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Abstract

The limited presence of futures exchanges in developing countries where commodity markets fall short of the ideal underscore the importance of understanding the relation between spot and futures markets. The paper examines the exceptional success of the soya oil contract at the National Board of Trade (NBOT) in India. The paper asks whether the NBOT contract exhibits the fundamental features of mature futures markets in terms of its use by hedgers. If the market offers arbitrage opportunities to hedgers and if such activity is significant, then the activities of commercial firms should affect the returns to their hedging portfolio i.e., change in basis. This insight is developed into an examination of the impact of soya oil imports on the basis. Despite the lack of key market institutions such as certified warehouses and centralized spot prices, the NBOT contract compares well with mature exchanges. Soya oil imports exercise a significant impact on the basis and provide enough short-term volatility to make the contract attractive to both hedgers and speculators.

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1. Introduction

Commodity futures markets have a limited presence in developing countries. Historically, governments in many of these countries have discouraged futures markets. If they were not banned, their operations were constricted by regulation. In the recent past, however, countries have begun to liberalize commodity markets. And in a reversal of earlier trends, the development of commodity futures markets is being pursued actively with support from governments (UNCTAD, 2002). Policy makers expect social benefits in terms of price discovery, risk management and better allocation of resources. Similarly, the World Bank has undertaken many initiatives to explore the possibility of market-based systems of price stabilization (Claessens and Duncan, 1993).

Yet, it is well known, that even in developed countries, not all commodities are traded on futures markets. Indeed, only a minority of contracts floated by commodity exchanges succeeds in attracting trading volumes to be liquid (Brorsen and Fofana, 2001; Thompson, Garcia and Wildman, 1996). If this happens in environments with smoothly functioning spot markets, mature legal institutions and supportive government policy what could be the prospects of futures markets in developing countries?

This question motivates our analysis of the soya oil contract at the National Board of Trade (NBOT) in Indore, India. Futures trading in India have had a long if chequered history. The beginning of organized futures markets can be traced to the establishment of the Bombay Cotton Association in 1875. By the time of the second World War, there were several exchanges in oilseeds, cotton, jute, pepper and wheat. After independence in 1947, the government enacted regulatory mechanisms and in 1966 banned futures trading altogether. Since 1980, government policy towards futures markets became gradually more permissive as it expanded the list of commodities in which futures trading was permitted. The process culminated in 2003 with the scrapping of the prohibited list. Currently, there are 24 approved exchanges dealing in oils and oilseeds, cotton & jute, metals (including gold and silver), spices (such as pepper, turmeric) and other agricultural commodities. Out of these, active futures' trading is operational in 14 exchanges.[1]

Although current government policy encourages futures markets as a mechanism for price discovery and risk management, the revival of futures trading has been slow. Volumes are low and most contracts and exchanges have languished for want of liquidity. A striking exception is the soya oil contract traded at NBOT in Indore.[2] In 2004, the volume of trade in this contract was about 50 times the quantity of domestic production. In the same year, the NBOT soya oil contract accounted for about half of the volume of trade in all futures exchanges in India. Since its inception, trading volumes in the soya oil contract have risen rapidly. In 2000, 2 million tones of soya oil were traded. This amount went up to 5 million tons in 2001, to 14 million tons in 2002, to 22 million tons in 2003 and to 26 million tons in 2004.

After a review of the literature and description of the soya oil markets and trading practices at the NBOT exchange, the paper asks whether the NBOT soya oil contract exhibits the fundamental features of mature futures markets as seen by earlier researchers. The wider implications for the growth of futures trading and its relation to spot markets are discussed in the concluding section.

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[1] For a detailed review of the evolution of futures markets in India, see Kolamkar (2003)

[2] Recently, impressive volumes have also been recorded in metals (bullion and silver) contracts at some exchanges.

2. Literature and Empirical Strategy

Previous authors have considered features of contract design (so that the contract is as close a substitute of the commodity as possible), characteristics of the commodity (whether it is capable of standardization and grading) and the institutions of the commodity spot market as factors that are likely to determine the success and viability of futures contracts. Of these three broad set of factors, the first calls for accurate contract design and poses no special problems for developing countries. Absence of standards and grading systems could be a trickier issue; however, it is unlikely to be an enduring obstacle especially for widely traded commodities such as cotton, sugar, wheat or oils.

The literature lists many spot market features as being crucial to the success of a futures contract: the presence of a centralized cash market, liquidity of cash market, whether it is active (i.e., sufficient frequency of transactions), the size of cash market (whether it is large enough to attract potential participants in the futures market as hedgers and speculators), the volatility of spot prices, the availability of public information and the absence of market power (Brorsen and Fofana, 2001; Thompson, Garcia and Wildman, 1996). It is not easy to test for the impact of some of these factors because they could be endogenous to the presence or absence of a futures market. For instance, the activity, volatility, and liquidity of cash market would be jointly determined with the futures market. Nonetheless, it can be seen that commodity spot markets in developing countries are unlikely to meet most of these conditions.

Although the above literature has researched these issues in the context of developed countries, similar concerns have been expressed in India as well. According to Nair (2004), "the major stumbling block for the development of commodity futures markets in India is the fragmented physical/spot market." As Nair points out, government laws and various taxes hinder the free movement of commodities. Furthermore, the absence of certified warehouses has meant that exchanges have promoted cash settlement rather than physical delivery. Thomas (2003) in a similar critique draws attention to the prevalence of bilateral deals, the lack of price transparency and the absence of certified warehouses.

Reviewing the performance of futures markets in India, Naik and Jain (2002) conclude that "Barring a few, they [futures markets] are still not congenial markets for hedgers. The markets are deficient in several aspects such as infrastructure, logistics, management, linkages with financial institutions, reliability and integrity, dominance of speculators, and efficient information system, which discourage market players from trading in these markets." Not surprisingly, researchers have called for policies that would reform both the spot and the futures markets. Such policies include institutions for greater price transparency (electronic trading rather than open outcry), clearing and settlements, price and trade information dissemination, laws to promote certified warehouses, and best practice regulatory practices for market monitoring and surveillance. In cooperation with an agricultural marketing cooperative, a futures exchange (the Multi-Commodity Exchange at Mumbai) is at the forefront of moves to establish a national spot market in agricultural commodities.

The literature on emerging commodity futures markets in developing countries is sparse. We are aware of only one study by Williams et. al (1998) that examines mungbeans futures trading on the China Zhengzhou Commodity Exchange (CZCE). They argue that the CZCE exchange has not evolved from an active spot market. If anything, the futures exchange has improved practices in physical trading. The important implication of this study is that rudimentary spot markets need not always constrain the growth of futures markets.

How does one assess the emergence of a futures market, however? In this paper, we rely on the work of previous researchers to suggest empirical strategies that could be applied to the NBOT soya oil contract. Peck (1980) refers to the "widely held and commonly accepted [proposition]…. that levels of activity on futures markets reflect commercial as distinct from speculative needs. In the absence of commercial use, futures markets have closed, and fundamental changes in a commodity's underlying productive pattern have caused fundamental changes in contract specifications." Similarly, Williams (2001a) states that "commercial firms as hedgers are the fundamental participants in futures markets."

Peck considers commercial firms as those "which trade futures contracts in conjunction with some operation – production, marketing or processing – in the cash commodity business." Williams defines the complement set – the non-commercials or speculators as those "who have no regular connection to the underlying physical commodity". In the U.S., large commercial firms report their futures positions to the regulators and researchers examining the importance of commercials to futures trading have exploited this data. What this literature has shown (summarized in Peck and in Williams), is that the futures positions of commercial firms (described as hedging) moves closely with stocks and with open interest. In our data, we do not have access to hedging positions but use the correlations observed earlier to analyze open interest and its correspondence with supplies.

For a firm that combines a futures position with a position in the spot market, the return from this portfolio is the change in basis. Hence, Working (1953) argued that commercial firms make money from predictable changes in the basis. The predictability of the change in basis is then a test of hedging effectiveness – an insight that has been used by a number of authors subsequently (Heifner, 1966; Hranaiova and Tomek, 2002; Peck and Williams, 1992) and is exploited in this study as well.

If the change in basis is a return to the portfolio of commercial firms, then their commercial decisions (in the aggregate) should affect the basis. This provides yet another way for examining the use of futures markets by commercials. While stocks held by commercials are not publicly observable, soya oil imports data is available and is used here to examine its effect on the basis. Tilley and Campbell (1988) in an earlier effort investigated the impact of underlying economic factors (including export commitments) on the basis in the Kansas city wheat futures contract.

3. The Soyabean and Oil Complex

From being a minor oilseed, soyabean has grown in importance and is next only to groundnut in terms of the output of oilseeds in India. With an annual production of around 6-7 million tons, soybeans constitutes about 25% of total oilseed production of the country in 2004. Between 1981 and 2004, the output of soybeans grew at about 10% per annum although the growth seems to be tapering off in the last 4-5 years. The detrended series is remarkably stable with its coefficient of variation around 8%. Soyabean production is concentrated in the state of Madhya Pradesh that accounts for nearly 75% of the country's output. The crop year is October-September and 60% of the crop marketings occur in the period from November – January. Soyabean prices exhibit a typical pattern of seasonality where the low price occurs in the harvest months of October-November after which prices rise till June when they level off.

Most soyabeans are processed to extract the oil for food and industrial use and high-protein meal or de-oiled cakes (DOC) for animal feed. Soyabean crushing operations are generally located near major soyabean production regions i.e. in Madhya Pradesh. Soya oil accounts for 18% of soyabean weight while the remainder 82% is soyabean meal.

Paralleling the growth in soyabean production has been the increase in soya oil consumption. In 2000, soya oil accounted for 21% of the consumption of all edible oils in India. In the early 1970s, the share of soya oil was negligible (Dohlman, Persaud and Landes, 2003). Higher crushing of domestically produced soybeans as well as higher imports of soya oil supplied the growth in soya oil consumption. Between 1990/91 and 2000/01, soy oil imports increased from 20,000 tons to 1.4 million tons. The oil is mostly imported in crude form and is refined locally (Dohlman, Persaud and Landes, 2003). The seasonal pattern of soyabean production means that soya oil supplies tend to come from domestic crushing through October to March while soya oil imports dominates supplies in the other months. Since about the middle of 2001, the government has applied an ad-valorem tariff of 45% on soya oil. To prevent under-invoicing, the government follows a tariff rate value system where the tariffs are applied with respect to a government reference price. Delays in revising these reference prices has meant that the effective tariff rate is sometimes higher than 45%.

Within Madhya Pradesh, Indore is the center of soyabean and soya oil trade. The soya oil spot market in Indore operates through specialized brokers operating out of their offices. There is no centralized market. Spot market contracts are for deliveries within 7-10 days. Brokerage is about Rs. 25 per ton in the spot market as opposed to Rs. 14 per ton in the futures market. Sometimes the spot market brokers arrange for forward deals upto 1-2 months. In case of disputes, the broker is the principal arbiter. As such deals can greatly affect the reputation of the brokers, they accept such transactions depending on the reputation and past dealings with the client. Compared to soyabean prices, seasonality is much less marked in soya oil prices. The strongest seasonality is that oil prices in the first 3 months of the soyabean marketing year (October – January) are significantly lower than the prices in the remaining months. The absence of seasonality in the remaining months is due to imports.

4. The Soya Oil Exchange

The soya oil futures exchange at Indore is operated by the National Board of Trade (NBOT). The exchange trades contracts for delivery in every month of the year. At any particular time, however, only the maturing contract and the two nearby contracts are traded. Thus, for instance, on February 1, the contracts that could be traded would the February, March and April contracts all of which expire in the middle of the respective months. Thus, a contract is open for trading for a maximum for three months.

The basic quantity for trading in respect of all contracts in soya oil is one metric ton or its multiple. The trading uses the open outcry system although the exchange plans to switch over to electronic trading in the near future. At the end of the trading day, transactions are marked to market. The trading rules allow for delivery at certain warehouses although in practice, delivery is rare and cash settlement at the exchange determined price is the norm. In India, the negotiability of warehousing receipts is not yet backed by law and this might have discouraged physical deliveries. The absence of gradation and certification systems and the fragmented nature of the spot markets also leads exchanges to avoid physical delivery. This feature is common to all exchanges in India.

The settlement price is decided by a committee of exchange members and is usually an average of the spot prices over 4 days preceding the settlement date. The exchange declares a spot price every day based on a sample of prices collected from brokers. The exchange maintains that it minimizes biases by taking care that quotations are not obtained from brokers with active positions in the futures market.

NBOT is owned by its members. About 64 % of the members are brokers/trading merchants, about 25% are traders, 8% are processors and 3% are importers/exporters. However, under a regulatory directive, NBOT has to transform itself to a demutualized exchange in the near future.

Trading in the soy oil contract at NBOT began in February 2000. Till the beginning of 2004, trading volumes in the soy oil contract at NBOT accounted for more than 50% of the combined volumes in all futures exchanges. From 2004, NBOT lost is position as a leading exchange as trading commenced at three well-equipped exchanges – the National Commodities and Derivatives Exchange (NCDEX) in Mumbai, the Multi-Commodity Exchange (MCX) also in Mumbai and the National Multi-Commodity Exchange in Ahmedabad. These exchanges have excellent financial backing, demutualised ownership structures and more transparent electronic trading systems. Of these exchanges soya oil is most actively traded at NCDEX. Trading volumes in this contract is still short of NBOT volumes by about 20%. However, the rapid growth in volumes in this new exchange suggests that NCDEX could emerge as the leading exchange in soya oil contracts in the future. In this paper, we focus on futures trading at NBOT as the experience with other exchanges is much too limited to afford a detailed study. Our data covers the period from February 2000 (i.e., from the inception of trading in the soya oil contract) to January 2005. In terms of contracts traded, this period includes 59 contracts starting from March of 2000 to February of 2005.[3]

5. Volume of Trade and Net Open Interest

As noted earlier, the soya oil contract at the NBOT exchange in Indore is open for trading for a maximum of three months. Across the 59 contracts in the sample, the average number of days traded is 56. In 60% of the contracts, the number of trading days was between 49 and 59 days. The average number of days traded has remained stable over the years (in the range 52-56) except for contracts maturing in 2002 where the average number of trading days surged to 65. While imports were highest in this year, it was not substantially higher than in 2001 where contracts traded on average for 53 days.

Despite no trend in the number of days traded, the volume of trading in soya oil contracts has grown rapidly while soya oil supplies have grown only modestly. Table 1 shows that the volume of trading started off in 2000 being twice that of the quantity of total supplies (domestic production plus imports). By 2004, trading volumes were 16 times the quantity of supplies. The large increases in trading volumes without such a

[3] In the initial year, 2000, the exchange did not trade the June contract

corresponding movement in physical supplies suggests that the soya oil contract has attracted speculative interest.

The exchange does not report the positions of hedgers and speculators separately. However, as discussed earlier, previous research has established that open interest mainly reflects the trading positions of commercial firms. The last 2 columns in Table 1 are yearly totals of open interest and the ratio of trading volumes to open interest. These numbers confirm the rapid growth in speculative volumes.

Based on daily volume data, we compute the empirical distribution of the volume of trade as a function of time. For any particular time interval, the histogram estimate of the probability of a trade occurring in that period is the ratio of volume of trade in that interval to the total volume. Figure 1 plots the probability of a trade in the soya oil contract against the time to expiry of that contract. Thus, time periods closer to zero are closer to contract expiry. The probability density is estimated non-parametrically using the Epanechikov kernel. The density curve is uni-modal and has the expected shape. The probability is small for more than 55 days from expiry. For less than 55 days, the probability first increases as contract expiry approaches, reaches a peak when there are about 25 days to expiry and then declines. The figure shows that most of the trades occur in the period from 40 days to about 10 days to contract expiry.

Analogous to Figure 1, Figure 2 computes the probability of positive open interest in any particular time interval. Once again, this curve has the expected shape. Most of open interest occurs in the period from 40 days to about 5 days to contract expiry. Open interest starts to rise when there are 55 days left to maturity and peaks when there are about 25 days to maturity after which it declines. Thus, the pattern in open interest and volume of trade is similar to the patterns observed in futures exchanges in developed countries (Williams, 2001a). However, there is an important difference as well. Contracts here are open for much shorter durations.

Peck (1980) showed that in the U.S., futures contract for wheat, corn and soybeans, the visible supplies of these commodities and the open interest followed similar seasonal patterns and therefore argued that futures markets depend upon commercial use. Figures 3 and 4 display the averages of monthly totals of soya oil supplies (whether from domestic production or imports) and the aggregate open interest in the contract expiring in the succeeding month. In figure 3 we see that the seasonal pattern in total supplies is U-shaped. They decline through the first months of the marketing year, plateau out during the months of February through April, after which they rise again. Figure 4 displays the behavior of open interest according to contract month. Note that here we begin the marketing year from October while it began a month earlier in figure 3. The reason is that for the contract expiring in month n, most of the trading days are in the previous month (n-1). The seasonality in open interest is much less marked than in supplies. However, it remains true that open interest is generally higher at the beginning and end of the marketing year than the middle of the marketing year. Once again, open interest is lowest for contracts expiring in March, April and May. There is therefore a broad but not a very tight correspondence between commodity supplies and open interest.

6. Hedging and the Predictability of Basis

Suppose a trader who is long in the commodity and takes an equal but short position in futures. It is well known that the return from such a portfolio is the change in basis. More formally, if the contract runs from period 1 to period 2, and if B_t denotes the basis in period *t*, then the return (to one unit of the commodity) is ($B_2 - B_1$). Similarly, if this trader held a portfolio combining a short position in the commodity with an equal and long position in futures, the return is ($B_1 - B_2$). More generally, if *X* is an agent's position in the spot market and if it is matched by an equal and opposite position in the futures market, then this agent's return is *X*($B_2 - B_1$). For a short hedger, *X* is positive and for a long hedger, *X* is negative.

As discussed earlier, if the basis is predictable then commercial firms would use the futures markets to profit from risk-neutral arbitrage. The argument for predictability rests on the convergence of the futures price to the spot price at maturity. If this is so, in a regression of the change in basis ($B_2 - B_1$) on the initial basis B_1, the slope coefficient would be -1, the intercept would be zero and the R^2 of the regression would be 1. Here the agent invests in a portfolio of spot and futures in period 1 and holds it till the futures contract matures in period 2. Williams (2001a) demonstrated the value of this idea by an application to the Columbian coffee contract traded in the Coffee, Sugar and Coca exchange at New York. He regressed the change in basis (computed as the basis at maturity minus the basis two months prior to maturity) on the basis two months prior to maturity. The R^2 was 0.62 and Williams concluded that the returns to storing or shipping Colombian coffee is predictable. Thus the agents, whether coffee exporters or importers or other kind of traders, who owned the commodity and were short in coffee futures "could act as if such storage decisions were essentially arbitrages" (Williams, p 789). For applications of this regression to other commodities, see Hranaiova and Tomek (2002) and Peck and Williams (1992).

The Working view that hedging is tantamount to a riskless arbitrage emphasizes the use of futures trading (for profit) by commercial firms. In this section, we consider whether the soy oil contract at NBOT affords similar opportunity to hedgers. We define the initial basis as the difference between the cash price and futures price that obtains on the first trading day of the month prior to the maturity month. Thus, for a March contract, the initial basis would be the basis on the first trading day of February. The final basis is taken to be the basis that occurs on the 10th trading day of the maturity month. On average, this amounts to a trading period of about 34 days. The results are shown in the first column of Table 2. The slope coefficient is close to –1 and is not significantly different from it at the 10% level of confidence. The intercept term is not significantly different from zero and the R^2 is high. Figure 5 plots the scatter between the change in basis and the initial basis as well as the regression line. The close fit shown in the figure means that a trader can use the initial basis to construct a portfolio combining positions in futures and spot market in such a way that the return from the portfolio is nearly riskless provided it is held upto the 10th trading day of the maturity month. A trader could, of course, liquidate the portfolio before this time if the return from doing so is better than the return from holding the portfolio upto the 10th trading day of the maturity month.

As a robustness check, we also considered what happened if we defined the initial basis to be the basis on the first trading day two months prior to final maturity. For a March contract, for example, the initial basis would be that on the first trading day of January. The final basis is defined as previously. On average, the period between the initial basis and final basis amounts to a trading period of 49 days. As some contracts were not traded long enough, they drop out of the sample. The results are in column 2 of Table 2 and are in conformity with what was obtained earlier.

Out of the 59 contracts traded over the period from 2000 to early 2005, the change in basis was negative for 30 contracts and positive for 29 contracts. As a result, the average change in bias is insignificantly different from zero. However, the market at different points in time favors short and long hedgers. The rate of return to a hedger's portfolio is $(B_2 - B_1)/P_1$ where P_1 is the spot price in period 1. The average rate of return is 2.4% for short hedgers and 2.2% for long hedgers (both significantly different from zero). Further, the 25 to 75-percentile interval is [1.1%, 2.9%] for short hedgers and [0.7%, 2.7%] for long hedgers. In interviews, traders in the soya oil market typically reported the cost of carryover to be in the range of 2-3% (of the cost of the commodity) over a period of 2 months. Thus, even though the hedges in the soya oil exchange can be so constructed to be almost risk-free, the net returns (after the costs of storage) are most of the time quite small.

7. Supplies, Basis and Open Interest

The predictability of basis dynamics in the Indore soya oil exchange facilitates commercial use of the futures contracts. This suggests that the basis should reflect the economic forces that underly the supply and demand of soya oil. In the previous section, we used the `initial basis' (i.e., the basis at the first trading day of the month previous to maturity) as the predictor of the change in basis. In this section, we examine the impact of supply factors on the `initial basis'.

Crushing of domestically produced soyabeans as well as imports of crude soya oil supply the Indian soya oil market that are refined locally. Both of these have distinct seasonal patterns. The proportion of supplies met by local production is at its peak during the early months of the soyabean marketing year after which it declines. Would the initial basis reflect a similar seasonal pattern and how does supply from crushing and how do imports affect it?

In Tilley and Campbell's (1988) investigation of the impact of exports and market stocks on the wheat basis traded at the Kansas City Board of Trade, exports led to a higher basis (higher cash price relative to futures prices) and thus encouraged stocks to move to the ports for export. Market stocks had an opposite impact. In our context, it could be argued that imports would have a positive impact on basis if it expands futures supplies more than current supplies thus leading the futures price to fall more than the cash price. On the other hand, imports could affect the basis negatively if it expands current supplies more than future supplies. Our estimating equation is the following:

$$B_{t,t+1} = \beta_0 + \beta_1 S_{2t} + \beta_2 S_{3t} + \beta_3 \ln(Q_t) + \beta_4 \ln(I_t) + \varepsilon_t \quad (1)$$

where $B_{t,t+1}$ is the basis on the first trading day of month t of the contract expiring at month t+1, Q_t is the quantity of soya oil produced by domestic crushers in month t, I_t is the quantity of soya oil that is imported at month t, and S_2 and S_3 are dummies that take the value 1 if month t falls in season 2 or season 3 respectively. The season dummies control for all the omitted factors that are correlated with the seasonality of production and imports. Season 1 dummy represents the months of November, December, January, February and March. Season 2 dummy stands for the months from April to July while season 3 dummy is for the months August to October.

As domestic prices could impact the quantity and timing of imports, imports have to be regarded as endogenous to basis. To instrument it, we use soybean output and the unit value of imports. Soybean output affects domestic oil prices through its impact on domestic oil production and imports and would therefore be uncorrelated with the error term in equation (1).[4] As the international price of soya oil is determined in the world market and since India's needs are a small proportion of the world's production, the unit value of imports is exogenous to basis, i.e., the unit value of imports would affect the basis only through imports and not through any other channel. In a first-stage regression of the endogenous variable (imports) on all exogenous variables, the F-statistic ($F(2,51)$) associated with the instruments is 4.31, which is significant at the 2% level.

To control for heteroscedasticity and autocorrelation (with lag 1), equation (1) is estimated by generalized method of moments. The results are in Table 3. The coefficients of both domestic oil production and imports are negative. Both are variables that relate to the same month as the basis. Therefore, if supply increases from either source, then it decreases the cash price in the same month relative to the price of a futures contract expiring the next month.

It should be remembered, however, that supplies from domestic crushing are negligible in the last few months of the soyabean marketing year. Hence, stocks from domestic supplies are also likely to be negligible during this time while they are likely to be of significant magnitude in the earlier months of the soyabean marketing year. To investigate whether the impact of imports varies across season, we interact imports with

[4] The exogeneity assumption would not hold if soya oil prices exert a strong impact on soybean output. Note, however, that these are long-term relationships that are unlikely to show up in a monthly data set over a period of five years.

the season dummies as below.

$$B_{t+1,t} = \beta_0 + \beta_1 S_{2t} + \beta_2 S_{3t} + \beta_3 \ln(Q_t) + \beta_4 S_{2t} \ln(I_t) + \beta_5 S_{3t} \ln(I_t) + \varepsilon_t \qquad (2)$$

The instruments correspondingly are the import prices interacted with the season dummies (and soyabean output) and the equation is once again estimated by generalized method of moments to take into account unknown heteroscedasticity and autocorrelation (upto the first lag). The results are in Table 4. This shows that the negative impact of imports on the initial basis is driven by the third season where such impacts are strong and significant. By comparison, the impacts are much smaller in the first two seasons. While the impact in the first season is negative, it is not statistically significant. This is to be expected given that imports are generally small during this period. Surprisingly, the impact in the second season is positive and nearly significant at the 10% level.

It could be argued that the monthly production of oil is also endogenous to the basis as processors possibly use spot and futures prices to distribute the production of oil across months. We control for this endogeneity by instrumenting oil production by soyameal price. As most of the soyameal output is exported, we use the one month lagged U.S. $ f.o.b price. As this is determined in international markets to which India is a small exporter, the soyameal price is exogenous to domestic prices. Further, its impact on commodity prices (spot and future) will work only through domestic oil production. Thus, monthly soyameal price is a valid instrument for monthly oil production.

The results in the second column of Table 4 are generalized method of moments estimates of equation 2 where both imports and oil output is instrumented. Compared to column 1, oil output loses its significance while the imports variables retain their earlier precision. In particular, imports in the second season continue to have a positive impact on the initial basis and the impact is just about significant at the 10% level.

This means that in the second season, current imports increase the cash price relative to the futures price. Why does this happen? The explanation lies in domestic oil production and stocks. While it is negligible during the third season, this is not so in the second season. Thus, when because of exogenous factors (e.g., say lower import price), imports increase, it prompts domestic processors to shift their supplies to later periods. They cover this with a short position in the futures market, which leads futures price to fall relative to cash prices. As against this, the addition to current supplies from imports will decrease cash prices relative to futures prices (as it happens in season 3). The coefficient estimated in Table 4 is the net effect. On the other hand, in season 3, because of scarce stocks, the hedging effect is largely absent and so the estimated coefficient represents only the impacts on the cash market.

If this explanation is correct, we would expect to see in the second season, imports to be positively correlated with short hedging. Unfortunately, we do not have data on short hedging and it is not possible to test this hypothesis directly. However, if open interest in this period is dominated by short hedging then we could see if there is a positive relation between open interest and imports. As open interest is jointly determined along with cash and futures prices, we could estimate open interest as a function of the explanatory variables in the basis equation.

The results are reported in Table 5. The dependent variable is the cumulative open interest in month *t* in all open contracts. Of the import variables, imports in the second season positively impact open interest and is significant at the 5% level. The impact of imports is negative in the other seasons; however the effects are not precisely estimated. These results are supportive of the hypothesis that imports stimulate a hedging effect in the second season absent in the other periods.

However, the estimates do not satisfy the test of overidentifying restrictions. The null hypothesis that the instruments are uncorrelated with the error term is rejected. As we could not find any other instruments, we report in Table 6, an ordinary least squares regression of open interest on the exogenous variables: import prices in each season, the lagged soyameal price and the season dummies. Notice that this set of variables has good explanatory power as the R squared in this regression is nearly 0.4.

Consistent with the earlier table and our hypothesis, import price in the second season is negatively correlated with open interest. As the variables are in logs, the coefficients are elasticities. Thus, a 10% decrease in import price increases open interest in season 2 by nearly 5%. The results also show that in the other periods, import prices have the opposite impact on open interest – lower import prices (and thus higher imports) decreases open interest. As season 1 is flush with domestic supplies and season 3 is dominated by imports, the behavior of commercials that drives open interest is probably different between these periods.

8. Conclusions

Trading volumes at the NBOT soya oil contract at Indore have grown rapidly. They have also grown relative to the change in supplies and in open interest suggesting a growth in speculative trading. Open interest, which past work has shown to be highly correlated with hedging positions, displays the typical pattern of mature exchanges – of rising steadily as the contract moves towards expiry but peaking and falling rapidly in the time just before maturity.

Like the successful commodity exchanges in developed countries, the NBOT exchange offers opportunities to short and long hedgers (at different times) to construct riskless profit-earning trading strategies. If hedgers actively participate in futures trading, then their commercial decisions in the aggregate would affect the returns from such trading. We find that soya oil imports exercise a significant impact on the basis and the impact varies with the extent of supplies that come from domestic production. Thus, by these commonly used criteria, the soya oil contract at Indore has been successful. The only count on which it falls short of developed country exchanges is that the NBOT contracts are open for trading for a much shorter time of three months or less.

The NBOT exchange has emerged despite a soya oil spot market that would be regarded as underdeveloped by rich country standards. The market is fragmented as transactions are mediated through brokers who match suppliers with buyers. Personal reputations play a role in pushing deals. Real time spot price information is not easily available. Forward contracts are not common and warehouse receipts are not traded because of lack of quality guarantees. Our account is consistent with evolution of the mungbean futures market at China Zhengzhou Commodity Exchange (CZCE). Williams et. al (1998) point out that the CZCE did not organically evolve from commodity trade in physicals; rather the futures exchange has encouraged improved marketing practices in physicals.

The emergence of the mungbean exchange in China and of the soya oil exchange in India suggest that spot markets need not be fundamental constraints. Like in many developing countries, contract enforcement is costly in India. The institutional mechanisms of futures exchanges (mark to margin, clearing house and the practice of traders transacting as principals) are attractive in this regard and allow agents to transact without costly verification of personal histories of other agents and without being tied to long-term bilateral deals (Williams, 2001b). It is therefore conceivable that the development of futures exchanges could precede that of spot markets in developing countries.

The success of the soya oil contract is exceptional when seen against the failure of contracts in soyabeans and soyameal. In the flow of beans from the grower to the oil crusher, there is only one layer of intermediary. These brokers operating in the soyabean spot market function as assemblers aggregating quantities picked up from individual growers. The spot market registers large volumes in the first 3 months of the marketing season after which volumes die off. The small size of the soyabean harvest (relative to processing capacity), the short marketing season and the fact that most output is purchased locally (as almost all soyabean crushing plants are located within the production region) have limited price volatility and long duration storage while encouraging long-term relationships between brokers and processors . As for soyameal, most of it is exported. Relative to world trade, India is not a large exporter and so international buyers have little interest in a futures contract traded in India. The inability to hedge soyabeans and soyameal positions would have also limited the interest and capacity of domestic oil crushers to participate in the soya oil futures contract.

Despite this, however, the soya oil contract has been liquid which underscores the role of imports in this regard. Imports have ensured a full marketing season for soya oil.

Although imports reduce seasonality, they increase short run volatility because of the sensitivity of soya oil prices to world prices (for soya oil and its competitors like palm oil). Imports driven hedging has drawn traders from consuming regions spread across the country for whom anonymous transactions backed by a clearing house would have been valuable.

Table 1: Trading Volumes and Supplies in Soya Oil

Calendar Year	Volume of Trade (‘000 tons)	Domestic Production (‘000 tons)	Imports (‘000 tons)	Total Supplies (‘000 tons)	Ratio of Volume of Trade to total Supplies	Open Interest	Ratio of Volume of Trade to Open Interest
2000	2313	622	601	1223	2	2621	0.88
2001	4629	714	1444	2159	2	4738	0.98
2002	13700	570	1531	2101	7	8297	1.65
2003	21700	602	1109	1711	13	8955	2.42
2004	26400	528	1091	1619	16	10500	2.51

Figure 1: Probability of trades occurring in any particular time period.

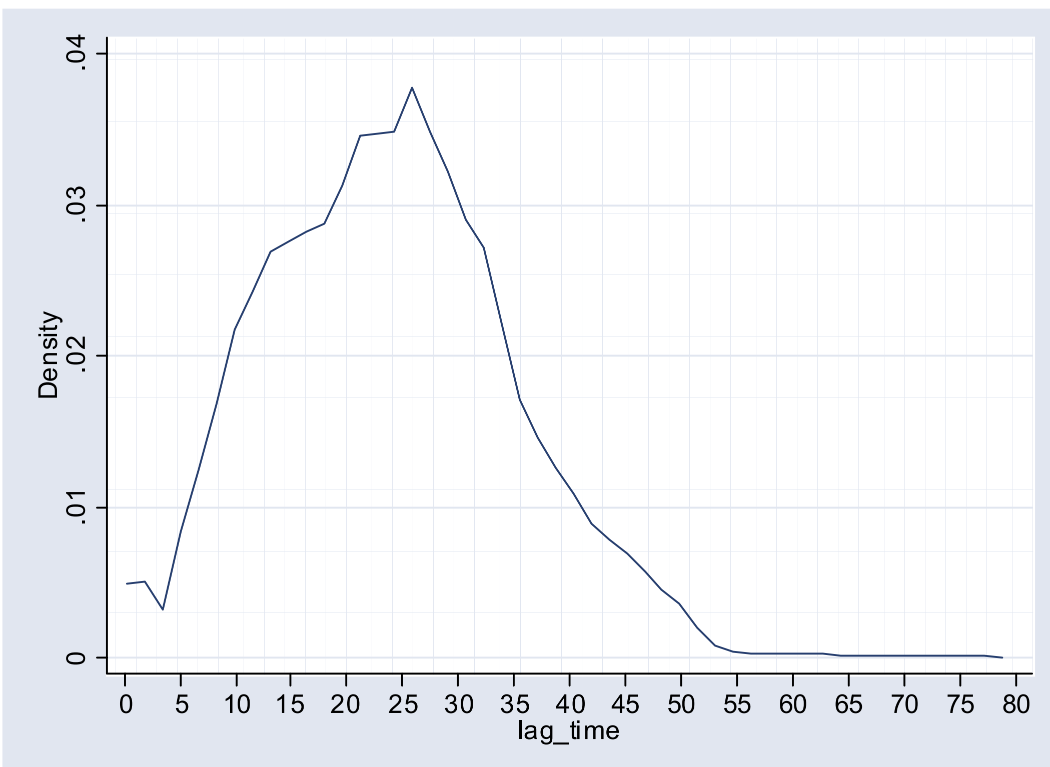

Figure 2: Probability of positive open interest

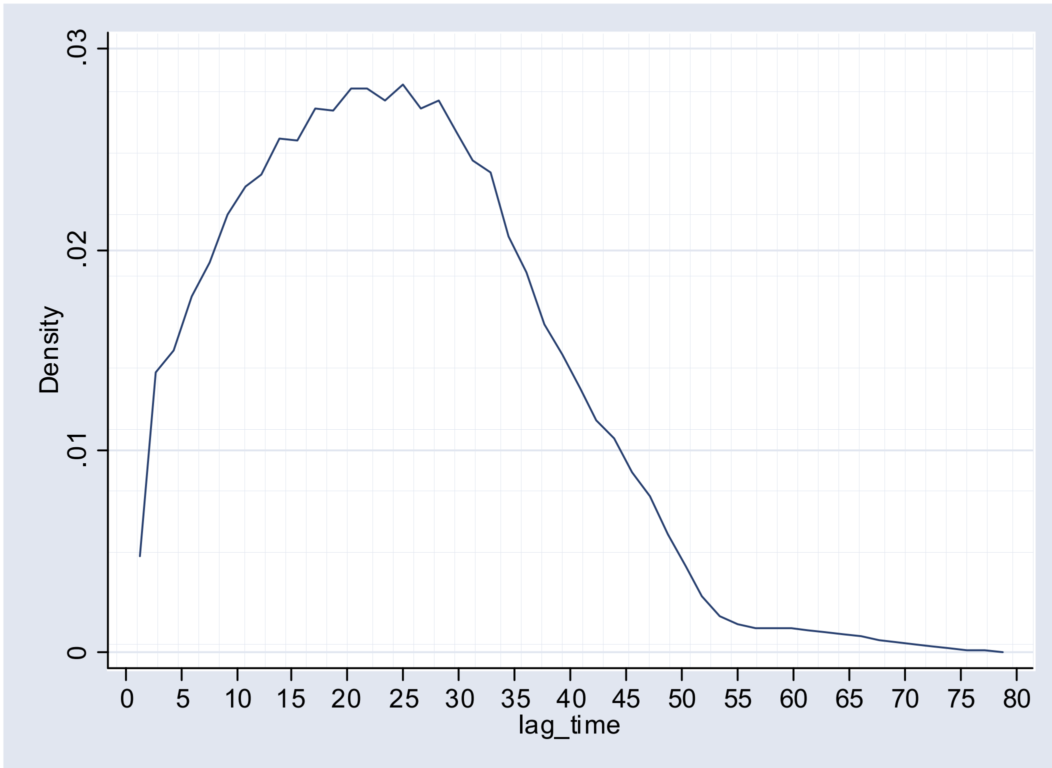

Figure 3: Seasonality in Total Supplies

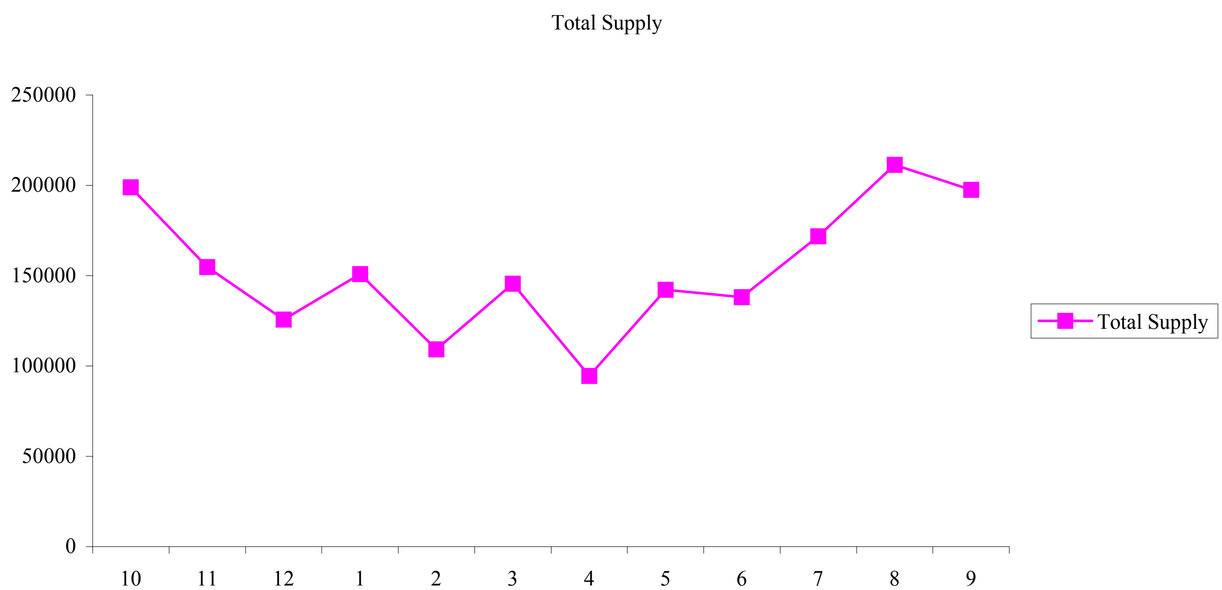

Figure 4: Seasonality in Open Interest

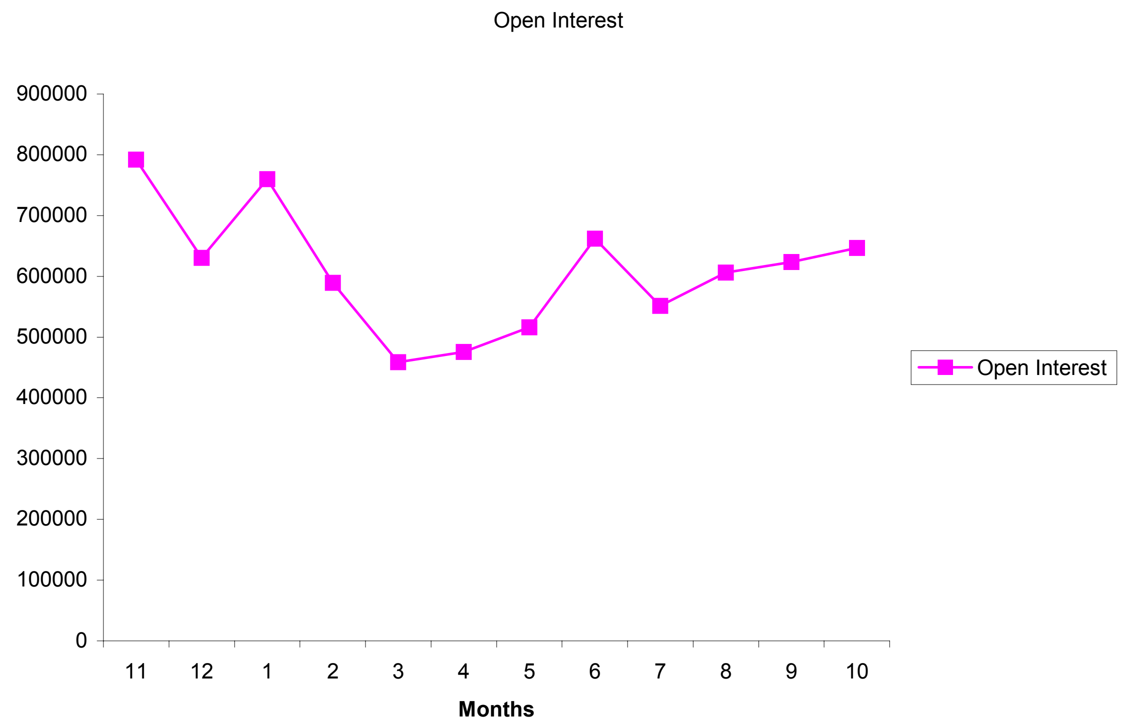

Table 2: Predictability of Basis

Dependent Variable: Change in basis

	Coefficient (robust t-ratio)	Coefficient (robust t-ratio)
Initial basis	-0.91 (31)	-0.98 (22)
Constant	0.04 (0.07)	-0.2 (0.3)
R^2	0.86	0.84
N	59	54

Figure 5: Predictability of Change in Basis

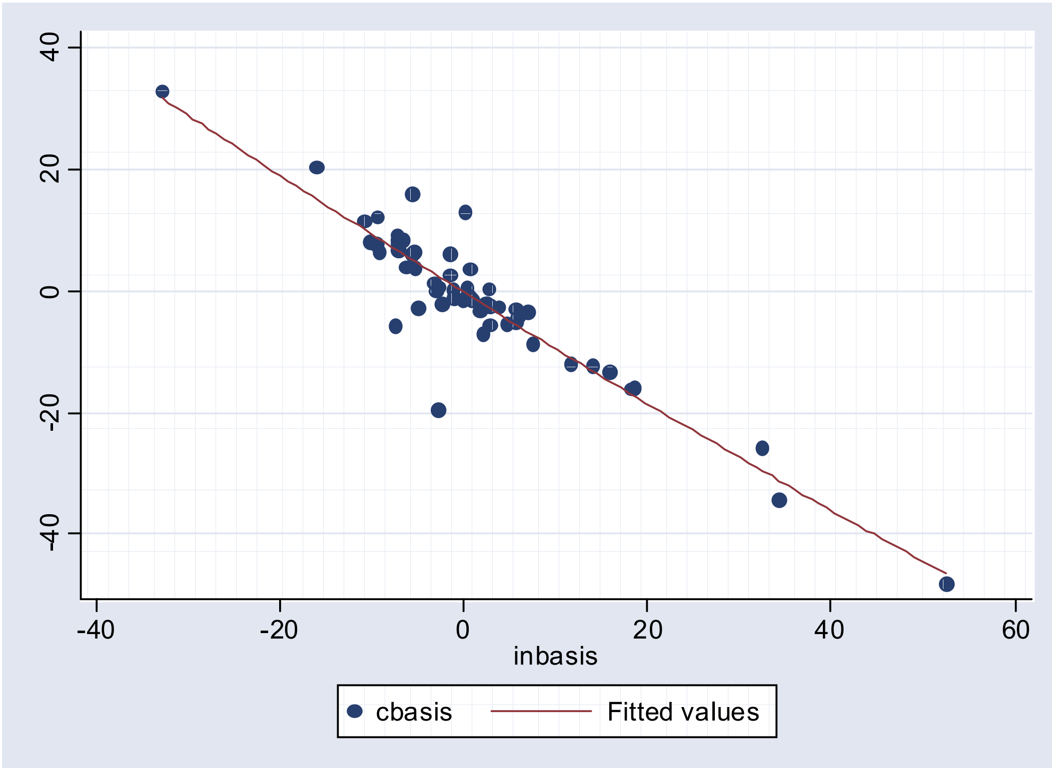

Table 3

Dependent Variable: Initial Basis

	Coefficients	t-ratios
Imports	-15.22	-2.07
Oil Production	-13.01	-2.53
Season 2 dummy	2.79	0.42
Season 3 dummy	17.51	1.84
_cons	304.32	2.45
N	56	
Estimation Method	GMM	

Both imports and oil production are in logs. The log of import price and the log of soyabean output instrument the log of imports. The Hansen-Sargen test statistic of overidentifying restrictions is distributed chi-squared with 1 degree of freedom. The value of the test-statistic is 0.01 and the null hypothesis is not rejected.

Table 4

Dependent Variable: Initial Basis

	Coefficients (t-ratios)	Coefficients (t-ratios)
Imports in season 1	-13.32 (-1.27)	-11.79 (-1.19)
Imports in season 2	5.78 (1.55)	4.78 (1.63)
Imports in season 3	-50.16 (-3.1)	-49.93 (-2.86)
Oil Production	-17.83 (-1.96)	-14.31 (-1.30)
Season 2 dummy	-219.07 (-1.61)	-187.84 (-1.55)
Season 3 dummy	447.69 (2.35)	463.10 (2.35)
Constant	337.71 (1.72)	282.50 (1.45)
N	56	52
Estimation Method	GMM	GMM

In column 1, the endogenous variables are imports in each season, which are instrumented by import prices in each season and soyabean output. In column 2, the endogenous variables are imports in each season and oil production. The instruments are soyabean output, import prices in each season and lagged (previous month's) meal price. Imports, oil production, meal price are in logs. In both cases, the Hansen-Sargen test statistic of overidentifying restrictions is distributed chi-squared with 1 degree of freedom. The value of the test-statistic is 0.034 and 0.117 respectively and the null hypothesis of valid instruments is not rejected in either case.

Table 5

Dependent Variable: (log) Open Interest

Variable	Coefficient (t-ratio)
Imports in season 1	-1.22 (-1.4)
Imports in season 2	0.25 (1.92)
Imports in season 3	-0.67 (-0.86)
Oil Production	-0.77 (-1.4)
Season 2 dummy	-16.82 (-1.73)
Season 3 dummy	-5.8 (-0.49)
Constant	34.96 (2.65)
N	52
Estimation Method	GMM

The endogenous variables are imports in each season and oil production. The instruments are soyabean output, import prices in each season and lagged (previous month's) meal price. Imports, oil production and meal price are in logs. The Hansen-Sargen test statistic of overidentifying restrictions is distributed chi-squared with 1 degree of freedom. The value of the test-statistic is 4.03 and the null hypothesis is rejected at the 5% level of significance.

Table 6

Dependent Variable: Open Interest

Variable	Coefficient	(t-ratio)
Import price in season 1	0.21	1.99
Import price in season 2	-0.51	-2.35
Import price in season 3	0.34	2.00
Lagged meal price	1.64	3.04
Season 2 dummy	-1.40	-3.05
Season 3 dummy	0.37	1.23
Constant	4.87	2.04
N	52	
R^2	.37	
Estimation Method	OLS	

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