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DIFFERENCES BETWEEN FUTURES AND FORWARD PRICES: AN EMPIRICAL INVESTIGATION OF THE MARKING-TO-MARKET EFFECTS

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Abstract

The purpose of this paper is to test the "marking-to-market" effects of futures contracts on the relationship between futures prices and forward prices. Several recent studies ([5], [7], [9], [13], [14] and [16]) have examined the theoretical relations between futures and forward prices in a perfect market without taxes and transaction costs. Particularly, Cox, Ingersoll and Ross [5] conjects that if an asset is a hedge against bond price fluctuations, futures prices will be less than forward prices, which stems solely from the marking-to-market effect in the futures contract. This paper tests this hypothesis using data on foreign currencies and physical commodities traded in organized exchanges. Empirical results strongly suggest that differences between futures and forward prices can be attributed to the continual resettlement procedure specified in the futures contracts.

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Differences Between Futures and Forward Prices: An Empirical Investigation of the Marking-to-Market Effects

The futures market and the forward market for commodities and financial assets perform the similar social functions of smoothing the different temporal patterns of supply and demand of commodities and financial assets and of allowing for risk sharing among economic agents. Futures contracts and forward contracts are similar but are not identical. The fundamental difference between them lies in the different payment schedules specified in these contracts. A daily resettlement, or the so-called "marking-to-market," is a standard requirement in a futures contract, but it is not included in a forward contract. Several recent studies ([5], [7], [9], [13], [14] and [16]) have examined the theoretical relations between futures prices and forward prices in a perfect market without taxes and transactions costs.[1] Particularly, Cox, Ingersoll and Ross [5] (referred to as CIR hereafter) and Margrabe [13] conject that if an asset is a hedge against default-free discount bond price fluctuations, future prices will be greater than forward prices. Specifically, if the covariance between the spot prices of the asset and the bond prices is less (greater) than the variance of the bond prices, then futures prices will be greater (less) than forward prices. This relationship stems from the continual resettlement specified in the futures contracts.

The purpose of this paper is to test this hypothesis empirically. A previous empirical study [4] concerning the effects of marking-to-market in futures contracts investigated only foreign currencies, finding no significant differences between futures and forward prices.

In order to obtain more definitive conclusions on the effects of marking-to-market in futures contracts as the key explanation for differences between futures and forward prices, we use the data of the futures contracts and the forward contracts not only for foreign currencies but for physical commodities which are traded in the organized exchanges where the clearing house stands behind the contracts and guarantees all transactions.[2]

The paper is organized as follows. Section I briefly describes the basic difference between futures and forward contracts. The relationship between futures and forward prices stemming from the marking-to-market effects and the test procedures for such effects are described in Section II. Section III describes the data and discusses the empirical results. The final section contains a conclusion.

I. Fundamental Difference Between Futures and Forward Contracts

A forward contract is a sale agreement between a buyer and a seller on a specific commodity at a specific price on a specific date, called the maturity or delivery date. The specific price in a forward contract is the forward price which is determined at the time the contract is initiated, and this price stays fixed for the life of the contract. In a forward contract, the initiation and the settlement of the contract are not simultaneous in the sense that there is no transfer of money when the contract is initiated, and the money transfers occur only on the maturity date. Forward prices fluctuate over time but the initial value of the forward contract is always set equal to zero by this convention. The forward contracts are normally written with specific times to maturity rather than with specific maturity dates.[3]

Similar to a forward contract, a futures contract is a contract between two parties where the buyer agrees to accept delivery at a specific price from the seller of a particular commodity in a designated month in the future. A key difference between the forward and futures contracts lies in their different payment schedules. A daily settling up (so-called marking-to-market) is required in the futures contracts but not in the forward contracts. At the end of each trading day, if the net change in the futures price during a day is negative, the buyer who takes a long position in the futures contract pays the full amount of the change to the seller who takes a short position, and the futures contract is rewritten at the new futures price in such a way that the value of the futures contract is set equal to zero. On the other hand, if the change is positive, the buyer will be paid the full amount of the change by the seller. The futures contracts are traded with specific maturity dates as opposed to specific times to maturity.

II. Causal Relations and Test Methodology

As noted before, previous studies ([5] and [13]) conject that if an asset provides a hedging instrument against bond price fluctuations, future prices will be greater than forward prices, which stems solely from the marking-to-market effect. More specifically, if the covariance between the price of a commodity and the price of a default-free discount bond is less (greater) than the variance of the bond price, then the futures price of the commodity will be greater (less) than the forward price. This relation can be restated as follows using the same notations as CIR [5]:

$$\begin{aligned} &\text{(i)}\ \ \mathrm{Cov}(V,P)/\mathrm{Var}(P) < 1 \quad \text{implies} \quad H(t) - G(t) > 0 \\ &\text{(ii)}\ \ \mathrm{Cov}(V,P)/\mathrm{Var}(P) = 1 \quad \text{implies} \quad H(t) - G(t) = 0 \\ &\text{(iii)}\ \ \mathrm{Cov}(V,P)/\mathrm{Var}(P) > 1 \quad \text{implies} \quad H(t) - G(t) < 0 \end{aligned} \tag{1}$$

where V and P are the price of the underlying asset and the price of the default-free discount bond respectively, and G(t) and H(t) are the forward price and futures price at time t respectively.

Therefore, the difference between futures prices and forward prices will depend on the ratio of Cov(V,P) to Var(P): if an asset provides a hedge against changes in bond price so that $\mathrm{Cov}(V,P)/\mathrm{Var}(P) < 1$, futures prices would be greater than forward prices.

However, it is important to note that only an unanticipated portion of the changes in prices would affect the consumption-investment opportunities of investors in a perfect market. Thus, the covariance and the variance should be interpreted as the covariance of the unexpected changes in commodity prices with the unexpected changes in default-free discount bond prices, and the variance of the unexpected changes in the bond prices, respectively. In this paper, Treasury bill prices are used as the default-free discount bond prices. Therefore, the ratio in (1) can be expressed as

$$\frac{\mathrm{Cov}[\log V(T) - \log E_t V(T),\ \log P(T) - \log E_t P(T)]}{\mathrm{Var}[\log P(T) - \log E_t P(t)]} ,$$

where V(T) and P(T) are the spot prices of commodities and Treasury bills respectively at time T and $E_t V(T)$ and $E_t P(T)$ are their expected prices as of time t.

In this paper, the above ratio is estimated by running the following OLS regression equation:

$$Y = B_0 + B_1 X + \varepsilon \tag{2}$$

where

$Y = \log V(T) - \log E_t V(T)$

$X = \log P(T) - \log E_t P(T)$

$B_1 = \text{Cov}(Y,X)/\text{Var}(X)$

ε = disturbance term with zero mean and constant variance.

If the perfect-market models of CIR [5] and Margrabe [13] describe futures and forward prices correctly and thus the hypotheses in (1), the difference between futures and forward prices should be positive (negative) for those commodities whose beta coefficients (B_1) are less (greater) than one.

III. Data and Results

A. Forward Price

This paper investigates the relation between futures and forward prices in six physical commodities (Gold, Silver, Silver Coin, Platinum, Copper and Plywood), and in four foreign currencies (Swiss Franc, German Mark, British Pound and Japanese Yen). The availability of forward price data is quite limited because forward contracts have been traded on only small number of commodities on only one exchange, namely the American Board of Trade in New York. The times to maturity of forward contracts are strictly standardized at one, two, three, six and twelve months.

Although the American Board of Trade was founded in 1969, it did not begin to trade the forward contracts until July, 1977. Furthermore, up to November, 1979, the availability of forward price data was restricted to three commodities, Gold, Silver and Silver Coins with maturities of three, six and twelve months. These data are available in the Journal of Commerce and only the daily closing prices are reported. Since November, 1979, the Wall Street Journal has provided daily closing prices for forward contracts on the six commodities (Gold, Silver, Silver Coins, Copper, Platinum and Plywood) and the four foreign currencies (Swiss Franc, German Mark, British Pound and Japanese Yen) with maturities of one, two, three, six and twelve months.

B. Futures Price

In contrast to forward prices, futures prices data are available over a longer period. However, for comparison purpose, we observed prices of futures and forward contracts on the same commodities and with the same maturities for the same observation period.

As noted before, futures contracts are traded with specific maturity dates (in terms of maturity month) while forward contracts are traded with specific times to maturity. Furthermore, the seller, who is in the short position of the futures contracts, is typically permitted to choose any delivery date within the specific maturity month. Therefore, selecting forward contracts whose maturities coincide with the maturity date in futures contracts is a difficult task.

To circumvent this problem to some extent, the data observed on two dates, the first trading date and the fifteenth calendar date, are used

for comparing forward contracts with the corresponding futures contracts. For example, on the first trading date and the fifteenth calendar date of January, one-month forward contract prices are compared with February futures contract prices, and two-month forward prices with March futures prices, and three-month forward prices with April futures prices and so on. Treating the price of a different maturity of a commodity as the price of a different commodity, each forward contract has a total of five price pairs with a futures contract since a forward contract is standardized at one, two, three, six and twelve month maturities.

The data used in the tests include closing prices of futures and forward contracts between July, 1977 and December, 1981. All of these observations were obtained from the Wall Street Journal and the Journal of Commerce. The details of futures contracts in terms of the unit of trading and the exchanges on which they are traded for the sample period are given in Appendix A.

C. Default-free Discount Bond Prices

One, three, six and twelve month Treasury bill rates were gathered from An Analytical Record of Yields and Yield Spreads, and converted into discount bond prices. Two month Treasury bill prices were obtained from the Wall Street Journal.[4]

D. Limitations of Data

If trading is active, the closing prices would reflect the market prices at the last few moments of trading. However, during a day of little or no trading in an extreme case, the Clearing Corporation of the exchange would have to estimate the market price. Furthermore,

neither trading volume nor open interest are available in forward contracts. Also, even if trading is active, if there is a range of closing price, a settlement price would be determined by the Clearing Corporation, usually the midpoint of the range. This might cause a problem in observing true settlement prices.

Also, in order to have a proper comparison of futures prices and forward prices, they should be the market prices that are observed contemporaneously. However, as we can see in Appendix B, the trading time periods during a day do differ across the two types of contracts. It is less likely that the reported closing prices of both contracts reflect the same information because of the time discrepancy. This might create measurement error problems to an extent. However, we will get this around by assuming that the errors are random and not moving systematically.

E. Results

Tables I and II present the results based upon the observations on the first trading dates.[5]

Table I summarizes the results of the test whether B_1 defined in equation (2) is greater than or less than or equal to one. The forward prices with one, two, three and six months maturities were used as the expected spot prices for the corresponding time periods, and the futures prices with twelve months maturities were used as the expected spot prices since Treasury bill forward contracts with one year to maturity were not available.

The regression coefficients of all physical commodities (Gold, Silver, Silver Coin, Platinum, Copper and Plywood) in all of the

maturities (one, two, three, six and twelve months) turned out to be significantly less than one at the five percent level excepting twelve-month maturity Silver Coin and Plywood.[6] The results indicate that these commodities may provide good hedges against the unexpected changes in Treasury bill prices, since the covariances between Y and X are less than the variances of X, where X and Y are as defined in (2). It is also noticeable that all of the regression coefficients of these commodities except twelve-month Silver Coin are negative regardless of their maturities, implying the negative correlations of the unexpected changes in those commodities with the unexpected changes in Treasury bills.

In contrast to the results on the physical commodities, all of the coefficients for the foreign currencies (Swiss Franc, German Mark, British Pound and Japanese Yen) turned out to be insignificantly different from one at the five percent level, excepting the one-month German Mark.

The results of the tests on the differences between futures and forward prices are presented in Table II. From (1) and (2), the hypothesis to be tested is as follows: The differences between futures prices and forward prices should be positive (zero) significantly if the slope coefficient (B_1) in Table I are significantly less than (equal to) one. As expected, in Gold, Silver, Platinum and Copper, the hypothesis is entirely satisfied.[7] In Silver Coin, Swiss Franc, German Mark, British Pound and Japanese Yen, the hypothesis is satisfied with one exception in each commodity: two-month maturity Silver Coin, Swiss Franc, British Pound, and three-month German Mark and Japanese Yen.

TABLE I

Tests on the Ratio of Covariance to Variance[a]

$$Y = B_0 + B_1 X + \varepsilon$$

Maturity (months)	Number of observations	B_0	t_0	B_1	t_1	
Gold						
1	19	0.1616	2.06	-1.5218	-4.0118	<
2	18	0.2368	1.99	-2.6525	-3.4107	<
3	17	0.2145	1.81	-3.2562	-3.4357	<
6	14	-0.0410	-0.49	-4.1391	-3.1839	<
12	30	0.2728	1.77	-3.4984	-2.3879	<
Silver						
1	17	0.1798	1.40	-1.6558	-2.4807	<
2	16	0.3904	2.25	-4.0998	-3.2259	<
3	15	0.5148	2.79	-6.5602	-3.9372	<
6	12	0.1115	0.66	-8.9489	-3.1197	<
12	30	0.2239	0.90	-8.8865	-3.0334	<
Silver Coin						
1	19	0.1791	1.92	-1.6961	-3.5919	<
2	18	0.3121	2.53	-3.4031	-3.9711	<
3	17	0.2879	2.06	-4.1312	-3.5157	<
6	14	-0.0106	-0.09	-5.0868	-2.0929	<
12	30	0.2564	1.15	3.1550	0.3830	=
Platinum						
1	17	0.1115	1.28	-1.0769	-2.7480	<
2	16	0.1873	1.43	-2.1473	-2.6339	<
3	15	0.2193	1.59	-3.3861	-3.0625	<
6	12	-0.0677	-0.61	-3.8218	-2.3070	<
12	10	-0.6171	-3.66	-4.1615	-2.1880	= b
Copper						
1	19	0.0722	1.46	-0.7565	-4.4267	<
2	18	0.0951	1.98	-1.2664	-5.2427	<
3	17	0.1338	1.74	-2.0027	-3.7283	<
6	14	-0.0206	-0.59	-2.1933	-4.6981	<
12	10	-0.3277	-3.97	-2.0470	-4.7402	<
Plywood						
1	19	0.1331	2.92	-1.1924	-5.9853	<
2	18	0.1858	3.24	-1.9692	-5.7532	<
3	17	0.2131	3.33	-2.7392	-5.5951	<
6	14	0.1190	2.65	-4.2647	-6.0271	<
12	10	-0.1487	-1.59	-1.2634	-1.2104	=

Swiss Franc						
1	19	-0.0308	-0.68	0.3376	-1.8565	=
2	18	0.0186	0.24	0.0337	-1.4057	=
3	17	0.0533	0.60	-0.1312	-1.2118	=
6	31	-0.0517	-0.91	1.5281	0.4395	=
12	10	0.1244	5.01	-0.2825	-0.8579	=
German Mark						
1	19	-0.0253	-0.70	0.3326	-2.2903	<
2	18	0.0042	0.07	0.2576	-1.3236	=
3	17	0.0428	0.59	0.1147	-1.1672	=
6	31	-0.0351	-0.84	1.5575	0.6275	=
12	10	0.1720	5.45	1.8076	0.9731	=
British Pound						
1	19	-0.0877	-2.28	0.7749	-0.7301	=
2	18	-0.1069	-1.90	1.1730	0.3424	=
3	17	-0.1250	-2.04	1.7772	1.2147	=
6	30	-0.0524	-1.12	0.6208	-0.3881	=
12	10	0.1014	1.17	-0.1976	-0.6910	=
Japanese Yen						
1	19	-0.0426	-0.94	0.3640	-1.7530	=
2	18	-0.0555	-0.97	0.5846	-0.8107	=
3	17	-0.1030	-1.99	1.2802	0.5179	=
6	27	0.0055	0.10	0.1477	-0.7182	=
12	10	-0.0260	-0.40	-0.6219	-1.2369	=

[a]The regression is as defined in equation (2).

The symbol '<' represents that B_1 is significantly less than 1 at the 5% level.

The symbol '=' represents that B_1 is not significantly different from 1 at the 5% level.

't' statistics of B_0 and B_1 are against $B_0 = 0$ and $B_1 = 1$.

[b]Significantly less than one at 10% level.

TABLE II

Difference Between Futures and Forward Prices[a]

Futures - Forward

	Maturity	1	2	3	6	12
Gold	Mean	1.4548	1.3000	3.6550	3.8243	3.0632
	t	2.17	2.07	5.30	5.02	3.29
		(+)	(+)[b]	(+)	(+)	(+)
	observations	21	17	50	53	53
Silver	Mean	3.7550	6.5125	10.5380	7.6280	6.8082
	t	2.05	3.06	5.91	5.08	3.54
		(+)[b]	(+)	(+)	(+)	(+)
	observations	20	16	50	50	49
Silver	Mean	0.8433	-0.6200	0.6542	0.5155	-0.0125
Coin	t	4.63	-7.75	3.12	1.99	-0.18
		(+)	(-)	(+)	(+)[b]	(0)
	observations	3	2	24	22	20
Platinum	Mean	2.4125	1.4000	4.5133	5.2179	4.6570
	t	1.91	2.30	3.69	3.99	2.27
		(+)[b]	(+)[b]	(+)	(+)	(+)
	observations	8	5	15	14	10
Copper	Mean	0.1933	0.2485	0.6295	0.6333	0.4705
	t	2.53	2.31	4.23	4.64	3.45
		(+)	(+)	(+)	(+)	(+)
	observations	21	20	21	21	22
Plywood	Mean	0.6591	-0.1900	2.0114	1.4525	0.2300
	t	1.44	-0.77	4.59	5.22	0.62
		(0)	(0)	(+)	(+)	(0)
	observations	11	5	22	20	10
Swiss	Mean	-0.0086	0.2257	0.0966	0.0624	-0.0769
Franc	t	-0.12	8.84	1.45	1.78	-0.51
		(0)	(+)	(0)	(0)	(0)
	observations	14	7	9	17	13
German	Mean	-0.0057	0.0500	0.0978	0.0425	-0.1400
Mark	t	-0.19	1.65	2.78	1.25	-1.70
		(0)	(0)	(+)	(0)	(0)
	observations	14	5	9	16	6

British Pound	Mean	0.0470	0.1333	0.0500	0.1413	-0.9500
	t	0.42	8.00	0.26	1.01	-0.90
		(0)	(+)	(0)	(0)	(0)
	observations	10	3	8	15	2
Japanese Yen	Mean	-0.0264	0.0614	0.0871	0.0273	c
	t	-0.64	1.28	4.59	0.94	
		(0)	(0)	(+)	(0)	
	observations	14	7	7	15	

[a]The symbols in parenthesis are used as follows:

The symbol '+' represents that the mean of the difference between futures and forward prices is significantly greater than zero at the 5 percent level.

The symbol '0' represents that the mean of the difference between futures and forward prices is not significantly different from zero at the 5 percent level.

The symbol '-' represents that the mean of the difference between futures and forward prices is significantly less than zero at the 5 percent level.

[b]Significant at the 10 percent level.

[c]No observation is available in twelve-month Japanese Yen.

For example, in two-month Swiss Franc, there are significantly positive differences between futures and forward prices even though the coefficient (B_1) is not significantly different from one. In the case of Plywood, the results are not conclusive relative to other commodities; two out of five different cases (five kinds of maturities) are not consistent with the hypothesis. The differences between futures and forward prices of one-month and two-month maturities in Plywood are not significantly different from zero even though the coefficients (B_1) are significantly less than one.

Overall, the prices of 73.5 percent of the commodities (thirty-six price pairs out of forty-nine) satisfy the hypothesis at the 5 percent level that the difference between futures and forward prices depends on the ratio of the covariance between the unexpected changes in commodity prices and the unexpected changes in bond prices to the variance of the unexpected changes in bond prices.[8] Moreover, interestingly enough, the number of observations of those commodities which are not consistent with the hypothesis is less than ten in general. Excluding those commodities whose number of observations is less than ten, noticeably, the prices of 85.5 percent of the commodities (twenty-nine out of thirty-four) satisfy the hypothesis at the 5 percent significance level.[9]

These results strongly support the relations between futures and forward prices expressed in (1). With regard to foreign currencies, the results in this paper (differences between futures and forward prices) are consistent with a previous study [4]. However, this paper provides more general evidence on the effects of marking-to-market in futures contracts by investigating not only foreign currencies but also physical commodities.

It should be noted nevertheless that there are some other possible factors such as tax effects, timing option, quantity and quality options in futures contrats, that may influence the relationship between futures prices and forward prices (see [3], [5], [8], [10] and [11]). The delivery process in futures contract varies from one exchange to another or from one commodity to another, as pointed out in Kilcollin [11] and Gay and Manaster [8]. For the lack of sufficient empirical evidence yet of the effects of those institution factors, we are not ruling out the possibility that the differences between futures and forward prices in particular commodities may be explained by those factors in addition to the marking-to-market effect. However, since the marking-to-market effects are common to all of the futures contracts, we contend that the differences we observed between futures and forward prices can be attributed at least to the daily settling up procedure in futures contracts.

IV. Conclusion

This paper has tested the marking-to-market effects of futures contracts on the relationship between futures prices and forward prices, using six physical commodities (Gold, Silver, Silver Coin, Platinum, Copper and Plywood) and four foreign currencies (Swiss Franc, German Mark, British Pound and Japanese Yen). We found significantly positive differences between futures and forward prices for the commodities in which the covariances between the unexpected changes in commodity prices and the unexpected changes in default-free discount bond prices are less than the variances of the unexpected changes in the bond prices

(Gold, Silver, Silver Coin, Platinum, Copper). For the commodities in which the covariances are not significantly different from the variances, we could not observe differences between futures and forward prices (all foreign currencies). These results provide a strong support for the hypothesis that the differ-ences between futures and forward prices can be attributed to the daily settling up procedure in futures contracts.

Footnotes

[1]Several previous studies have focused on market imperfections such as transactions costs and taxes, or market inefficiency as important factors in explaining the differences between futures and forward prices. See Capozza and Cornell [2], Lang and Rasche [12], Burger, Lang and Rasche [1] and Kane [10] for market imperfections, and see Rendleman and Carabini [17] for market inefficiency.

[2]To our knowledge, there is only one organized forward market in U.S.A., the American Board of Trade in New York City. The forward contracts offered and traded on the American Board of Trade include six basic commodities, five financial securities and five foreign currencies: Gold Bullion, Silver Bullion, Silver Coins, Platinum, Copper, Plywood, CDs, T-bills, T-notes, T-bonds, GNMAs, Swiss Franc, German Mark, British Pounds, Japanese Yen, FX-5 Basket.

[3]Since the forward contracts in the organized exchange (the American Board of Trade) are standardized by specific times to maturity (one, two, three, six and twelve months), if the trader of forward contracts wants to liquidate his or her position before the maturity date, there is no way to find the market price of the contract for the remaining period. The ABT in this case simply uses the proration method. For example, if the spot closing price for Gold was $330.00 per ounce and the three-month forward closing was $350.00, a contract maturing in one month and a half would have a value of $340.00 at closing for that day.

[4]Two-month T-bill rates are not available in An Analytical Record of Yield and Yield Spreads.

[5]The results based on the fifteenth calendar dates do not deviate significantly from those based on the first trading dates, and hence are not reported here. However, they are available from the authors upon request.

[6]The coefficient B_1 of twelve-month Platinum is less than one at the 10% significance level.

[7]The differences in two-month Gold, one-month Silver, six-month Silver Coin, one-month and two-month Platinums are significantly greater than zero at the 10% level.

[8]The prices of 83.7% of the commodities satisfy the hypothesis at the 10% significance level.

[9]94.1% of the commodities are consistent with the hypothesis at the 10% significance level.

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Appendix A

EXCHANGES AND UNITS OF TRADING IN FUTURES CONTRACTS

Futures Contracts	Exchange	Unit of Trading
Gold	Chicago Mercantile Exchange	100 troy oz.
Silver	Chicago Board of Trade	1000 troy oz.
Silver Coin	N.Y. Mercantile Exchange	$1000 F.A. bag
Platinum	N.Y. Mercantile Exchange	50 Troy oz.
Copper	Chicago Mercantile Exchange	25000 lbs.
Plywood	Chicago Board of Trade	76032 square feet
Swiss Franc	International Monetary Market	125000 Franc
German Mark	International Monetary Market	125000 Marks
British Pound	International Monetary Market	25000 Pounds
Japanese Yen	International Monetary Market	12.5 million Yen
Treasury bills	International Monetary Market	$1 million

Appendix B

TRADING HOURS OF FUTURES AND FORWARD CONTRACTS*

	Futures	Forward
Gold	8:25-1:30 CT	10:00-2:15
Silver	8:40-1:25 CT	10:00-2:15
Silver Coin	9:40-1:25 ET	10:00-2:15
Platinum	9:30-2:30 ET	10:00-2:15
Copper	9:50-2:00 ET	10:00-2:00
Plywood	9:00-1:00 CT	10:00-2:00
Swiss Franc	8:15-1:16 CT	10:30-2:00
German Mark	8:15-1:20 CT	10:30-2:00
British Pound	8:15-1:24 CT	10:30-2:00
Japanese Yen	8:15-1:26 CT	10:30-2:00
Treasury Bills	8:35-1:35 CT	10:30-2:00

*The exchanges of each futures contracts are shown in Appendix A. The exchange of forward contracts is the American Board of Trade in New York.

CT: central time

ET: eastern time

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