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Market-Based Price-Risk Management for Coffee Producers

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Coffee is characterised by high levels of price fluctuation, which exposes coffee producers to price risk. Coffee is widely traded in international commodity futures markets. This offers scope for producers to mange their price risk by hedging on these markets. The hedging mechanism proposed is based on the use of put options. The paper uses historical data of actual coffee put options contracts to estimate the costs of the mechanism; the benefits are inferred from field evidence. It emerges that the costs are relatively low, the benefits outweighing the costs for most producers. The paper then looks at the operational feasibility of the mechanism for producers and compares it with other hedging mechanisms. The mechanisms differ in their strengths and weaknesses; their choice largely depending on their viability in individual coffee producing countries.

1 Introduction

Coffee[1] is the developing world's biggest trading commodity[2], with annual export quantity varying in the range of 4.8 to 5.4 million metric tons and export value varying in the range of US$ 5 to 12 billion over the period 1997 to 2005 (ICO, 2006). Coffee is almost entirely produced in developing countries and mostly consumed in the developed world. A key feature of the world coffee market has been the substantial short-term fluctuations in coffee prices, both at the level of international markets as well as markets relevant for coffee producers (hereafter producers). This exposes producers to high levels of price risk.

In the past, chosen policies in response to price variability relied on market interventions to maintain prices within agreed ranges. The interventions essentially took the

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[1] Unless specified otherwise, ‘coffee’ means green (raw or unroasted) beans.

[2] The term ‘commodities’ refers to ‘primary commodities’ and it excludes petroleum, because petroleum is a special case as regards market structure and price trends. Commodities are mostly agricultural products and minerals in the raw, semi-processed or processed form in which they are first traded internationally. These products are generally inputs into the manufactured products.

form of export supply management through regulations or buffer stock schemes. For their impact on producer welfare, the policies are in general regarded as unsuccessful. The cost of reduced volatility seemed too high, given that the administered prices usually were far below the certainty equivalent that would be accepted by producers – for evidence on this see Krivonos (2004). From time to time there is talk about producer cartels as a solution to low and variable coffee prices, but too many sources of supply negate the scope for successful supply control[3] (Maizels et al., 1997). Nevertheless, interest in supply management shall persist, but mainly for the purpose of raising prices rather than as a solution for price variability.

The initiation of economic reforms in developing countries in the late 1980s resulted in countries liberalising their coffee sector by replacing state-controlled marketing systems with markets run by private agents. The reforms are expected to bring clear benefits to producers from introduction of more efficient markets, but they also give rise to new problems, the most important being that price risk is thrown back onto the local producers and intermediaries, who are ill equipped to deal with it. Price risk poses a greater problem for them because they lack market power, due to their sheer numbers and wide geographic spread, and have limited ability to hedge[4] their risk exposure (Gilbert, 1999). Therefore, how to manage best the negative consequences of volatile markets for producers remains a key issue for governments and policy makers.

In recent years, a growing body of work has contributed to a change in thinking toward policies that emphasise the management of price risk – policies that deal with market uncertainty using market-based solutions for hedging the risks arising from the uncertainty. Such approaches accept as immutable the market's view of relative prices, but address directly the negative consequences of volatility (Varangis et al., 2002). The increasing globalisation of commodity markets and the introduction of new information technology provide new opportunities for commodity producers and exporters in remote parts of the world to make efficient use of commodity-linked financial risk management instruments like futures and options for hedging their price risks. In line with this thinking, the World Bank and the United Nations constituted the 'International Task Force on Commodity Risk

[3] The Association of Coffee Producing Countries' members promoted a retention scheme from October 2000 to hold back and release coffee supplies on the basis of world market prices, but the experience of the scheme has been disappointing. It is difficult to maintain the continuing commitment of the parties to the discipline of the agreement, while free-rider problem persist with those suppliers outside (Hallam, 2004).
[4] Hedging means to take action to reduce a risk that has already been undertaken.

Management in Developing Countries' (hereafter ITF) in 1999 to bridge the gap in commodity risk-management markets in developing countries.

Coffee is widely traded in the international commodity futures[5] markets. The international community feels that this offers possibilities for producers to manage their price risk by hedging on these markets. This approach raises certain important questions:

- How important is price risk for producers?
- How reliable is futures market price risk hedging for them?
- What are its costs and how do they compare with the potential benefits?
- What is the most effective way of providing price risk management to producers?

It is beyond the scope of this paper to comprehensively answer all the questions. The first two questions have been well researched in the literature, so the paper restricts to reporting the current thinking on them. The focus of the study is on the third and fourth questions, which are not understood fully in the literature and are important for policy planners.

The paper proceeds as follows. The next section reviews the significance of price risk for producers and the section thereafter discusses the reliability of futures market price risk hedging for them. Section 4 models the ITF proposed price risk management mechanism for producers. Section 5 estimates the returns (costs) of the mechanism, while Section 6 analyses its welfare benefits. Section 7 reviews the operational feasibility, problems and challenges of delivering price risk management services to producers. Section 8 concludes.

2 Price risk faced by producers

Producers face three main risks in the production and marketing of coffee: price risk from the volatility of prices; production (yield) risk from the uncertainty of production; and currency risk due to exchange rate fluctuations. Producers are not concerned with the risks per se, they are important to them to the extent they affect their income. Proponents of price-risk hedging acknowledge that it addresses only a portion of the underlying income risk problem, the extent of risk reduction achieved depending on the nature and magnitude of production and currency risks. But they argue in its favour on the ground that the hedging decision of a

[5] Includes markets for other related instruments such as options and swaps.

producer is based on their individual perception of price risk relative to other risks, its costs are known up-front, and a producer has the leverage to choose the time horizon and the quantity of output they desire to hedge. In addition, price-risk hedging does not deter producers from hedging their other risks. On the contrary, it allows them to use a combination of hedging instruments to optimise their hedging requirements.

The evidence appears to support that price risk is relatively more important for producers. Past studies for agricultural commodities that are traded in the international market, find that for the most part, price effects tend to dominate quantity effects – at least when measured globally. Larson et al. (1998) decompose the variance, in logs, of world export earnings for selected agricultural commodities into price effect and quantity effect over the period 1970-1995. They find the price effect to be the most significant determinant of export earnings volatility for all the selected commodities except maize. The ITF (2002) field survey reports: 'nearly all farmers interviewed cited volatility of prices a greater risk than volatility in production. They also considered the price risk for coffee as being substantially greater than other crops'.

The ITF study also found that producers are less concerned about currency risk: 'producers are happy to use both a price insurance level and a price against which the insurance is settled denominated in US dollars'. This is because the problem of variability of real exchange rates is becoming less serious as countries increasingly adopt sound central banking principles. The exchange rate is well managed and is determined on the basis of market forces. Also, if countries are pegging their currency to the US dollar or if an appreciation of the domestic currency against the dollar is highly unlikely, hedging currency risk may be dispensed with.

It is difficult to exactly define price risk; the most accepted being the difference in the expected sale price, on the basis of which a producer makes production and marketing decisions, and the actual sale price. Coffee producers assume price risk while taking decisions regarding application of inputs and labour on the basis of price they expect to receive after harvest and processing, which may turn out to be different from the actual price. Therefore, price risk reflects the risks associated with changes in the price of output that may occur after the commitment to production or store has begun and hence is essentially the result of price uncertainty.

Although questions concerning how to measure price uncertainty over time have generated considerable debate, for commodities we usually use the price instability index, which measures the average deviation from trend. The advantage of the measure is that it

separates random price variability from systematic variability. Coffee enjoys most of the characteristics (low price elasticities of demand and supply, low income-elasticity and lagged output response) that contribute to high levels of price variability (Mohan, 2004). Macbean and Nguyen (1987) find that the instability index of coffee (real world prices) for the period 1951-80 is 39.7. For the arabica coffee traded in the NYBOT the average historic volatility over the entire period 1994-2001 was 42 per cent (ICO, 2003).

How price risk affects producers may vary according to their individual circumstances. In general, it impacts their ability to optimise output because the risk may induce them to compromise on input usage and diversify their risk exposure by engaging in activities in which they enjoy relatively lower comparative advantage. The unpredictable prices also make it difficult for them to plan longer-term investment to improve productivity or quality of the output. It is incorrect to assume that price risk affects producers only if actual price is lower than the expected price. It also affects them in the opposite case, because producers may have lost the opportunity of higher production and higher income.

3 Derivative market hedging: reliability for producers

A derivative market price risk management does not guarantee that the profit on the contract will fully offset the loss to a producer on the physical transaction. This is because under the contract, a producer will not be locking in their producer price, but rather a price on the commodity exchange for coffee. If the Exchange price remains stable, while the producer price falls, even with a price risk management in place, there would be no compensation for the lower producer price. This does not necessarily imply a loss, because the opposite, that is compensation without lower producer price, is equally possible. But it means that the hedging purpose of producers will not be served if producer prices do not move in lockstep with Exchange prices on which the hedging instrument is based. This lack of correlation between the two prices is the so called ‘basis risk’ – it is the risk arising from the possibility that the difference between the two prices (say at the NYBOT and in ‘producer countries’) may change in unanticipated ways. The hedging mechanism is designed to swap total market risk for basis risk. A greater unpredictability in the basis, or higher basis risk, reduces the effectiveness of risk management.

The economic reforms and liberalisation of coffee marketing in producing countries has promoted a greater degree of vertical integration in coffee markets. There is now a closer cointegrating relationship between coffee grower prices and terminal market prices, meaning

that the transmission of price signals from the world market to domestic producers has improved: the countries that have liberalised fully experience almost instant pass-through of prices today (Krivonos, 2004). The ITF (2002) study, using weekly data from 1996-2001, found a high degree of vertical integration (around 99 per cent) in the El Salvador and Nicaragua coffee-marketing sector; prices at each level of the marketing chain are derived from prices on the international commodity exchange for coffee. Varangis et al. (2002) study report similar results for other coffee producing countries, Côte d'Ivoire being an exception, but explained by the very strong stance taken by the government in the late 1980s on controlling producer prices. Fortenbery and Zapta (2004) find, more or less, similar results for the coffee markets of Guatemala and Honduras. The evidence clearly supports the reliability of futures market hedging for producers.

The integration of the two markets is also obvious from a large number of producers subscribing to receive regularly information on coffee futures on their beepers or fax machines. This illustrates their high degree of understanding of how these prices affect local prices. Nevertheless, there is always an element of basis risk involved in any hedging strategy. This should not undermine the strategy, as it is the usual risk taken on by any hedger in return for eliminating risks associated with changes in general prices (Fortenbery and Zapta, 2004).

4 The price risk management mechanism

Coffee is actively traded in the London International Financial Futures Exchange (LIFFE) and the New York Board of Trade (NYBOT) commodity exchanges. The ITF developed test cases to evaluate the feasibility of making the LIFFE/NYBOT price risk management instruments available to coffee producers in El Salvador, Tanzania, Mexico, Uganda and Nicaragua. Initial results suggest that producers: (i) have little difficulty with the concept of a floor price for the coming crop, and payment of some premium to insure that price; (ii) understand that the premium level would depend on the price level, period and the quantity of produce that they elect to insure; (iii) are generally reluctant to sacrifice upside price potential, their concern is primarily to avoid unfavourable outcomes, periods of price slump, in which they cannot meet essential cash expenditures. Based on this, the instrument suggested is the purchase of 'put or put type options', where the strike price of the put effectively guarantees a price-insurance to producers in the form of a minimum price floor. The insurance can be a purely financial transaction not requiring a commitment regarding

physical trade of the commodity, therefore avoiding risks relating to delivery and performance under the contract (ITF, 2002).

The LIFFE/NYBOT coffee contracts specify a standard lot size and are not available locally, which makes them inaccessible to small producers. The ITF risk management mechanism proposes that small producers access the instrument through local intermediaries, who can be commodity traders, exporters, local banks or futures merchants, producer co-operatives or even large producers. A large number of producers purchase 'put options type' floor price insurance from intermediaries, who in turn offset their assumed risk exposure by purchase of an appropriate number of LIFFE/NYBOT coffee put options contracts.

For the initial analysis, we specify that producers directly purchase put options, the involvement of intermediaries and the costs of intermediation are incorporated later on. Let us say that at time t a producer purchases a put options contract with a floor price P_{FP} maturing at time $t+x$. The contract confers to the producer the right, but not the obligation, to sell the options underlying futures contract for the floor price on any day up to maturity of the contract. For the sake of simplicity we restrict the contract to be settled only at maturity time. If the cash price of the options underlying futures contract (that is, the official futures settlement price which is announced daily) at maturity time $t+x$ is, say P_{SP}, then the value of the options contract can be written as: $\max(0, P_{FP} - P_{SP})$.

The main cost involved in purchase of put options is its price, the options premium, which is paid up-front. The value of the premium depends on the floor price relative to the underlying value of the options futures contract, duration of the contract and the volatility of the coffee market prices. The other cost is the transaction cost comprising of the exchange fee and brokerage commission. For computing the total opportunity cost of options, the value (borrowing) cost of the premium payment and transaction cost for the duration of the options contract is added to the costs.

The currency denomination of the contract is US dollar. As discussed in Section 2, we abstract from the problem of currency risk and treat that producers are willing to conduct all transactions in US dollars. Given the private information (such as costs, resources and aversion to risk) available to producers, they can be expected to make their decision regarding the quantity of output they wish to hedge and the choice of floor price. The total revenue of a producer who hedges with put options can be expressed by the equation:

$$Y_H = \left[\max\left(0, P_{FP} - P_{SP}\right) - \left(O_P + T\right) + R\left(O_P + T\right)\right]Q_{PO} + P_K Q \qquad (1)$$

where

Y_H = revenue if producer engages in hedging.
P_{FP} = floor price on the put options contract.
P_{SP} = official futures settlement price at maturity of the contract.
O_P = options premium.
T = transaction costs.
R = value cost per unit of the money for the duration of the options contract.
Q_{PO} = output subject to put options.
P_K = spot rate (average) of the physical transaction.
Q = total output volume.

Equation (1) shows the revenue to a producer and not the earnings, because earnings is revenue net of costs, and the equation only considers the costs of hedging and not the other production and marketing costs.

5 Estimation of return (cost) of hedging for producers

5.1 Review of past studies

The finance literature has generated a number of models that provide a benchmark for valuation of options. Most models, the most widely used being Black and Scholes (1973), rely on the fact that the returns from the options exactly replicate their costs if continuously adjusted through the life of the options. In terms of Equation (2) it implies, if calculated over many years, $O_P = \max(0, P_{FP} - P_{SP})$. Therefore, whether a producer sells the produce with or without hedging, s/he is expected to achieve the same return over a long period, except for fee and commissions paid for hedging. However, studies of options markets show that, in practice, this does not hold. The problems of ill liquidity[6] and the associated danger of systematic losses (that is, negative bias in the underlying futures market) tend to predominate in commodity markets, so costs of options may be higher than the return (UNCTAD, 1993).

[6] Liquidity refers to the ability to buy or sell a large amount of derivatives contracts in a short time without significantly affecting price. Speculative profits cannot be eliminated by arbitration owing to lack of liquidity in the market.

In general, it is anticipated that buying options would not, on average, result in gains, because otherwise the counterparty (options seller) would, on average, make losses. However, in principle, a positive return is conceivable because options sellers are concerned with the overall return from all transactions, they may have an incentive in offering attractive terms for put options in order to neutralise their risk by offsetting their position on the Exchange. Under such circumstances it is possible for hedging to result in a systematic increase in earnings.

Using statistical tests, Hallett and Ramanujam (1990) found a positive bias in the return at the 5 per cent level for jute, coffee and copper. Claessens and Varangis (1993) simulate a put options strategy for the years 1957-1990 in which they buy four put options for coffee during the same period every year, they find that the payoffs is 2 per cent of the average spot price of coffee. A study by Sarris (1999) of trends in options transactions over the period 1975-1988 concludes that the maximum cost of provision of price insurance for coffee is not excessive, mostly below 2 per cent. Studies in the US for a range of agricultural products show that costs of hedging generally sum to less than 2 per cent of the value of the product (Harwood et al., 1999).

For evaluating the efficacy of the hedging mechanism, it is crucial to assess its return (cost), because it is this that needs to be compared with the other welfare gains from it. The evidence from past studies is not explicit about the return from options and also the studies differ in their treatment of costs other than the options premium. The following sections empirically estimate the return taking into account all the hedging costs.

5.2 Methodology and data

The first term on the right hand side of Equation (1) depicts the return (cost if negative) on the options contract, O_R, expressed as:

$$O_R = \left[\max\left(0, P_{FP} - P_{SP}\right) - \left(O_P + T\right) + R\left(O_P + T\right)\right] Q_{PO} \qquad (2)$$

In the equation the variable P_{SP} is unknown to the producer when the decision regarding Q_{PO} and P_{FP} is taken. Without knowing P_{SP}, advance estimate of the return is difficult to make. However, historical data of past several years is available for the entire LIFFE and the

NYBOT coffee put options transactions, which can be simulated to estimate an average return and its range.

The question that arises is which contracts to consider for calculating the return. Coffee cherries are harvested annually, and thereafter they undergo processing through to the stage of green bean coffee; hence the production cycle is over one year requiring inputs (investment) throughout the year as well as for post-harvest processing. Since producers assume price risk throughout the production and marketing cycle, there cannot be a standardised options contract in terms of timing of purchase and duration, a producer may choose to hedge at any time of the year for duration's ranging from two to twelve[7] months. We, therefore, calculate the return for all contracts traded, rather than restricting to contracts of specific duration or expiry dates.

Historical data of LIFFE and NYBOT provide information about Q_{PO}, P_{FP}, $O_{P,}$ and P_{SP} in Equation (2). Transaction costs, *T*, can be determined. Table 1 gives the charges applicable to outside users (non-member firms of the commodity exchange). The brokerage may vary over each transaction, but within a range, so we take an average. The charges (all figures in US$) are doubled to incorporate possible both sides of the transaction and a safety margin, giving an estimate of *T*: LIFFE $20 per contract ($4 per ton); NYBOT $40 per contract ($2.35 per ton). Value cost, *R*, can be computed as the duration of the options contract is known, this determines the period of credit and the cost of borrowing is taken as 15 per cent per annum.

Table 1: Transaction cost for options contracts, 2006

Exchange	Contract (tons)	Exchange Fees	Floor Brokerage*	Brokerage**	Average Brokerage
LIFFE	5	$0.55	N/A	$4.30 – 12.90	$9.25
NYBOT	17.010	$1.35	$2	$5.00 - 25.00	$16.50

*Fee paid to the company who executes the order in open outcry markets. **This is the range from the most active to the least active clients.

For comparing the returns over a period, we compute them as a percentage of the spot (sale) price of coffee. We use P_{SP} as an estimate of the spot price since its value reflects the

[7] Active options trading is limited beyond the future period of 12 months.

spot price at the time of maturity: the difference between the current price and the futures price will narrow as the contract draws near maturity, approaching the actual market price; if this were not so, speculators could make a sure profit by simultaneously trading in coffee spot and futures. This way the entire data set is drawn from the Exchange, the quality of which is assured, being a record of the actual transactions and prices quoted on the Exchange.

The returns for the LIFFE are calculated over the period 1992 to 2003 and that for the NYBOT over the period May 2000 to 2003. It was not feasible to consider data prior to 2000 for the NYBOT because of very large number of observations. In view of the higher number of contracts for the NYBOT compared to the LIFFE, we consider periods of one year for the LIFFE and six months for the NYBOT for calculating the returns. The return over a particular period is the weighted average of the returns of all the contracts traded during that period. We also tabulate the returns by averaging only the negative returns in order to calculate an adverse scenario limit of the costs of options contracts.

5.3 Empirical results

Tables 2 to 6 summarise the results: Table 2 for the LIFFE, Table 3 for only the negative returns, similarly Table 4 and 5 for the NYBOT, and Table 6 for totals of both the LIFFE and the NYBOT. The tables are based on an analysis of a very large data set, but for the sake of brevity only the results are stated[8]. Column three of the tables depict the total volume of the put options contracts; four the average return; five the average spot price; and six the return as a percentage of the spot price.

[8] The full data set can be obtained from the author.

Table 2: Returns, LIFFE robusta coffee put options

Period	No. of contracts	Volume (in tons)	Average return ($/ton)	Average price ($/ton)	Return as % of Price
1992	34490	172450	9.25	852.40	1.09
1993	83317	416585	-38.08	1213.94	-3.14
1994	83813	419065	-47.58	3265.87	-1.46
1995	61147	305735	6.89	2419.14	0.28
1996	54323	271615	-24.83	1651.78	-1.50
1997	83663	418315	-22.14	1723.38	-1.28
1998	69429	347145	-13.45	1752.47	-0.77
1999	76443	382215	54.51	1292.99	4.22
2000	23116	115580	53.92	809.91	6.66
2001	29161	145805	32.66	491.72	6.64
2002	79402	397010	-27.17	685.70	-3.96
2003*	29186	145930	-0.30	710.24	-0.04
1992-2003	707490	3537450	-9.98	1575.69	-0.57

*Only contracts until Nov 2003 expiry included.

Table 3: Returns (negative only), LIFFE robusta coffee put options

Period	No. of contracts	Volume (in tons)	Average return ($/ton)	Average price ($/ton)	Return as % of Price
1992	22823	114115	-29.81	885.28	-3.25
1993	80296	401480	-39.83	1222.55	-3.26
1994	78027	390135	-69.33	3269.27	-2.12
1995	35767	178835	-80.86	2516.67	-3.21
1996	45490	227450	-47.52	1663.46	-2.86
1997	75193	375965	-46.12	1738.01	-2.65
1998	58211	291055	-42.84	1794.51	-2.39
1999	28630	143150	-38.06	1422.28	-2.68
2000	3584	17920	-12.26	774.23	-1.58
2001	8806	44030	-25.16	509.14	-4.95
2002	77222	386110	-29.36	686.53	-4.13
2003*	18151	90755	-24.26	716.46	-3.39
1992-2003	532200	2661000	-45.60	1669.08	-2.73

*Only contracts until Nov 2003 expiry included.

Table 4: Returns, NYBOT arabica coffee put options

Period	No. of contracts	Volume (in tons)	Average return ($/ton)	Average price ($/ton)	Return as % of Price
2000(5-12)	134580	2289191	155.60	1631.93	9.53
2001(1-6)	111894	1903304	89.77	1184.74	7.49
2001(7-12)	80134	1363070	15.42	1032.89	1.49
2002(1-6)	124587	2119211	-19.45	1142.14	-1.62
2002(7-12)	160278	2726311	-19.51	1282.16	-1.44
2003(1-6)	192216	3269573	-10.62	1345.81	-0.79
2003(7-12)*	101084	1719428	-24.00	1344.81	-1.78
2000-2003	904773	15390088	24.73	1301.30	1.90

Short term ‘Serial options’ and ‘Mini-coffee options’ are not included.

*Only contracts until December 2003 expiry included.

Table 5: Returns (negative only), NYBOT arabica coffee put options

Period	No. of contracts	Volume (in tons)	Average return ($/ton)	Average price ($/ton)	Return as % of Price
2000(5-12)	28613	486703.9	-56.16	2142.69	-2.62
2001(1-6)	35105	597132.1	-36.19	1366.59	-2.65
2001(7-12)	36015	612611.1	-66.63	1085.05	-6.14
2002(1-6)	83596	1421959	-59.60	1182.56	-4.96
2002(7-12)	114818	1953041	-54.34	1287.78	-4.22
2003(1-6)	140880	2396353	-46.49	1369.22	-3.40
2003(7-12)*	89659	1525090	-31.34	1344.81	-2.33
2000-2003	528686	8992890	-49.75	1340.21	-3.64

Short term ‘Serial options’ and ‘Mini-coffee options’ are not included.

*Only contracts until December 2003 expiry included.

Table 6: Returns, totals for LIFFE and NYBOT

Period	No. of contracts	Volume (in tons)	Average return ($/ton)	Average price ($/ton)	Return as % of Price
LIFFE 1992-2003	707490	3537450	-9.98	1575.69	-0.57
LIFFE NR* 1992-2003	532200	2661000	-45.60	1669.08	-2.73
NYBOT 2000-2003	904773	15390088	24.73	1301.30	1.90
NYBOT NR 2000-2003	528686	8992890	-49.75	1340.21	-3.64
NYBOT and LIFFE	1612263	18927538	19.43	1352.58	1.36
NYBOT and LIFFE NR	1060886	11653890	-48.03	1415.30	-3.39

*Negative returns only.

5.4 Interpretation of results

The cash loss from the options contracts, as a percentage of the sale price, varies over time in the range of –0.77 to –3.96, whilst the cash gain varies in the wide range of 0.28 to 9.53. This is because the loss of a put options contract is limited by the options premium and the other costs, while the gain depends on the contracts underlying futures price at maturity, which may vary over a much wider range depending on the volatility of coffee prices. Overall, for all contracts over the total period the return percentage is -0.57 for LIFFE, 1.90 for NYBOT and 1.36 for both combined. For LIFFE, 75 per cent of the total number of contracts resulted in a negative return, whilst for NYBOT the figure is 32 per cent. If we consider only the negative returns, the cash loss for LIFFE and NYBOT comes to 2.73 and 3.64 per cent respectively.

The results come with a health warning – they are based on assumptions and averages. The assumptions relate to estimating the spot price and assuming standard transaction and money borrowing costs over the entire period though it may differ over the years. The estimated spot price, as explained in Section 5.2, is a realistic estimate of the actual. The transaction and money borrowing costs have not varied too much over the period, and are hence well represented by the standard. The assumptions being realistic are therefore unlikely to distort the results. The averages used are weighted averages and they represent the overall results fairly accurately.

Can it be said, on the basis of the combined empirical results of the LIFFE and the NYBOT (return of 1.36 per cent) that on the average, the option holder gets the costs back as gains from exercising the options? To conclude so requires simulation of past contracts over a much longer period of time for the NYBOT, because unusual circumstances during certain periods can affect the results. For example, the somewhat sharp and continuous fall in world coffee prices during the period 1999 to 2001 contributed to the relatively high cash returns to the option holders during this period. This is because a higher number of options were exercised during this period as the underlying futures settlement price mostly fell below the floor price. Hence, we can not say conclusively that the options pay back their costs or would do so in the future, but what is apparent from the results is that the cost of options is relatively low.

Therefore, adopting a cautious approach, and also in view of the LIFFE results being over a longer period of time compared to the NYBOT, we consider only the LIFFE results for the remaining analysis. The cost of put options over the last ten years for LIFFE has been 0.57 per cent of the international coffee price and in adverse circumstances the cost should mostly remain below 2.74 per cent. This cost can be treated as indicative of the average cost to producers of hedging using put options. The inference is valid because the conditions in the Exchange are not likely to change drastically: put options contracts should, under normal circumstances, follow the past trend in terms of price of the options and transactions costs.

In order to calculate the costs as a per cent of producer price, we make adjustments for the fact that producer prices are on the average 30 to 40 per cent lower than international spot prices (ITF, 2005). If 40 per cent is incorporated, the average cost rises from 0.57 to 0.95 and the adverse scenario cost rises from 2.74 to 4.56 per cent of the producer price.

5.5 Cost of intermediaries

The cost of intermediaries in providing the price-insurance instrument to producers can be on three counts: i) the cost of its retail distribution; ii) the risk cost associated with any mismatch of the minimum price protection retailed to producers and the hedging of the assumed risk on the commodity exchange; iii) costs associated with non-performance by retail counterparties (can be considered very low because producers pay the costs in advance and the commodity exchange non-performance risk is covered).

There are two views on the level of the intermediaries' cost. One, the intermediaries have a vested interest to provide the service at a very low cost to producers in order to ensure regular supply of the produce or to reduce the risk of loan default. Many country elevator operators in the USA appear willing to bear these costs to assure a timely flow of wheat and corn into their facilities. They routinely hedge their own risks and this is passed on to farmers at quite low cost (Harwood et al. 1999). The other view is that the involvement of intermediaries further increases transaction costs of hedging and impedes the flow of information.

Intermediaries could also provide over-the-counter (OTC) instruments that meet the specific needs of producers in terms of contract size, maturity, margin requirements, and settlement and delivery procedures. Estimating OTC transaction cost is difficult, because by nature, OTC transactions are not visible to the public, and the value of the factors at the time used in the pricing model are not determinable. According to ITF (2002): 'it is anticipated that by using an OTC instrument it is possible to provide price insurance at a cost slightly lower than prices prevailing for straight commodity exchange traded options'. We can, therefore, treat OTC transaction costs to be the same as that of the Exchange.

The ITF (2002) study considers the cost of intermediaries as being similar to the transaction cost in the Exchange. The transaction costs for the LIFFE/NYBOT are mostly below 0.1 per cent, so the cost of intermediaries can be safely fixed at 0.2 per cent of the producer price. If we incorporate them, the cost to producers of hedging becomes 1.15 per cent of the producer price, with the worst scenario limit being 4.76 per cent.

6. Hedging: welfare benefits for producers

6.1 Resource Allocation Gains

According to the traditional theory of production, producers make production decisions, such as deciding recommended levels of input use, by equating marginal cost with marginal return. The theory is based on assumed certainty of the marginal returns and does not apply when the prevalence of risk and the reality of widespread risk aversion are recognised. Typically in coffee production the prices of the inputs are known at the time their levels are to be set, but the price of the output is uncertain, and the level of uncertainty may well be quite high. This makes it difficult for producers to efficiently plan their output, they usually do so by fixing some benchmark expected price of the output. This price is based on their expectation of outcome of prices at the time of intended sale and the variance of that expectation. A high downside risk-aversion attitude results in fixing of a low price to avoid an adverse (cash loss) outcome. Hedging, by offering price assurance, enables them to plan without worrying that financial viability could be jeopardised, making it easier for them to optimise output (or input usage). This could mean higher earnings from an increase in revenue net of costs.

The degree of dependence of producers on coffee is quite high, with over 50 per cent farms deriving over 50 per cent of their income from it (ICO, 2003). This, coupled with lack of credit facilities, promotes a risk-averse attitude among them. Producers deal with risk by mainly using few to no inputs other than own labour[9] (keeping production costs at the minimum), even though high yields require larger doses of fertiliser and other inputs. The cost of a typical coffee production comprises of variable cost (includes labour and material cost and ranges between 73-83 per cent), and the balance represents overhead (that is, the fixed cost structures of plantations) and processing cost. Only a reported 25-30 per cent of farmers apply any type of inputs, and they too at rates below, or at a small proportion of, the recommended rates. The low input and low yield production technologies could result in loss of up to 50 per cent of the potential yields (ITF, 2002). The low level of input usage is also evident from an ICO (1998) study, reported in Table 7.

[9] Studies of farm activities by Reardon (1997) and Ellis (1998) found strong evidence that farmers in poor rural communities are risk-averse and take actions that result in lower, but more stable incomes.

Table 7: Input use by activity for arabica coffee

Inputs	Minimum needs	Levels of confirmed usage by producers
Copper based fungicides	1 kg/ha (5 times)	7%
Non copper fungicides	2 kg/ha (4 times)	26%
Pesticides	1.5 litres/ha	34%
Fertiliser	1 bag	15%
Infilling/Replanting	All ageing trees	47% small holder trees are 25-50% overage
Weeding	5 rounds per year	27% do 3 wet rounds
Annual pruning		85-100%
Mulching		13%

Source: ICO (1998)

The studies show that producers in general produce far less than possible. Although the reasons for this can be many, but price risk can be considered an important one, as it is the main risk (Section 2) faced by producers. Hedging by offering price insurance could alter this. This could mean the use of hired labour to weed the farm and add pesticides, fungicides and whatever is the best for the farm as well as for any processing or storage, potentially resulting in an increase in output and earnings. Field studies on the consequences of hedging for agricultural activities in the US support this: Markowitz' (1959) concept of 'expected value-variance efficient', which states that expected return can increase only by accepting a larger variance of return, applies to most farm activities, and hedging by reducing the variance of return for a producer with a typical income utility function (which expresses averseness to risk) results in a higher expected return (Harwood et al., 1999). Studies on the implications of hedging for competitive firms also find that in the absence of hedging, the risk-averse producer selects a lower level of output (or input) than the amount he would choose if the price of the output were to be more certain, and the amount of output decreases as aversion to risk increases (Baron, 1970; Sandmo, 1971; Holthausen, 1979).

6.2 Gains from specialisation

Diversification is a risk management (self-insurance) method used by many agricultural growers. The idea is to reduce the risk of the overall return by selecting a mixture of activities that have net returns with low or negative correlation. The fact that coffee constitutes a high proportion of the income of many producers does not imply low levels of diversification. This is because coffee is their only export produce and the diversified activities are mostly subsistence activities characterised by very low cost and very low income (ICO, 2003).

The common perception is that diversification comes at a cost because it reduces the ability to reap the benefits of specialisation and scale. Diversifying is held to supposedly reduce coffee yields not only by diverting land and effort to other activities, but also because yields per tree will decline. Although scientific inter-cropping with certain shade trees or crops may boost production, but inter-cropping resorted for the purpose of diversification is mostly not scientific (Commonwealth Secretariat, 1997). Hedging by reducing the need to diversify allows producers to accomplish greater degree of specialisation in the production of coffee, which may translate into higher earnings from an increase in output and/or fall in the unit cost of production.

However, contrary to common belief, some agricultural economists feel that the gains from specialisation are often less than may be imagined. A mixture of agriculture production activities may make better use of available resources: labour, cash flow and machinery requirement for a mixed system may be more evenly spread throughout the year, using these resources more efficiently. Moreover, the majority of the risk-reducing benefits from diversification can often be captured by having only two or at the most three activities, thereby not requiring excessive compromise on the comparative advantage. Also, a rational producer should be able to find the risk-efficient combination of activities, not the one that merely minimises variance. It is, therefore, difficult to say anything conclusively about specialisation gains from hedging for producers.

6.3 Gains from improved marketing

On a priori grounds, it can be expected that hedging would enable producers to achieve a higher average sale price (P_K in Equation 2) of the physical output by improving their marketing capabilities, though it is conceivable that at times the final outcome may be that of a lower price. Protection of (downside) risk for part of produce should make it possible for

producers to store coffee, if they so desire, waiting for a high price, thus giving them greater control over timing of the sale. This appears important for coffee because harvesting takes place in a few months, while selling takes place throughout the year. Although intuitively appealing, but it is difficult to establish empirically that this would result in net gains for producers. There have been studies on this for corn, wheat and soybean in the US: Heifner (1972) found some evidence that this would work for storage, as did Tomek (1987). However, others have found little evidence to support this possibility for producers (Irwin et al., 1996).

6.4 Credit access gains

The cash flow situation of producers can also constrain their ability to optimise input usage and exploit marketing opportunities. Here again, hedging presents scope for improved credit terms and access: if default risk is diminished by presenting the risk management instrument as part of collateral, lenders can feel more secure in providing finance and borrowers can feel more secure in obtaining finance (ITF, 2005).

7. Delivering price risk management services to producers

Our results show that the benefits for producers of managing their price risk using derivative markets are reasonably indisputable. This opens the door to the question of how most effectively to provide hedging instruments to them. For answering this, we analyse the operational feasibility of the ITF mechanism and compare it with other approaches that can be used for delivering risk management services to producers, namely developing local coffee futures market or main exchanges (NYBOT/LIFFE) establishing branch exchanges in producer countries.

7.1 How practical is the ITF risk management mechanism for producers?

The ITF risk management mechanism relies on local intermediaries to provide the risk management instrument on a micro basis. The intermediaries are expected to provide advice, knowledge, and expertise to close the gap between instruments and potential users. The target groups for intermediaries are co-operatives and producer associations that represent small growers and can gain economies of scale in acting on behalf of lots of them, but they can also

be traders, exporters and local banks. The intermediary purchases the macro instrument from a wholesale provider (a local aggregator who deals with the exchange) and sells micro instruments in the retail market in a back-to-back manner. It is possible that some intermediaries may also act as wholesalers. For the purpose of this paper, we treat intermediaries to also include wholesalers.

In Section 5.5 we noted that the cost of intermediation need not be too high. This presupposes the existence of viable intermediaries capable of fair and transparent discharge of their obligations. Not all countries have a good experience of co-operatives and producer organisations. The finances of many of them are in a mess. In addition, they have their own administrative costs, which can be rather high if they do not operate efficiently. Some of these organisations are sophisticated and financially strong, but they too need to be introduced and trained in the use of risk management instruments (Sarris, 2002).

Even though the risk management instrument is simple and transparent, but the complex nature of intermediation requires the existence of trained personnel, together with control systems that these personnel do not abuse their positions. Appropriate systems must be in place that ensure transparency of the actions of intermediaries and that protect the interests of producers. It will be necessary to provide a very high component of technical support on a continuous basis to support such personnel and systems. Furthermore, making reasonable hedging decisions based on fine-tuned hedging instruments (future and options) requires permanent access to information and processing of the various data. The existence of intermediaries may not be conducive for free flow of information and this may limit the more general use of the hedging instruments.

The risk management mechanism is limited in its scope. It caters mainly to the needs of producers. It ignores the hedging needs of other market participants, particularly exporters and traders, and even large producers and importers. Once an exporter (includes trader) has bought coffee from producers, s/he is open to risk of losses if international spot prices fall to below a certain level. Of course, if the prices rise s/he stands to gain. The pressure to eliminate their exposure as rapidly as possible can force them into back-to-back sales at less attractive but fixed prices than would otherwise be obtainable. A back-to-back sales policy can never be extremely precise, and the exporter may be required to ‘warehouse’ a residual ‘long or short position’ if the quantities sold and bought does not match.

The ability to hedge using futures and options can improve exporters’ ability to compete and access credit. Whilst futures trading eliminates any potential gains or losses to the exporter resulting from spot price fluctuations, the use of put or call options can put a

minimum price floor under negative movements in spot prices whilst allowing the exporter to take advantage of gains resulting from price rises or fall, as the case may be. The disadvantage with options is that the premium required is often large. Currently, there is a limited degree of exporters' participation in the use of marked-based mechanisms for managing their price risk. Given the relatively short-term nature of hedging requirement, they would seem to be ideally suited for the use of derivatives trading (Fontenay and Leung, 2004). Therefore, a hedging mechanism should cater to their needs as well. This is important even if the objective is producer welfare, because their participation would also mean implied benefits for producers (Mohan, 2004).

There are problems relating to the costs associated from non-performance of retail counterparties. As long as the producer purchases the hedging instrument upfront or the ITF guarantees default on their part, there is no risk. But what about default risk on the part of intermediaries? This is not a problem if they offset their assumed risk exposure by purchase of matching quantity of LIFFE/NYBOT coffee put options contracts. If not, then it may require establishing and managing a margin account, which involves additional costs.

We noted in sections 2 and 3 that the hedging mechanism does not cover for currency and basis risk, although these risks are not significant for most producers. This should not be treated as a major limiting factor because complete revenue insurance against price and currency risk cannot easily be designed. Nevertheless, the degree of exposure is important, as the mechanism would not work in countries were these risks are very large.

7.2 Development of local Exchange

Given that the ITF mechanism is not without its problems, does it represent a case for developing local coffee futures market? The most appealing case for doing so is the advantage of lower basis rate risk. In-country futures markets means having customised contracts designed with delivery specifications more closely linked to the way cash market transactions take place in the local market. If the basis risk is unacceptable, or if there are long time lags between price changes in the futures market and associated changes in the cash markets because of frictions in information flow, incentives may exist to develop domestic futures markets (Fortenbery and Zapta, 2004).

Local futures markets can take into account the hedging needs of most market participants. Exporters, importers and medium to large producers can hedge directly on the exchange. However, to accommodate use by relatively smaller producers would require

adjusting contract sizes according to their needs or promoting more flexible OTC products to supplement the exchange-traded product. An agent or broker of the exchange can offer OTC products to producers. This works much the same as the ITF mechanism, except for the advantage of proximity of the counterparties to the Exchange.

The price discovery information in local Exchange will be more transparent to producers and local traders. They can access information about contracts and historical information with no restrictions, and they can correspond with their brokers, counterparties and advisors with no impediments. This could increase the value to producers of forward price information and increases access to forward pricing opportunities for that segment not wishing to hedge

Developing a local futures contract priced in the domestic currency can manage not only the price risk of the export commodity, but also the currency risk. A futures contract priced in local currency could provide more useful hedging opportunities for producers and smaller intermediate marketers whose cash transactions are in local currency, but exporters and importers would still be exposed to, and need to deal with, exchange rate risk. Their lack of participation in local currency contracts makes transfer of risk difficult in the Exchange. It is for this reason that most existing futures exchanges in developing countries trade commodities priced in US dollars, and thus any exchange rate risk faced in these markets is the same as if they traded the same commodity on an outside exchange where contracts are priced in US dollars.

The members of the Exchange can provide valuable services in marketing the concept of derivatives trading and the benefits of free market to participants in the market. SAFEX (South Africa Exchange for agricultural products), in the early days, spent many days on the road training and marketing the concepts of futures and options. The Exchange members have a vested interest to do so, which may not be the case with intermediaries because of uncertainty over their likely future evolution.

The above factors, the standardised and transparent nature of trading and the clearing house taking care of performance risk by standing between both parties in the transaction can be expected to stimulate high trading volumes and encourage higher usage compared to intermediaries.

However, there are several preconditions before an Exchange can be a viable proposition. Critical to the success of any local futures Exchange will be the ability to ensure a liquid market. Liquidity is an important parameter in attracting participation in derivative markets. Participants need to know that there is adequate depth in the market so that they can

buy or sell a contract without the market moving significantly and also that they will be able to move out of the market (that is, close a position) quickly and efficiently. Hedgers will in general prefer to transact in a market with high liquidity rather than in an illiquid market where the contract more precisely matches their requirements. Local exchanges, because of limited size of the domestic market, may not generate sufficient participation by all market participants. Consequently, trading volumes (liquidity) remains at relatively low levels. Speculator activity adds liquidity to the market, and there may not be enough incentives (business) for them to be active in local exchanges. Finally, there are substantial costs associated with developing both the physical infrastructure, trading and regulatory environment necessary to develop a successful futures market (Morgan et al., 1999).

Nevertheless, reasons exist for developing countries to encourage local exchange development even if the costs of doing so are high. In those cases in which either there is currently no traded contract or in which current international contracts correlate poorly with prices received by developing countries' exporters and producers, and where there is sufficient speculative capital to make a local exchange viable, there may be some point in encouraging the establishment of a futures exchange for that commodity. If enough volumes are generated on both sides, then there is possibility of setting up commodity exchange on its own right. Therefore, only under certain circumstances would the creation of new commodity exchanges in producer countries themselves be worth supporting.

7.3 Branch of the main Exchange

It is suggested that established main exchanges (NYBOT/LIFFE) integrate backwards in producer countries for provision of risk management instruments directly to entities there. This can be through an agency relationship with institutions in producer countries or even by a direct presence. The form of arrangement is not material, as long as it functions as a branch of the main Exchange. The branch Exchange will use the price discovery and futures price and the premiums of the main Exchange. The main advantage of this approach is that it would achieve economies of scale from risk pooling with the main Exchange and its branches. This way the commercial price of the contracts will be determined at competitive terms in an actuarially fair way.

The branch Exchange would need to make available appropriate contracts, either as Exchange-traded or OTC products, for producers and other entities in producer countries. The least the contract departs from terms and conditions existing in the main Exchange, the

easier it will be for commercial operators to transfer or reinsure their risk, and hence the less expensive will be the contract. For instance, several put like options of an operator can be set-off against a call options contract sold in the main Exchange.

The branch Exchange offers most of the advantages of local futures market: price discovery, accessibility, standardised and transparent nature of trading, performance guarantee, and hedging choices for most market participants. The proactive involvement of the main Exchange can play a vital role in providing infrastructure, training and instruments, for market-based risk trading. What it does not offer is the advantage of lower basis risk, although under certain circumstances it can result in a reduction of basis risk. If the risk is as a result of frictions in information flow from the main Exchange to developing cash markets, then this flow is likely to improve with the activities in the branch Exchange.

The key question is if it would be viable for main exchanges to establish branches in producer countries. The success of the branch would depend on the volumes of business it would generate. The LIFFE and NYBOT have the advantage of having large transaction volumes (liquidity) and are well established in terms of rules and regulations. The branch would benefit from the reputation of the main Exchange, and its well established futures market would attract a large number of financial institutions, brokers, traders and speculators, they will be prepared to participate in the new market, even in early days. This will help in providing it with liquidity and the critical mass of operators required for the working of a vibrant Exchange.

Furthermore, the greater degree of vertical integration in the world coffee market has resulted in less transaction on the demand side of the coffee supply chain, whilst untapped and growing market exists on the supply side. This also holds for other commodities that are traded in international markets. This is why commodity futures merchants, investment banks and international commodity trading companies (such as Cargill, Neuman Kaffe Gruppe and Volcafe) are now keen to be more actively involved in developing countries, especially countries with large markets such as Brazil, Mexico, China, Colombia and India (ITF, 2005). Importers and traders locating in producer countries make offset each other risks easier in the branch Exchange. These factors point to the growing opportunities for main exchanges to develop institutional foundation in emerging markets.

The main concern in retailing of risk management instrument to producers is that the transactions cost of making contract size small and ensuring its availability to producers may be prohibitive. This need not always be the case, as operators should be able to demonstrate that economies of scale may make provision of the instrument in bulk at reduced transactions

cost. Also, the contract size need not be very small. The ITF (2005) report states that risk management is not strictly for the poor. The main clients are commercially-oriented producers. They may have small land plots but they are producing a reasonable surplus that they market. They are not subsistence farmers, but those that spend money on inputs. It is realistic to accept that the main beneficiaries are the commercially-oriented farmers. This should not diminish the value of price-risk management per se, but we must have realistic expectations. In addition, it is possible for agents of the branch Exchange to offer smaller size contracts as an OTC product to producers. As a matter of fact, OTC providers will be more active in the branch Exchange, because higher liquidity in the Exchange makes it easier for them to offset their risk.

Another concern is the high establishment costs of the branch Exchange. Here again, there are possibilities for the main Exchange to affect savings from exploiting partnership arrangements with organisations in producer countries and from utilising its own resources and skilled professionals. The branch Exchange could also achieve economies of scale from dealing in diversified hedging activities.

7.4 The way ahead

Given that the hedging strategies discussed in sections 7.1 to 7.3 differ in their scope, benefits and limitations, it is difficult to choose one over the other. All we can do is draw some broad conclusions. Local exchanges have their merit, but are viable only under certain preconditions, which do not often exist in several emerging markets, so setting them may prove to be premature and could also be counterproductive (see Tsetsekos and Varangis, 1999 for a discussion on this). A branch Exchange offers the same service as the ITF mechanism, with a much wider scope, and also offers most of the benefits of a local Exchange. Furthermore, it does not deter, as a matter of fact, when it is clear that conditions are appropriate and that proper foundations exist, it will be easier to establish a local futures market – it serves as a step in that direction. Therefore, encouraging branch exchanges appears to be the recommended approach, but in markets where they are not feasible or viable, there is no alternative but to rely on the ITF mechanism.

Whatever the mode of providing risk management, producer countries need to provide the institutional framework within which risk management activities may be carried out, because the financial regulations may affect the ability and capacity of a financial service provider to offer derivative products. A liberal foreign exchange environment is required to

make hedge transactions on international markets. It is imperative that orders associated to the transactions are executed immediately they are made and therefore cannot await confirmation of the availability of the required currency. Reliable telecommunications links are also required if price information and hedging decisions are to be reliably and promptly communicated both to and from international markets and within the country.

The political necessity for governments to be involved often in financially unsustainable farm price support schemes means that governments can also be potential beneficiary of futures trading in commodities. Not only can the derivatives market be less expensive to manage and operate than traditional price support programs, it is also friendlier towards free trade. Therefore, it is in the interest of governments and the international community to support and encourage its development. The role of the international donor community, the ITF and governments in channelling funds to education and training policy makers, producers and other users of derivative markets, and also to support them in using such market mechanism for risk management is quite important in early years.

8 Conclusion

The liberalisation of coffee marketing in coffee producing countries has increased the direct exposure of producers to price risk. The international community feels that producers can mange their price risk by hedging in the international futures market (LIFFE/NYBOT) for coffee. The hedging mechanism proposed is based on the use of 'put type options' offered to producers through intermediaries. The paper uses historical data of coffee put options contracts transacted in the LIFFE and the NYBOT to infer the likely cost of the hedging mechanism for producers. The important result that emerges is that the cost is relatively low, being 1.15 per cent of producer price, the adverse scenario cost being 4.76 per cent of producer price.

Although the low cost points in favour of hedging being a viable proposition for producers, but to say so conclusively requires the welfare gains from hedging for producers to exceed the cost. In the absence of data, it is not possible to empirically estimate the gains, but field studies overwhelmingly support positive payoffs, especially from producers being able to allocate resources more efficiently in the production of coffee. The magnitude of the gain can be quite high, given the high level of risk-aversion attitude among producers and the uncertainty of coffee prices. Another benefit for producers is from improved access to credit on finer terms.

The conclusion reinforces the challenge for the international community, governments and risk management providers for making price risk management operational for producers. An analysis of the operational feasibility of the proposed hedging mechanism shows that its success depends on the existence of viable intermediaries, who play a vital role in bridging the gap between producers and the Exchange. Such intermediaries may not be forthcoming in many producer countries. Another limitation of the mechanism is that it ignores the hedging needs of other entities in producer countries.

The paper also looks at other ways of providing risk management services to producers. These can be through developing domestic futures exchange for coffee or through main exchanges (NYBOT/LIFFE) establishing their branches in producer countries. It emerges that trading volumes in most producer countries may not suffice to justify establishment of viable local exchanges. Branch exchanges offer similar service to producers as that of the proposed hedging mechanism with added advantage of proximity and transparency. Therefore, their establishment is a step in the right direction. This study concentrated on coffee, but the analysis can be extended to a multitude of commodities.

References

Baron, D.P. (1970) 'Price uncertainty, utility and industry equilibrium in pure competition', *International Economic Review* 11(1970): 463-480.

Black, F. and Sholes, M.S. (1973) 'The pricing of options and corporate liabilities', *Journal of Political Economy* 81(3): 637-654.

Claessens, S. and Varangis, P. (1993) 'Risk management strategies in the Costa Rican coffee sector', in S. Claessens and R.C. Duncan (eds), *Managing Commodity Price Risk in Developing Countries.* Baltimore: John Hopkins University Press.

Commonwealth Secretariat (1997) 'Vanuatu: Coffee development project', London: Commonwealth Secretariat.

Ellis, F. (1998) 'Household strategies and rural livelihood diversification', *Journal of Development Studies* 35(1): 1-38.

Fontenay, P.D. and Leung, S. (2004) 'Managing price fluctuations in Vietnam's coffee industry', Discussion Paper, National Centre for Development Studies, Australian National University.

Fortenbery, R. and H. Zapta (2004) Developed speculation and underdeveloped markets - the role of futures trading on export prices in less developed countries. *European Review of Agricultural Economics* 31(4): 451-471.

Gilbert, C. (1999) 'Commodity risk management for developing countries'. Paper presented at Third Meeting of the International Task Force on Commodity Risk Management of Developing Countries (ITF), 23-24 June, Geneva.

Hallam, D. (2004) 'Falling commodity prices and industry responses: Some lessons from the international coffee crisis', *Commodity Market Review 2003-2004.* Rome: Food and Agriculture Organisation of the United Nations.

Hallett, Andrew J. and Ramanujam, P. (1990) 'The Role of futures markets as stabilisers of commodity earnings', in L.A. Winters and D. Sapsford (eds), *Primary Commodity Prices: Economic Models and Policy.* Cambridge: Cambridge University Press.

Harwood, J., Heifner, R., Coble, K., Perry, J. and Somwaru, A. (1999) 'Managing Risk in Farming: Concepts, Research, and Analysis', Agricultural Economic Report No. 774. Washington, DC: United States Department of Agriculture.

Heifner, R. G. (1972) 'Implications of hedging for the agricultural lender', *Agricultural Finance Review* 33(July 1972a): 8-14.

Holthausen, D. M. (1979) 'Hedging and the competitive firm under uncertainty', *American Economic Review* 69(1979): 989-995.

ICO (1998) 'Coffee sector strategy study', Coffee Management Unit, London: International Coffee Organisation.

ICO (2003) 'Coffee Price Risk in East Africa: The feasibility of intermediating price risk management to coffee farmers and coffee cooperatives in Ethiopia, Kenya, Uganda, Tanzania and Zimbabwe'. London: International Coffee Organisation.

ICO (2006) *Coffee Statistics*. London: International Coffee Organisation.

Irwin, S. H., Zulauf, C. R., and Jackson, T. E. (1996) 'Monte Carlo analysis of mean reversion in commodity futures prices', *American Journal of Agricultural Economics* 78(May): 387-399.

ITF (2002) ‘Field survey coffee reports: Cameroon, Cote D'Ivoire, El Salvador, Nicaragua and Tanzania’. Washington, DC: International Task Force on Commodity Risk Management in Developing Countries.

ITF (2004) ‘Status Report and Discussions: The Integrated Risk Management and Finance’ International Task Force on Commodity Risk Management in Developing Countries, Annual Meeting, May 5-6, 2004, Rome, Italy.

ITF (2005) ‘Country and Commodity Profiles’. Washington, DC: International Task Force on Commodity Risk Management in Developing Countries.

Krivonos, E. (2004) ‘The impact of coffee market reforms on producer prices and price transmission’, Policy Research Paper No. 3358. Washington, DC: World Bank.

Larson, D., Varangis, P., Yabuki, N. (1998) **‘**Commodity risk management and development’, Policy Research Paper No. 1963. Washington, DC: World Bank.

MacBean, A., and Nguyen, D.T. (1987) *Commodity Policies: Problems and Prospects.* New York: Croom Helm.

Maizels, A., Bacon, R., and Mavrotas, G. (1997) *Commodity Supply Management by Producing Countries: A Case Study of the Tropical Beverage Crops.* Oxford: Clarendon Press.

Markowitz, H. M. (1959) *Portfolio Selection: Efficient Diversification of Investment.* New York: John Wiley and Sons.

Mohan, S. (2004) ‘Market-based price-risk management by commodity producers in developing countries: The case of coffee’, Doctoral dissertation, University of Strathclyde, Glasgow, UK.

Morgan, C.W., Rayner, A.J. and Vaillant, C. (1999) ‘Policy arena: agricultural futures markets in LDCs: a policy response to price volatility?’, *Journal of International Development* 11: 893-910.

Reardon, T. (1997) ‘Using evidence of household income diversification to inform study of the rural non-farm labour market in Africa’, *World Development* 16(9): 735-747.

Sarris, A. (1999) ‘Market based commodity price insurance in developing countries’. Paper presented at Third Meeting of the International Task Force on Commodity Risk Management in Developing Countries (ITF), 23-24 June, Geneva.

Sarris, A. (2002) ‘Market Based Commodity Price Insurance For Developing Countries: Towards A New Approach’. Washington, DC: International Task Force on Commodity Risk Management in Developing Countries.

Sandmo, A. (1971) ‘On the theory of the competitive firm under price uncertainty’, *American Economic Review* 61(1): 65-73.

Tomek, W.G. (1987) ‘Effects of futures and options trading on farm incomes’, Staff papers 87-89, Department of Agricultural Economics, University of Cornell.

Tsetsekos, G. and Varangis, P. (1999) ‘The structure of derivatives exchanges: Lessons from developed and emerging markets’. Washington, DC: International Task Force on Commodity Risk Management in Developing Countries.

UNCTAD (1993) ‘A survey of commodity risk management instruments’. Geneva: United Nations.

Varangis, P., Larson, D., Anderson, J.R. (2002) ‘Agricultural markets and risks - management of the latter, not the former’, Policy Research Paper No. 2793. Washington, DC: World Bank.