THE ASSOCIATION BETWEEN NEARBY COTTON FUTURES PRICE AND NET BALE COMMITMENTS OF SPECULATIVE TRADERS

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Abstract

Granger causality tests and time series methods were used to identify the relationship between nearby futures price and net bale commitments of speculative traders in cotton. Ordinary least squares analysis was employed to find out the big hit ability of the speculative traders on nearby cotton futures price. Net positions of speculative traders aided in predicting the subsequent nearby futures price and the strongest response was observed within two weeks. Speculative traders had big hit ability and statistically significant relationships were found when they were net long and net long positions decreased as well as when they were net short and net short positions decreased.

Introduction

The relationship of futures price movements and buying and selling commitments of large speculative trader accounts is of interest to all market participants such as producers, merchants and textile manufacturers involved in the selling and buying of cotton. Professional speculators perform a major role in the price discovery process and in the hedging of trade positions to reduce the risk of adverse price movements during the cotton production, storage and marketing process. Speculators are investors seeking to profit from anticipated price movements in futures contracts. By contrast, producers, merchants and textile manufacturers use the future markets to “hedge” their buying and selling prices of cotton to reduce the risk of price changes during the production, marketing and textile manufacturing stages of ownership and also to profit on changes in basis. In order to hedge prices, cotton buyers and sellers must use positions in the futures market opposite to their cash positions. For example, a producer of cotton sells futures to hedge a price prior to delivery. Depending upon their price expectations, however, professional speculators can freely buy or sell futures at any time based on price expectations. The question is how do their aggregated holdings and changes of net positive or negative commitments relate to price movements?

The economic role of speculators in futures trading is widely acknowledged. They assist in providing a liquid market for hedging transactions. But still some regard speculation as an undesirable source of instability. The large hedge funds are particularly suspect. Several studies have investigated the role of speculators and their impact on the commodity futures prices. There are no contentions to the point that speculators are necessary to redistribute risk and their role is vital in providing liquidity and enhancing the efficiency of the price discovery function that futures markets fulfill. Houthakker (1957), using aggregate data studied the profits and losses of different groups of traders and reached the broad conclusion that large hedgers lost and the large speculators gained. This result implies that the large traders lost on the futures side of their hedging activity while the results of their cash transactions are not known. In a later study, Hartzmark (1987) has shown that the commercial (hedging) traders were most profitable, while speculative (non-commercial) traders earned negative or zero profits in the futures market. The theory of normal backwardation that futures price increases over the life of a contract and its extensions were also rejected in his study.

Empirical results offer mixed results. These studies fall into two groups based upon the data used. Hartzmark used the individual trader’s records and analyzed the profit and losses. His comparison of results with that of earlier methods used by Houthakker and Rockwell implied that the results using the publicly available month-end reports were misleading. They appear to miss substantial within-month profits earned by large commercial traders, resulting in the conclusion stated above.

Our study uses the readily available published data instead of individual trader records and examines the relationships between the nearby futures price and net positions of large speculative accounts.

Objectives

The objectives of the current paper are two fold. First, do the speculative traders (non-commercial) as a group have any significant impact on the futures price? This question can be answered by looking for causal relationships between the variables of interest eg., nearby futures price and net long positions in bale commitments of speculative traders. Second, we would like to examine the “big hit” ability of the speculative traders as a group. A trader possessing big hit ability is able to predict both the *direction* and *magnitude* the of the price changes and will thus establish his largest positions (make his biggest bets) when the highest returns (largest absolute price movements) are anticipated. In the present context we could interpret this as the magnitude of the net positions of the speculative traders changing with regard to the strength of opinion held by this group of traders about the subsequent price direction. For example, if they are net long then the subsequent anticipated price move is upwards.

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Procedures

Data Sources

From the NewYork Cotton Exchange's weekly cotton trade report the long and short positions of speculative speculative traders were obtained from 8/01/1986 to 8/28/1998. These reports have been prepared on the basis of information furnished to the Exchange by Clearing Members who are required to furnish accurate reports to the Exchange. The reports are published every Tuesday giving the previous week's activity.

The nearby futures price series was constructed by taking the weekly average of the settlement prices of the next to expire contract month of the five (March, May, July, October and December) cotton futures contracts. The nearby futures data is obtained from the daily futures report published by New York Cotton Exchange.

Net positions of speculative traders are calculated by taking the difference between the long and short positions at any given time. Net positions will be positive if the long are greater than short positions and is said to be net long. Opposite to this is the net short situation. All the contracts were converted into number of bales (One contract equals 100 bales).

Methods

Prior to any economic analysis each time series should be tested as to whether they are stationary or non-stationary. Stationary processes are those whose mean and variance are invariant to time. Non-stationarity invalidates conventional test statistics because the asymptotic distributions and rates of convergence for the estimated coefficients of unit root processes differ from those of stationary processes.

Stationarity tests were conducted on each series using augmented Dickey-Fuller, Phillips-Perron test and Variance ratio test statistics. Variance ratio test of random walk, which is due to Cochrane(1988) and Lo and MacKinley(1988), is performed which is robust relative to the earlier tests. The earlier tests are based on the assumption that nearby futures prices are normally distributed. However, it is well documented that the distribution of futures price changes is not normally distributed. Instead, the distribution exhibits excess kurtosis relative to a normal distribution. The variance ratio test allows heteroscedasticity in the data, and, more importantly, does not require the assumption of normality. Several statistical loss functions were used to determine the optimal lag length selection such as AIC (Akiake Information Criterion), SIC (Schwartz Information Criterion) and log likelihood.

Granger Causality Tests

A variable X is said to "Granger cause" a variable Y if Y can be better predicted using past values of X along with past values of Y. If X Granger causes Y and Y does not Granger cause X, then X is said to unidirectionally cause Y. The causation is said to be bi-directional if X causes Y and Y causes X.

VAR Methodology

The VAR is designed explicitly to characterize a dynamic system without a priori forcing particular patterns of interactions among a set of variables. By using VAR methods every variable in the multi-variate system is allowed to influence every other variable in the system with lags. Several dynamic attributes of an economic system can be examined using the VAR methodology. First, reaction times for responses of one series to another can be investigated by studying the impulse response functions. The impulse response function simulates over time the effect of a shock in one series on itself and on the other series of the system. Second, patterns, directions, and duration of price responses can be investigated by performing forecast error variance decomposition. In forecast error variance decomposition, the forecast error variance at alternative horizons is attributed to shocks in each series in the system – including itself. This operation provides one with a general procedure closely related to Granger type causality tests. While Granger causality is defined strictly in terms of the difference in forecast error variance with and without a particular series in a given information set, error decompositions are defined in terms of forecast error variance with the full information set (Bessler 1984). For a complete description of these methods refer to Bessler.

In order to test for the big hit ability two versions of the test are available
from the literature. Cumby and Modest (1987) proposed the original:

$$R(t) = \alpha + \beta\, U(t)$$

Where R(t) is returns at time t and U(t) is a binary variable taking the value of one if the forecast of returns are positive and zero if not. Hartzmark (1991) proposed the second version as a modification of CM:

$$R(t) = \alpha + \beta\, NP(t) + e(t)$$

Where R(t) is returns and NP(t) is net positions (either net long or net short) at time t. We follow the second version in our analysis. It is assumed that returns (R(t)) depends on the net position of trader, and big hit ability is demonstrated if trader's largest positions are held when there exist the largest price movements in a favorable direction, i.e., the trader has stronger feelings about a price move and takes bigger positions. Returns are calculated following the standard convention of difference of log prices ($\log(P_{t+1}/P_t)$). Define NP(t) as the net position (long minus short positions) at time t, such that NP(t) is greater than zero if the trader is net long and NP(t) is less than zero if the trader is net short. The NP(t) are measured in net bale commitments instead of number of contracts. We can test the big hit ability by testing the coefficient b. If b is significantly greater than zero, it indicates the presence of big hit ability. Hartzmark(1991) provided the comparable measure of big hit ability for individual traders by constructing a forecast coefficient from the parameter estimate b's sign, standard error and degrees of freedom. In our study, as we are dealing with aggregate data and not dealing at an individual trader level, this measure is not necessary and hence not reported.

Using the same specification, except that the independent variable is a zero – one dummy variable representing the specified percentage change in the net positions, we test for the significance of the b in order to get the magnitude of the effect of percent change in net positions on the returns. The modified equation looks as follows:

$$R(t) = \alpha + \beta\, U(t) + e(t)$$

This equation is in semi-logarithmic form with a dummy variable as independent variable. We can test for the significance of the coefficient and get the sign on the coefficient by the ordinary least squares analysis. We need to be careful in interpreting the magnitude of the coefficient on the dummy variable. We have to exponentiate the coefficient in order to get the magnitude of the effect of percent change in net positions on the returns. We defined the dummy (U(t)) variable as follows depending on the test of interest:

> Case 1: U(t) = 1 if net long; Case 2: U(t) = 1 if increase in net long or decrease in net short; Case 3: U(t) = 1 if net long and net long increases by >= 10%; Case 4: U(t) = 1 if net long and net long increases by >= 50%; Case 5: U(t) = 1 if net long and net long decreases by >= 10%; Case 6: U(t) =1 if net long and net long decreases >= 50%; Case 7: U(t) = 1 if net short and net short positions increases by >= 10%; Case 8: U(t) = 1 if net short and net short increases by >= 50%; Case 9: U(t) = 1 if net short and net short decreases by >= 10%; Case 10: U(t) =1 if net short and net short decreases by >= 50%. U(t) will take the value of zero in all of the above cases if it does not meet the condition specified.

In case 1 we expect a positive sign on the coefficient as the net positions are net long. In case 2 we expect the sign to be positive as both the effect of net long increase or net short decrease will have the same effect on returns (subsequent price moves). Case 2 is symmetric to the situation if we define U(t) = 1 if net long positions decrease or net short positions increase. In case 3 and 4 we expect a positive sign and the magnitude of the effect of a percent increase of net long positions in case 4 to be higher than case 3. In case 5 and 6 we expect negative sign and the magnitude of the effect in case 6 to be greater than case 5. In case 7 and 8 we expect negative sign and the magnitude of the effect in case 8 to be greater than case 7. Likewise for case 9 and 10, we expect positive sign and the magnitude of the effect of a percent decrease in net short positions to be higher in case 10 rather than case 9.

Results and Discussion

All of the stationarity tests for the nearby futures lead to the conclusion that the price series was stationary (see table 2). Variance ratios are greater than one indicating the stationarity of the series. By the nature of construction the net positions series is stationary (see fig.3). The nearby futures price series constructed is stationary due to long period of the study selected. In the futures literature we observe that the futures price series are non-stationary for selected contract months. As both the series are stationary the remainder of the analysis is conducted on the levels data.

Pairwise Granger causality tests were conducted on the variables, net positions of noncommercial and nearby futures prices. At a significance of 0.05 (confidence level 95%) the null hypothesis of net positions does not Granger cause nearby futures price was strongly rejected. But the test of the hypothesis that nearby futures prices does not cause net positions was not rejected (see table 1). This shows unidirectional causal relationship with the net positions causing the nearby futures prices. There is a positive relationship between futures and net positions of speculative traders positions (correlation coefficient = 0.248). This states that when net positions were positive (net long) the nearby futures price rose and when net positions were negative (net short) the nearby futures price declined.

VAR with two-lag specification was estimated. Lag length of two weeks was selected based on SIC, AIC and Log-likelihood values (see table 3). In VAR methods ordering of the variables is important. Decomposition of forecast error variance provides insight regarding the appropriateness of the variables ordering. In both the short run (1 to 4 weeks) and long run (5 to 20 weeks) nearly all (99.9% to 99.4%) of the forecast error variance in net positions is explained by variance in the net positions itself. Two orderings of the variables with net positions as the first variable and also as the second variable provided the similar error variance decompositions, indicating the exogenous nature of the net positions. Hence the ordering of net positions – nearby futures price is followed. Forecast error variance decomposition of nearby futures price reveals that in the short run 83.89% to 76.43% variance is explained by nearby futures and 16.1% to 23.5% variance is explained by variance in the net positions of the speculators. In the long run 75.1% to 67.87% of the variance in nearby futures is explained by itself and 24.8% to 32.1% of the variance is explained by variance in the net positions (see fig.1). The forecast error variance decompositions reveal the importance of net positions information in explaining the variation in nearby futures price.

The finding that the information flows from net positions to nearby futures price is confirmed by examining the impulse response functions, which shows that the response of each series in the system to a one-time unit shock (1 standard deviation) to one of the series. Figure 2.C demonstrates the dynamics of a shock to net positions in the nearby futures price. We also provide ± 2 standard error bands, which give whether the responses are significantly different from zero at the 0.05 significance level. It is clear that the response of nearby futures is significantly different from zero at all the horizons. Strongest response is shown in the nearby futures at 1 to 2 weeks with steep climb in the prices to a shock in the net positions. From 3 to 4 periods the responses are also up followed by slight decline at all other periods. Figure 2.B demonstrates the response of net positions to shock in the nearby futures. Even though net positions responded positively in the earlier period, the responses at all the horizons are statistically insignificant. Figure 2.A and figure 2.D gives the response of net positions and nearby futures to a shock in their own series respectively. It is clear that the responses are positive and are going up in the first 1 to 2 weeks followed by decline at later horizons. Except at a very long horizon i.e. at 17 to 20 periods the response of net positions to shock in net positions of speculative traders, all the responses are statistically significant.

Big hit ability was tested by conducting the regression and testing the coefficient b. The coefficient is significantly greater than zero indicating the big hit ability of the noncommercial traders (see table 4). In order to determine the magnitude of the change in nearby futures price we performed several regressions as mentioned in the cases above. The results of these regressions are presented in table 5.

In case 1 when we considered the net long positions only, the coefficient is positive and is significant at the 0.10. In this case net long positions include both increases and decreases. This case is symmetric to the case of testing net short positions only. In case 2, increase in net long or decrease in net short, the coefficient is positive as expected and is significant at .05 level. As mentioned earlier this case is symmetrical to the situation that when net long decrease or net short increase with the sign on the coefficient being negative. Cases 3 and 4 consider the situations when the net positions are net long and net long increases by greater than or equal to 10 % and 50 % respectively. The sign on the coefficients are positive as expected but are insignificant. In cases 5 and 6, when net long and net long positions decrease by greater than or equal to 10% and 50% respectively resulted in a negative sign on the coefficient as expected and both are statistically significant at 0.05 significance level. The magnitude of the coefficient for 50% or more drop in net long positions translates into a nearby futures price fall of 1.81 cents. Likewise for 10% or more drop in the net long positions lead to a fall of 1.42 cents in nearby futures price. In cases 7 and 8, when net short and net short increases by greater than or equal to 10% and 50%, the coefficients are negative but are insignificant. In cases 9 and 10, when net short and net short positions decreases, the coefficients are positive as expected and are statistically significant at .05 level. The magnitude of coefficient for 50% or more drop in net short positions translates into a nearby futures price increase of 1.61 cents. Like wise for 10% or more decline in the net short positions lead to a rise of 1.34 cents in nearby futures price.

It should be noted that when futures prices decline the magnitude of the fall is greater than when they rise. Further, when net long positions decreased or net short positions decreased considerably then there were statistically significant nearby futures price changes. When we analyze these results with that of case 2 where we considered both increase in net long or decrease in net short, the significance of the test is due to the contribution of net short positions. Like wise, net long positions decreases contributed to the significance of the test using either net long decrease or net short increase.

Summary and Conclusions

Speculative traders (non-commercial) had big hit ability and their net positions aided in predicting the direction of the subsequent nearby futures price. There was a lead-lag relationship between net positions of speculative traders and nearby futures price. Nearby futures followed (lag) the net positions of speculative traders within two weeks period. This was shown by the impulse response function of net positions of speculative traders to a shock in net positions. The strongest response of the nearby futures in weeks one and two was observed with a steep climb in prices to a shock in the net positions of speculative traders.

When net long and net long positions decreased by greater than or equal to 10% and 50% respectively, it resulted in a statistically significant relationship. For 50% or more drop in net long positions the nearby futures price fell by 1.81 cents. A 10% or more drop in the net long positions lead to a fall of 1.42 cents in nearby futures price. When net short and net short positions decreased by greater than or equal to 10% and 50%, respectively, it resulted in a statistically significant relationship. For 50% or more drop in net short positions the nearby futures price increased by 1.61 cents. Like wise for 10% or more drop in the net short positions led to a rise of 1.34 cents in nearby futures price. Futures prices fell more than they rose in magnitude for the same percentage moves in either net long and net short.

These results might be useful to the hedgers in order to time their operations. For example a long hedger might want to delay placing his hedge by a week or two when he observes that the net long positions of noncommercial speculators have dropped considerably. Like wise a short can time his hedging operation by immediately placing a hedge instead of waiting. There are several other variables (volume, open interest etc.,) which influence the nearby futures price which were not taken into consideration in the analysis. But none the less, it was shown that net positions taken by speculative traders contain useful information regarding lead – lag relationship of nearby futures price movements and net positions. Hence speculative traders positions should be monitored closely in order to achieve desired goals of all market participants. It is also interesting to observe the option sensitivities, especially the delta term (ratio of the change in the option premiums with change in the underlying futures price) for the options written on the futures contracts with reference to the net positions of the speculative traders. We have not formulated and tested any trading strategies based on these results, which needs to be done on out of sample data. These require further study.

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Table 1: Piarwise Granger Causality Tests with two lag specification.

Null Hypothesis	F-statistic	p-value
1. Net positions does not Granger cause Nearby futures price	3.57114**	0.02870
2. Nearby does not Granger cause Net positions	1.39353	0.24897

Note: ** indicates significance at 0.05 level.

Table 2: Augmented Dickey-Fuller (ADF) and Phillips-Perron tests for stationarity of the levels in nearby futures price and net positions of non-commercial traders.

Test statistic	Nearby futures price	Net positions
1. ADF	-3.518867**	-5.963529**
2.Phillips-Perron	-3.530121**	-5.513625**

Note: ** indicates significance at 0.01 level. MacKinnon critical value for rejection of hypothesis of a unit root at 1% is –3.4432, 5% is –2.8665 and at 10% is –2.5694.

Table 3: Tests for lag length determination using Schwatz information criterion (SIC), Akaike information criterion (AIC) and Log-likelihood function.

Lag	AIC	SIC	Log-likelihood
1	27.06408	27.10643	-10307.05
2	26.98392*	27.05457*	-10261.47
3	26.98452	27.08255	-10241.01
4	26.99589	27.12338	-10224.56

Note: *Based on low values of SIC and AIC lag length of two was selected.

Table 4 : Test for the big hit ability.

	Coefficient	Std. Error	t-statistic	p-value
Intercept	0.045411	0.053487	.848999	.39620 6
Net position	1.23E-07**	5.6E-08	2.19359 5	0.0286 3

Note: ** indicates significance at 0.05 level.

Table 5: Tests for different cases with dummy variable.

Case	Coefficient	Std. Error	t-statistic	p-value
1. Net long only	0.198689*	0.107669	1.845375	0.065454
2. Increase in net long or decrease in net short	0.222055**	0.10683	2.078589	0.038061
3. Net long & net long increase by >= 10%	0.181942	0.128968	1.410752	0.158814
4. Net long & net long increase by >= 50%	0.164669	.0167202	.984846	.32508
5. Net long & net long decrease by >= 10%	-0.353513**	0.140382	-2.518222	0.012043
6. Net long & net long decrease by >= 50%	-0.595353**	-0.595353	-2.219951	0.026779
7. Net short & net short increase by >= 10%	-0.025769	0.157554	-0.163557	0.870133
8. Net short & net short increase by >= 50%	-0.450888	0.339921	-1.32645	0.185174
9. Net short & net short decrease by >= 10%	0.291805**	0.135905	2.147122	0.032166
10. Net short & net short decrease by >= 50%	0.479017**	0.175026	2.73684	0.006379

Note: ** indicates significance at 0.05 level and * indicates significance at 0.10 level.

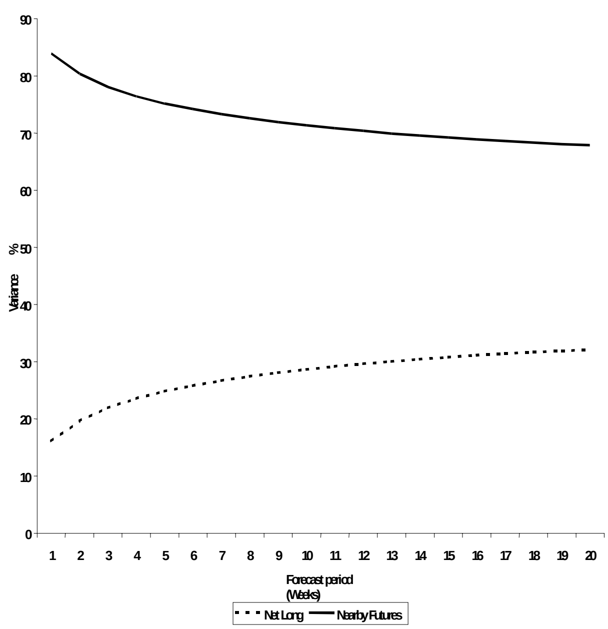

Figure 1 : Variance decomposition of nearby futures price. Legend: Xaxis = Weeks Y-axis = Bales (A&B); Cents(C&D)

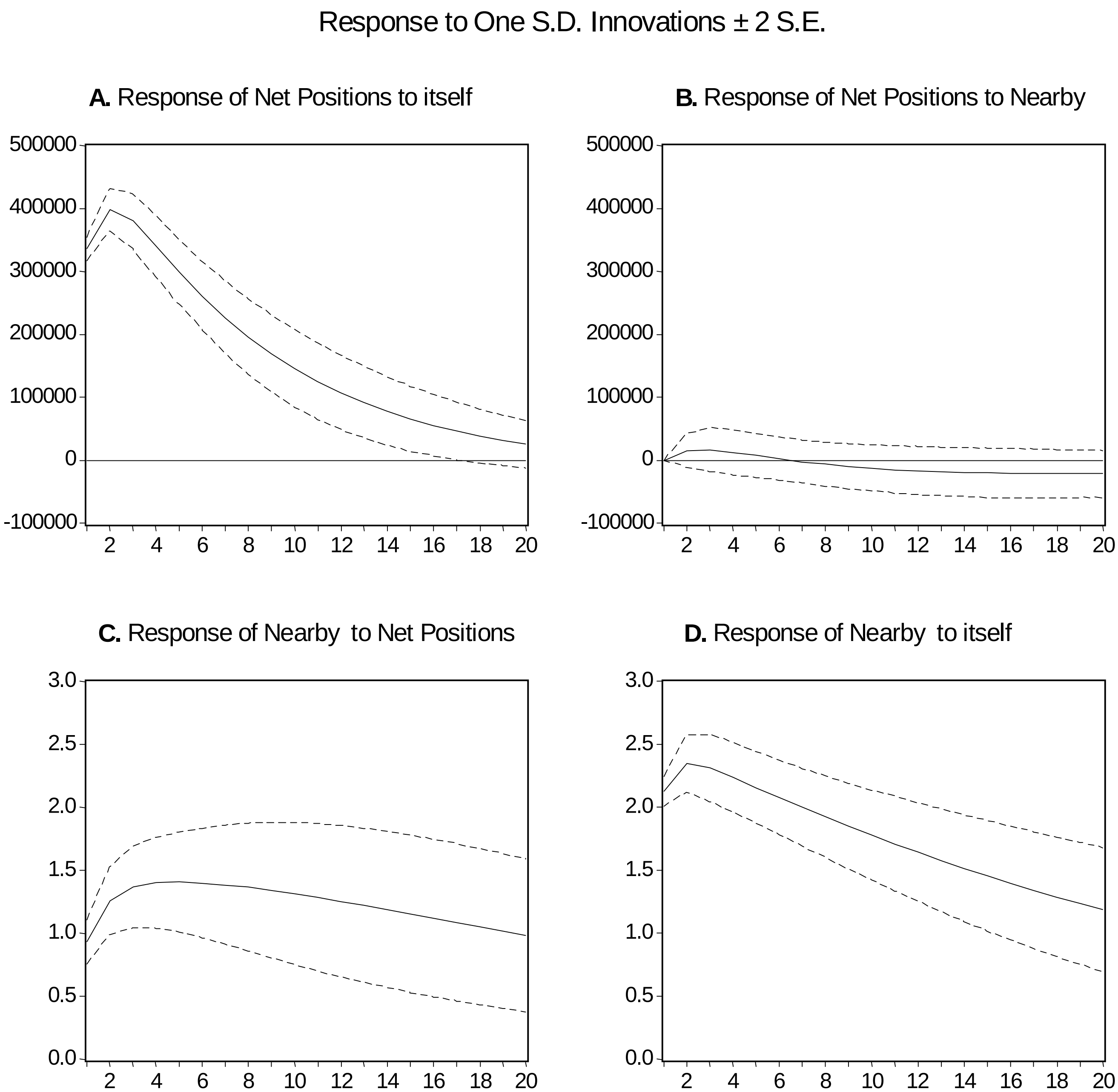

Figure 2 : Impulse response functions of nearby futures price and net positions of speculative traders.

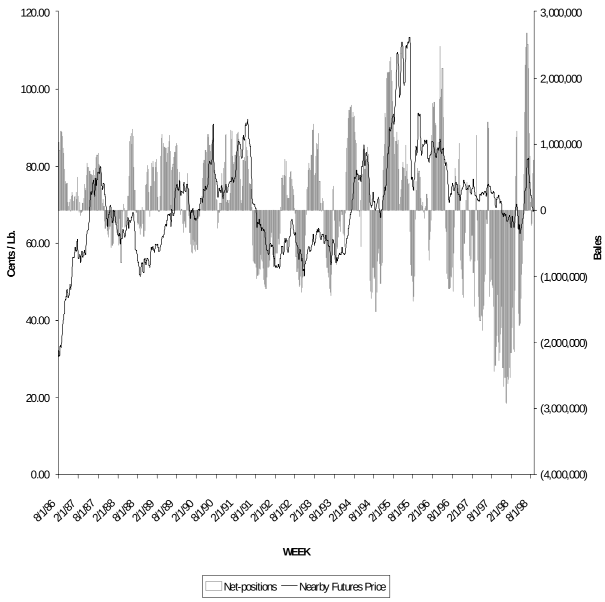

Figure 3: Net bale commitments of speculative traders and nearby futures price of cotton.