	Long-run
1966/67–1972/73	0.17%	0.27%
1973/74–1992/93	0.00%	0.10%

Table 5:
The size of the parallel market

Switching effect: lost supplies to official channel from increased smuggling

	73-75	76-80	81-85	86-89	90-91	92
Extra official supplies (in tons) if no incentive to smuggle (average per year)	4997	10281	11350	14956	9479	5377
Estimated black market share	6%	11%	11%	14%	12%	6%
In million dollars (export unit values)	7	37	37	44	22	12

Figure 1:
Official Coffee Deliveries (tons)

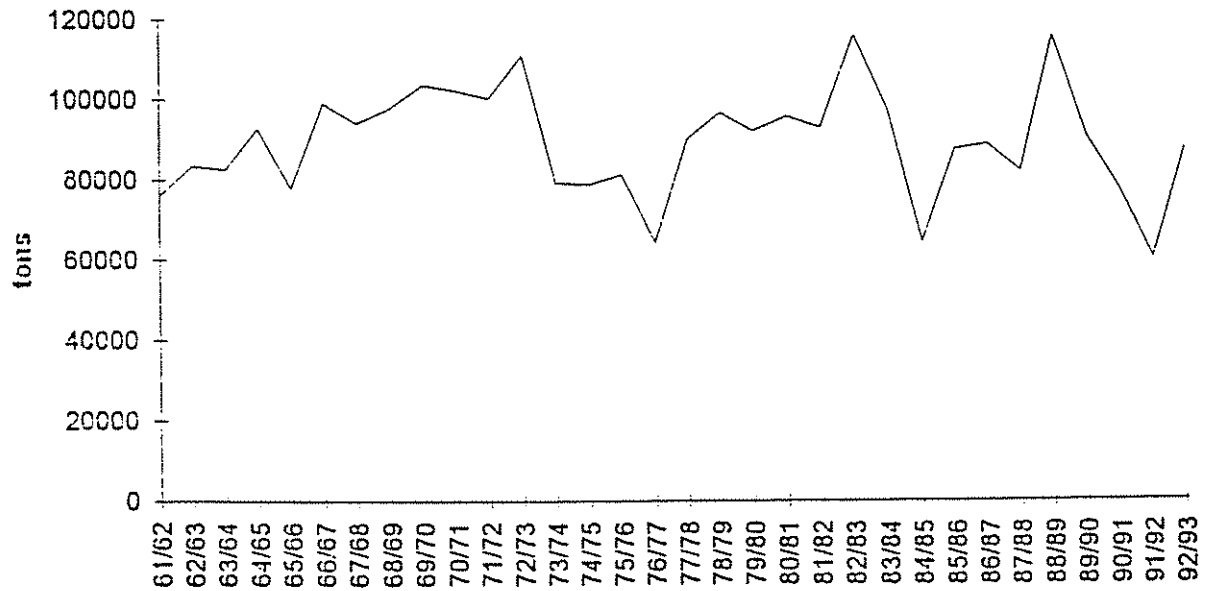
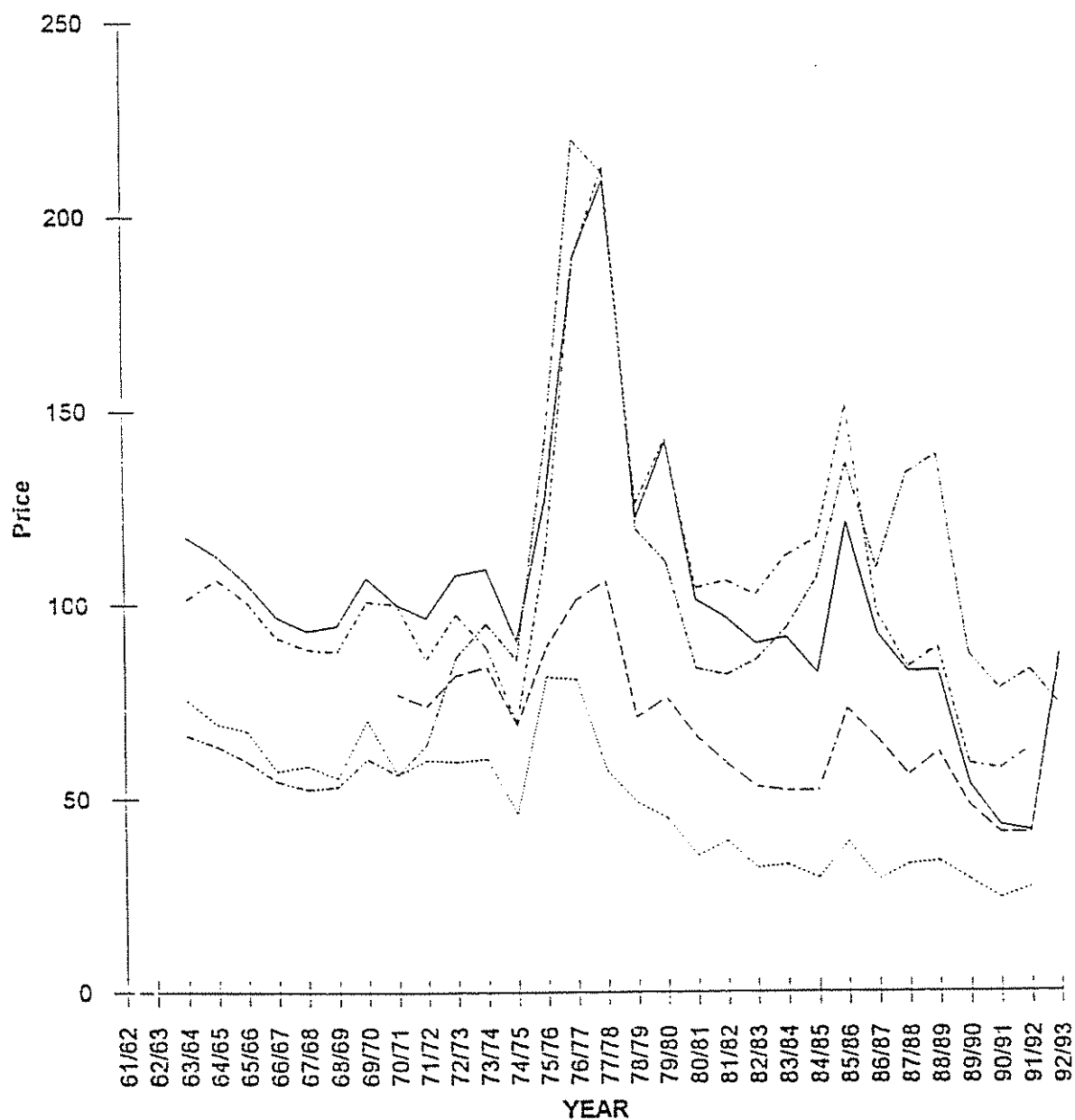


Figure 2:
Coffee Price Index (1970/71 prices)



— Export price (birr) (RPC30)	- - - Export price after tax (RCPBAT) Farmgate price (RFGPBO)
- . - . - World price (\$ (RPCS) Farmgate Smuggling Price (RFBPSS)	

Figure 3:
Chat Price Index (1970/71 prices)

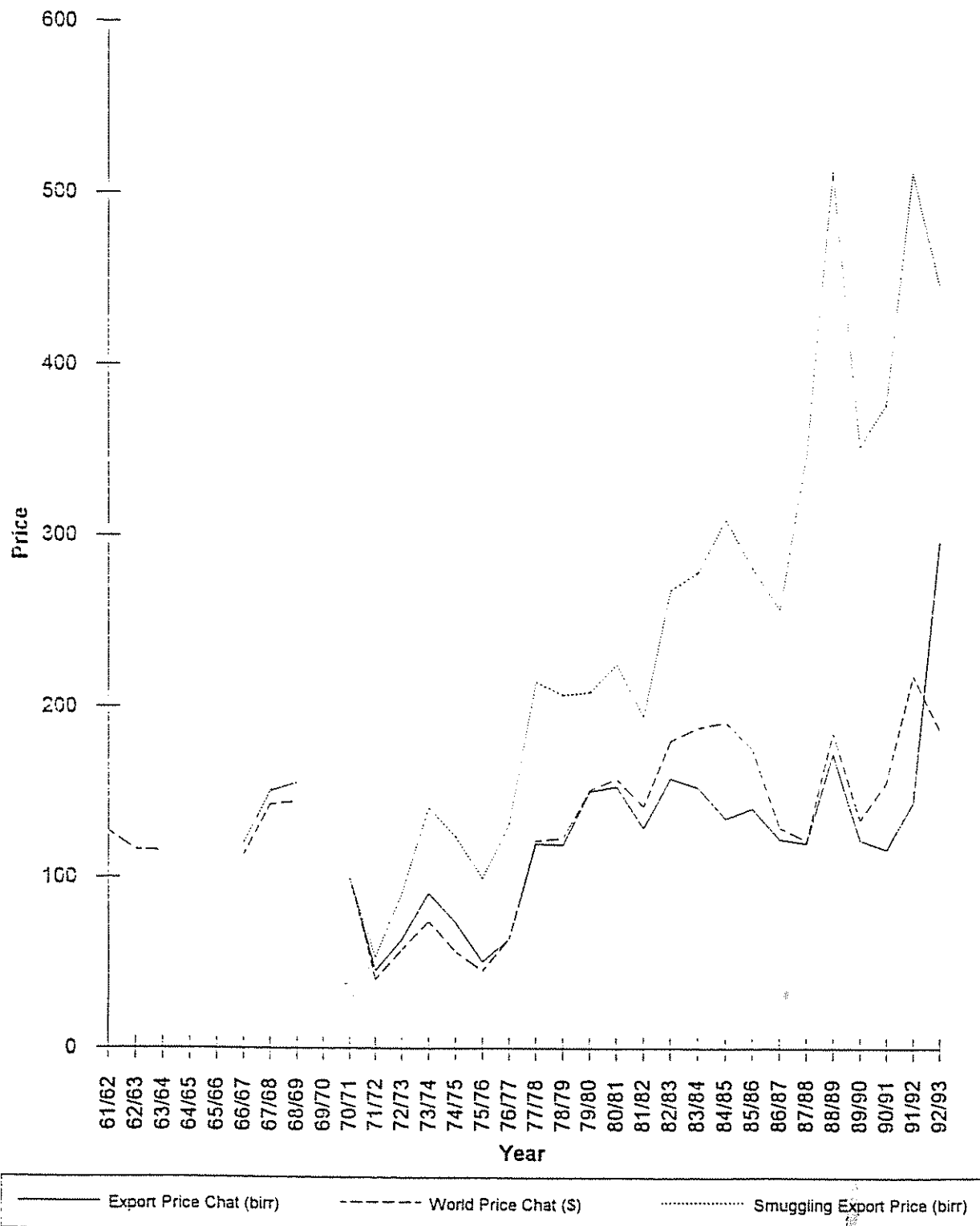


Figure 4:
Relative Coffee and Chat Price (1970/71=100)

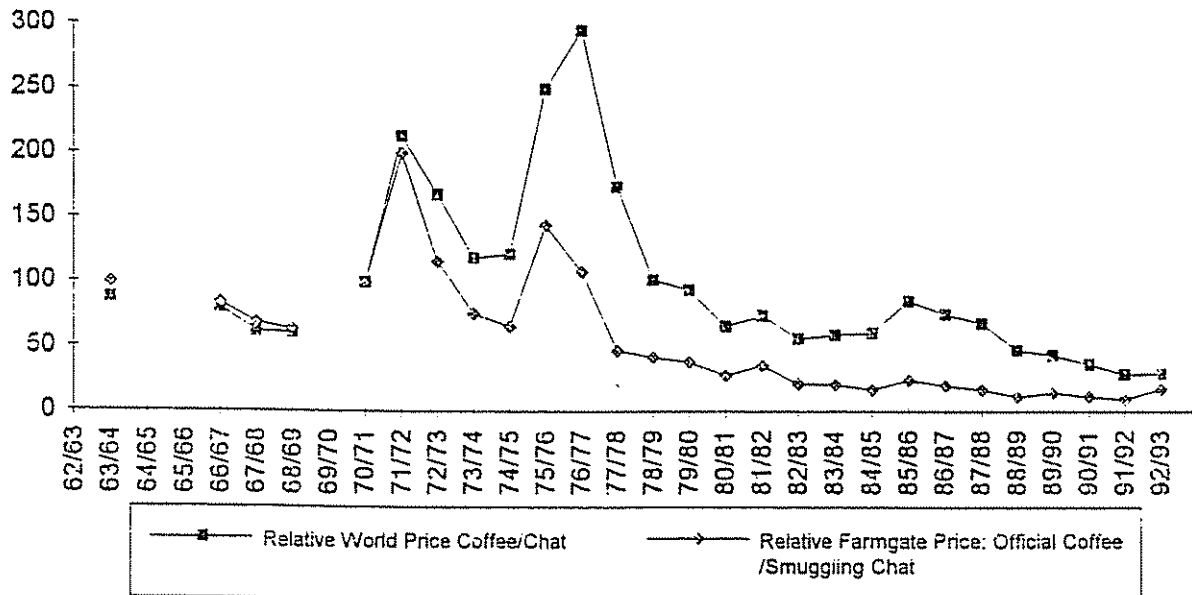


Figure 5:
Relative Coffee and Chat Export Price (1970/71=100)

