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THE HEDGING PERFORMANCE OF THE NEW FUTURES MARKETS: ADDITIONAL EVIDENCE

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I. Introduction

In a recent article appearing in this Journal, Louis H. Ederington [1] very effectively reviewed the theoretical basis for evaluating the hedging effectiveness of financial futures markets and provided evidence regarding the effectiveness of the GNMA and Treasury bill (T-bill) futures markets in reducing the risk associated with cash positions in their respective deliverable securities. Commercial bankers, among others, have begun to use the financial futures markets in a variety of ways.[1] Not only have they hedged asset positions, they have also used the T-bill futures market to cross-hedge their positions or anticipated positions in certificate of deposit (CD) liabilities.

The major purpose of this article is twofold. First, evidence is presented regarding the effectiveness of the T-bill futures market in reducing the risk of CD price fluctuations. This CD evidence is contrasted with evidence from an identically constructed sample of T-bill hedges, as well as with the T-bill evidence provided in Ederington's study. Second, the stability of that hedging effectiveness is examined within the sample period which extends from January 6, 1976 through September 11, 1979.

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1. See the Treasury/Federal Reserve Study of Treasury Futures Markets [2].

II. Theoretical Measures of Hedging Effectiveness

Conventional portfolio theory provides a way to measure the effectiveness of hedging activities. The potential hedging effectiveness can be measured by comparing the risk, or variance, of an unhedged portfolio with the risk, or variance, of a hedged portfolio. Using Edering-ton's notation,

$$e = 1 - \frac{Var(R^*)}{Var(U)}$$

where Var(R*) represents the minimum variance on a hedged portfolio and Var(U) is the variance of an unhedged portfolio. As a result, e represents the maximum percentage reduction in variance possible with a hedged portfolio. This maximum percentage reduction in variance occurs where b*, the risk minimizing proportion of the spot market position which is hedged, is defined as follows:

$$b^* = \sigma_{sf} / \sigma_f^2,$$

where σ_{sf} is the covariance of spot and futures price changes, and σ_f^2 is the variance of futures price changes.[2]

III. The Evidence

a. Total Sample Results

Traditional hedges, where the hedge is constructed utilizing the futures contract and its deliverable security, are believed to be relatively more effective than cross-hedges. Cross-hedges are constructed when the

2. See Ederington [1], pp. 161-164.

cash market being hedged differs from the instrument the futures contract specifies as deliverable. Evidence regarding the effectiveness of these two types of hedging activities utilizing the T-bill futures market is examined here.

The first type of hedge (the traditional hedge) involves the use of the International Monetary Market's (I.M.M.'s) three-month Treasury bill futures contract to hedge three-month Treasury bill price fluctuations; Ederington [1, pp. 165-166] provided some evidence on the effectiveness of this type of hedge. The second type (a cross-hedge) involves the use of the I.M.M.'s three-month Treasury bill futures contract to hedge CD price risk.

All of the hedges constructed ultilize the closing price or yield quotations for each Tuesday from January 6, 1976 through September 11, 1979.[3] The data represent hedges which actually could have been constructed in the market. If the market was closed or there were no trades on a particular Tuesday, hedges utilizing that data point were dropped from the sample. Hedges were constructed for three lengths of time: one week, two weeks, and four weeks. Since it is conceivable that the effectiveness of the hedge may depend upon when the hedge is begun relative to the maturity month of the contract (contract month), the hedges are grouped by their beginning dates according to the number of months prior to the contract month.[4]

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3. While the particular day of the week chosen should not make that much difference, Tuesday was chosen because it was not the beginning or end of the week; it was not the last day of trading of maturing futures contracts; and it was not the day on which Treasury securities are delivered.

4. Ederington recognized this possibility but used a more aggregative approach. Each of the twelve data samples contains from 50 to 61 observations.

The measures of effectiveness (e) of the three-month T-bill futures contract in hedging portfolios of Treasury bills or CD's over 3 time periods are displayed in Table 1. In general the shorter the length of the hedge, the less effective the T-bill hedge and the CD cross-hedge. However, the differences in effectiveness measures between one-, two-, and four-week hedges are sometimes relatively small. As Ederington's results for his T-bill hedges showed, the effectiveness measures for both the T-bill hedge and the CD cross-hedge decline the further from the contract month the hedge is initiated. While the effectiveness of Ederington's two-week T-bill hedges is lower than the results presented in Table 1, the four-week T-bill results are much closer to the range of effectiveness obtained by Ederington: .741 down to .369 for T-bill hedges constructed furthest from the contract month.

Ederington's effectiveness estimates decline monotonically the further from the contract month; the results presented in Table 1 do not indicate such a dependable decline for either T-bill hedges or CD cross-hedges. In fact, the four-week hedging effectiveness measures for T-bills suggest that hedges begun in some periods are worse than hedges begun one month earlier or later. Specifically, hedges begun two, five, eight, and eleven months prior to the month the contract matures are relatively less effective in reducing the variance of an unhedged portfolio. The beginning dates for these hedges fall in the following months: January, April, July, and October. This apparent seasonality (for lack of a better term) does not appear to be as pronounced in the effectiveness measures for CD cross-hedges.

The conventional wisdom suggests that cross-hedges may not be as effective as traditional hedges. The results in Table 1 do confirm this for hedges begun at least three months prior to the contract month. In the remaining nine months, the traditional hedging results do not have an absolute edge over cross-hedging results. In those monthly samples, CD price risk was more often effectively accomplished with the T-bill futures contract than when that futures contract was used to hedge T-bills.[5]

CD hedgers have suggested that a CD futures contract be developed in order to more effectively hedge CD price risk than is possible with the current T-bill futures contracts. Presuming delivery problems can be ironed out and also that the hedging effectiveness of this new contract resembles the results for T-bill hedges, the evidence provided here suggests that there may not be much gain in effectiveness for this new contract for hedges begun four or more months prior to the contract month.

To obtain the maximum percentage reduction in the variance of an unhedged portfolio, the proportion of the spot market position which is hedged must equal b*. Table 2 contains estimates of b* for both T-bill hedges and CD cross-hedges of various lengths. Simplified examples of hedging usually ignore the possibility of any change in basis and suggest that b* should be one. In general, CD cross-hedging b*'s are significantly different from one. This result is also true for T-bill hedges begun two or more months prior to the contract month. However, all the b*'s for one-, two-, and four-week T-bill hedges begun one month prior to the contract month are <u>not</u> significantly different from one.

5. For one-, two-, and four-week hedges, CD cross-hedges were more effective than T-bill hedges six, seven, and five times out of the nine remaining samples, respectively.

b. Yearly Results

The extent to which effectiveness measures over the total sample period are useful depends crucially upon how accurately the total measures depict the hedging effectiveness of the T-bill futures market within the sample period. The yearly effectiveness measures for hedges of four weeks in duration are displayed in Table 3 for both T-bill hedges and CD cross-hedges. For the practicing portfolio manager using the T-bill futures market routinely, the effectiveness measures show disappointingly sizable variations across the years for T-bill hedges and CD cross-hedges.

Just as the yearly effectivness measures were volatile, the yearly b*'s for both T-bill hedges and CD cross-hedges are sometimes volatile (Table 4). Where the four-week T-bill hedges begun one month prior to contract month are fairly similar, the four-week hedges begun seven months prior to the contract month had an estimated b* of .0474 in 1977 versus .7521 in 1978. Again, for practicing portfolio managers wishing to minimize risk these results are not encouraging.

The T-bill b*'s for hedges begun one month prior to the contract month are not significantly different from one in each year of the sample. Consequently, the total sample results are accurately represented within sample results. For T-bill hedges begun two or more months prior to the contract month and for all of the CD cross-hedges, the total sample estimates of b* often did not approximate very well one or more years within the sample. For example, with CD cross-hedges begun one month prior to the contract month the risk minimizing b* was significantly different from one based on the total sample. However, only in 1978 was the estimated b* significantly different from one.

IV. Conclusion

The main results of this study can be summarized in two main areas. First, while not as effective as the traditional T-bill hedges, CD cross-hedging with the T-bill futures contract does provide some insurance against CD interest rate fluctuations. A new futures contract specifying CD's as the deliverable security may improve prospects for hedging CD interest rate risk for hedges begun within four months of the contract month. However, for hedges begun four or more months prior to the contract month, it is possible that there will be only modest improvement if the results for the traditional T-bill hedges are any guide.

Second, when the entire data sample is decomposed by calendar year, there is considerable instability in hedging effectiveness measures and b*'s for both T-bill hedges and CD cross-hedges. These results suggest that to obtain the maximum effectiveness possible in any given year, the proportion of the portfolio hedged must be altered over time. Using some sort of average b*, such as could be obtained from the whole sample, would not lead to risk minimization in any particular year.

Table 1

Effectiveness of Hedging
Treasury and CD Postions[1]
[One-, Two-, and Four-Week Hedges]

Number of Months Prior to Contract Month	Treasury Bill			CD		
	One-Week	Two-Week	Four-Week	One-Week	Two-Week	Four-Week
1	.7610	.8329	.8885	.2522	.5157	.6600
2	.7003	.7131	.7463	.6065	.5488	.6902
3	.7562	.7353	.7784	.3303	.5876	.5622
4	.3849	.5224	.6742	.4220	.6140	.6406
5	.5174	.5254	.5509	.5494	.5615	.6594
6	.6925	.6732	.6692	.3084	.5499	.5608
7	.2908	.3616	.5180	.3811	.4851	.5373
8	.4086	.4226	.3724	.4994	.4785	.4900
9	.5622	.5534	.5826	.2394	.5002	.5242
10	.2019	.2506	.3656	.3839	.3866	.4092
11	.3108	.3570	.2997	.3922	.3977	.3723
12	.4710	.3544	.4831	.2698	.3568	.4433

[1] Sample period covers January 6, 1976-September 11, 1979.

Table 2

Estimates of the
Risk Minimizing Proportions (b*) for
Treasury and CD Samples
[One-, Two-, and Four-Week Hedges]

Number of Months Prior to Contract Month	Treasury Bill			CD		
	One-Week	Two-Week	Four-Week	One-Week	Two-Week	Four-Week
1	.9062	.9554	.9637	.5065*	.6848*	.7707*
2	.9053	.8099*	.7617*	.7088*	.7762*	1.1072
3	.6699*	.6634*	.6156*	.4177*	.5315*	.5855*
4	.4522*	.6158*	.7045*	.4487*	.6201*	.6380*
5	.6505*	.5912*	.5308*	.5639*	.6677*	.8777
6	.6090*	.5446*	.4789*	.3833*	.4412*	.4907*
7	.3921*	.4638*	.5409*	.4152*	.4949*	.5057*
8	.5335*	.4636*	.4131*	.4961*	.5389*	.7162*
9	.5278*	.4560*	.4092*	.3249*	.3886*	.4344*
10	.3026*	.3401*	.4020*	.3879*	.3898*	.3851*
11	.4653*	.4177*	.3679*	.4248*	.4837*	.6219*
12	.4882*	.3469*	.3580*	.2808*	.3068*	.3824*

* Significantly different from one at the 95 percent confidence level.

1 The sample period is January 6, 1976-September 11, 1979.

Table 3

Effectiveness of Hedging
Treasury and CD Positions
[Four-Week Hedges; Yearly Estimates]

Number of Months Prior to Contract Month	Treasury Bill					CD				
	Total	1976	1977	1978	1979	Total	1976	1977	1978	1979
1	.8885	.8295	.8183	.9041	.9536	.6600	.8827	.3536	.4376	.7760
2	.7463	.8342	.8248	.8643	.5522	.6902	.8392	.7520	.6607	.9205
3	.7784	.9042	.8690	.6383	.8992	.5622	.7196	.7374	.3649	.7974
4	.6742	.5714	.1612	.6355	.9132	.6406	.6228	.2904	.5278	.7668
5	.5509	.5966	.7732	.6267	.3789	.6594	.6150	.7105	.8597	.9024
6	.6692	.8729	.7984	.4365	.7557	.5608	.6986	.6572	.5323	.7949
7	.5180	.4997	.0067	.2887	.9026	.5373	.5511	.0256	.3022	.7884
8	.3724	.4213	.5279	.5040	.3048	.4900	.4735	.4333	.8484	.8247
9	.5826	.8260	.7060	.3944	.5583	.5242	.6511	.5439	.5529	.6997
10	.3656	.4424	.0029	.0301	.8799	.4092	.5014	.0024	.0742	.7484
11	.2997	.3878	.4291	.3751	.2575	.3723	.4161	.3333	.7575	.6853
12	.4831	.7140	.6524	.3885	.4134	.4433	.5294	.4776	.5717	.5849

Table 4

Estimates of the
Risk Minimizing Proportions (b*)
for Treasury and CD Samples
[Four-Week Hedges; Yearly Estimates]

Number of Months Prior to Contract Month	Treasury Bill					CD				
	Total	1976	1977	1978	1979	Total	1976	1977	1978	1979
1	.9637	1.1194	.9906	.8565	.9956	.7707*	1.2112	.6991	.4278*	.9116
2	.7617*	.8248	.7839	.9092	.5455*	1.1072	.9808	.9603	1.1986	1.3450*
3	.6156*	.5015*	.6426*	.8056	.8206	.5855*	.4581*	.5960*	.8514	.4809*
4	.7045*	.6009*	.2449*	.9205	.7547*	.6380*	.6610*	.3768*	.6334*	.7003*
5	.5308*	.4563*	.5481*	.7703	.3795*	.8777	.5492*	.6740*	1.3603*	1.1185
6	.4789*	.3511*	.5665*	.6351	.6723	.4907*	.3216*	.5175*	.9802	.4290*
7	.5409*	.4232*	.0474*	.7521	.6253*	.5057*	.4684*	.1066*	.5810	.5874*
8	.4131*	.2972*	.4844*	.7205	.3638*	.7162*	.3736*	.5631*	1.4094*	1.1427
9	.4092*	.2901*	.4941*	.5927	.6193	.4344*	.2637*	.4366*	.9808	.4314*
10	.4020*	.2724*	-.0266*	.2469	.5795*	.3851*	.3042*	.0275*	.2926*	.5360*
11	.3679*	.2624*	.4237*	.6952	.3927*	.6219*	.3224*	.4791*	1.4896*	1.2233
12	.3580*	.2414*	.4639*	.6100	.6389	.3824*	.2125*	.3996*	1.0341	.4729*

* Significantly different from one at the 95 percent confidence level.

References

1. Louis H. Ederington. The Hedging Performance of the New Futures Markets. The Journal of Finance 34 (1979).

2. U.S. Treasury and Federal Reserve System. Treasury/Federal Reserve Study of Treasury Futures Markets, Vol. I and Vol. II, May 1979.