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INTEREST RATE PARITY IN TIMES OF TURBULENCE: THE ISSUE REVISITED

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Abstract

Empirical studies on covered interest arbitrage suggest that the interest rate parity condition does not always hold during times of turbulence in the foreign exchange markets, implying market inefficiency. This paper considers two different approaches [Taylor (1989) and Clinton (1988)] to measuring deviations from interest rate parity for a period of turbulence in the foreign exchange markets and for a control period. The different procedures yield results which conflict with earlier studies.

INTRODUCTION

The efficient market hypothesis states that current prices reflect all available information such that no abnormal profits can be earned from arbitrage activities. Covered interest parity states that the interest differential between two assets which are identical in every respect except for currency of denomination should be equal to the forward premium or discount in the forward foreign exchange market. If covered interest parity does not hold, then riskless arbitrage profits are possible implying that the foreign exchange markets are not efficient.

Past empirical evidence shows that the interest parity condition is not always satisfied. Various studies have reported deviations from covered interest parity for a number of assets and currencies, suggesting unexploited profit opportunities. Potential profits, however, are reduced by causes for deviations such as transactions costs, political risk, tax effects, liquidity premiums, and/or measurement errors.

Frankel and Levich (1975) tested the parity condition in terms of transactions costs. They used triangular arbitrage (as an equilibrium condition) to estimate the costs of transactions in the foreign exchange market and the bid-ask spread to measure the transactions costs in the money markets. They defined a neutral band around the interest parity line within which no arbitrage is profitable. They found that transactions costs explained almost all the deviations from the interest parity line; few were outside the neutral band. They added that the existence of elasticities of demand and supply in the securities and the foreign exchange markets which are less than infinite will widen the neutral band and will account for an even greater percentage of the deviations from the line.

Deardorff (1979), also analyzed interest parity in terms of transactions costs but used one-way arbitrage to define the limits of the neutral band. He found that one-way arbitrage which involves three transactions instead of four yields a neutral range of deviations from interest parity which is smaller than previously believed. Thus, with the presence of one-way arbitrage, covered interest arbitrage will never occur because one-way arbitrage will prevent interest and exchange rates from ever taking on values where covered interest arbitrage is profitable. Callier (1981), reinforced Deardorff's study by generalizing results and adding additional restrictions to the size of the neutral band for covered interest arbitrage.

Clinton's study (1988), based on the bounds for deviations from interest parity developed by Deardorff (one-way arbitrage) and Callier (covered arbitrage), defined the maximum limits of deviations from parity that can be explained by transactions costs when foreign exchange costs are swap costs. Clinton's conclusion is that transactions costs explain much less of the deviations from parity than previously believed and, contrary to

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Deardorff's conclusion, adds that regular covered interest arbitrage implies lower bounds for the neutral band than one-way arbitrage.

More recently, Taylor (1989) reported the presence of profitable opportunities from covered interest arbitrage after taking into account transactions costs based on the exact formulas used by market traders; that is, explicitly incorporating bid and ask quotes. His tests were performed in periods when there was turbulence in the markets.

This paper compares deviations from interest rate parity during a period of turbulence and a period of stability in foreign exchange markets for recent time periods. The turbulent period selected is January 2, 1991 through March 8, 1991, the dates of the Gulf War. The control or stable period is July 31, 1991 through September 27, 1991 during which time no significant news occurred. Both Clinton's and Taylor's measurements of transactions costs are tested to determine whether any turbulence impacts found can be generalized across these two models. The first section states the covered interest parity theorem and describes the methodology. Section II describes the data and reports the empirical results. A final section summarizes and concludes.

METHODOLOGY

Covered interest parity states that the interest rate differential between two exactly identical assets except for currency of denomination should be equal to the forward premium/discount in the foreign exchange market:

$$\frac{F - S}{S} = \frac{i - i^*}{1 + i^*}$$

where:

F is the forward exchange rate, expressed as units of local currency per unit of foreign currency,
S is the spot exchange rate, expressed as units of local currency per unit of foreign currency,
i is the domestic interest rate for a time period corresponding to F,
i* is the foreign interest rate for a time period corresponding to F.

Taylor applied the exact formulas used by market traders to calculate deviations from interest rate parity, explicity taking into account interest rate bid-ask spreads, brokerage costs, and bid-ask spreads in the foreign exchange markets.

His no-profit conditions for covered arbitrage are the following:

From Sterling To Dollars: $S^b/F^a \ (1 + (i^{*b} \times D/360)) < (1 + (i^a \times D/365))$

From Dollars To Sterling: $F^b/S^a \ (1 + (i^b \times D/365)) < (1 + (i^{*a} \times D/360))$

yielding the following percentage period return from arbitrage in either sterling to dollars or vice-versa:

Pound Return = $100 \times [S^b/F^a \ (1 + (i^{*b} \times D/360)) - (1 + (i^a \times D/365))]$

Dollar Return = $100 \times [F^b/S^a \ (1 + (i^b \times D/365)) - (1 + (i^{*a} \times D/360))]$

where:

a and b stand for ask and bid, respectively,
i is the annual interest rate in the Eurosterling market,
i* is the annual interest rate in the Eurodollar market,
S and F are spot rates and D-day forward rates, respectively.

i and i* are multiplied by D/365 and D/360, respectively, to make them comparable to the "D-days" forward premiums/discounts. The formulas incorporate the 365-day basis that is used by the British instead of the typically used 360 days.

Clinton (1988), on the other hand, uses swap rates instead of spot and forward outright quotes to measure transactions costs. He argues that most of the transactions in foreign exchange markets are in fact performed in the interbank swap market. Therefore, it is wrong to assume that the cost of foreign exchange operations consists of the transaction cost of an outright spot plus that of an outright forward. Rather, he argues, the relevant cost is that of a swap which implies smaller transactions costs. Swap rates are the bid and ask spreads quoted by banks and are nothing more than the forward premium or discount.

Clinton based his study on the bounds of the neutral band of deviations from interest parity developed by Deardorff (one-way arbitrage) and Callier (covered arbitrage). The rationale for these bounds is that the transactors with the lowest transactions costs determine the maximum bounds of deviations from interest parity that can be attributed to these costs. Therefore, any deviations that fall outside of the bounds represent profitable arbitrage opportunities.

The bounds for the neutral zone are the following:

$$|W - Wo| < \min [2(t + t^*), 2t_w]$$

where:

- W = observed forward premium (F-S)/S or swap rate
- Wo = Forward premium that would exactly equate IRP
- t = transaction cost in the domestic money market
- t^* = transaction cost in the foreign money market
- t_w = transaction cost in the swap money market

(W-Wo) represents the total deviations from interest parity, and the bounds $\{\min [2(t+t^*), 2t_w]\}$ represent the maximum deviations from covered interest parity caused by transactions costs. Therefore, the difference between these two terms described above, if positive, will represent profitable arbitrage opportunities. Thus profits, P, can be written:

$$P = |W - Wo| - \min [2(t + t^*), 2t_w]$$

DATA AND EMPIRICAL RESULTS

Data are taken from *The London Times*. The period from January 2, 1991 to March 8, 1991 is selected for studying the possible effects of turbulence in foreign exchange markets caused by the Gulf War. Another period during which no significant news occurred is used as a control period - July 31, 1991 to September 27, 1991. Currencies selected are British pounds and U.S. dollars. Foreign exchange rates are spot bid and ask rates and 30-day and 90-day forward bid and ask rates. Sterling and U.S. dollar CD rates in London for 1-month and 3-month maturities are utilized. Aliber (1973) argued that one should go to the same geographic market for interest rates to be comparable in terms of political risk. Therefore, interest rates are taken from the same market in order to avoid any impacts of political risk in the analysis.

In Clinton's formulation, transactions costs are bid-ask spreads in the foreign exchange market and the money markets (CD rates).

$$t_w = t_F - t_S$$

where:

- t_w is the swap transaction cost,
- t_F is the forward transaction cost, and
- t_S is the spot transaction cost.

The swap transaction cost is computed as:

$$t_w = 360/D \times (W^a - W^b) / (S^a + S^b)$$

where:

D is the number of days in the swap agreement,
$W^a = (S^a - F^a)$ is the ask swap rate, and
$W^b = (S^b - F^b)$ is the bid swap rate.

In the money markets,

$$t = (i^a - i^b) / 2$$
$$t^* = (i^{*a} - i^{*b}) / 2$$

where:

t is the pound Eurodeposit transactions cost, and
t^* is the dollar Eurodeposit transactions cost.

Thus, the bounds for the neutral zone,

where:

$$W = 360/D \times (W^a + W^b) / (S^a + S^b), \text{ and}$$
$$Wo = ((i^a + i^b) / 2) - ((i^{*a} + i^{*b}) / 2) / (1 + ((i^{*a} + i^{*b}) / 2)),$$

are:

$$|W - Wo| < \min [\, 2(t + t^*), 2t_w \,]$$

Therefore, $P = |W - Wo| - \min [2(t+t^*), 2t_w]$ gives the residual deviations after allowing for transactions costs and represents profitable arbitrage opportunities. As explained above, Clinton argues that the transactors with the lowest transactions costs determine the maximum limits on deviations from covered interest rate parity and hence he uses the minimum transactions costs.

t_w, t, t^*, W, and Wo are computed for the 1-month and 3-months maturities for comparability with the tests of Taylor's formulation.

Results applying Taylor's approach to the turbulent and control period are reported first. Table 1 sets forth deviations from covered arbitrage during the turbulent period. Only seven days reflect positive gains, six of which arise when arbitraging from sterling to dollars. Results for the control period, shown in Table 2, reveal only two profitable arbitrage opportunities with both relating to movement into dollars from sterling. Thus, as expected, profitable arbitrage opportunities arise more often during periods of turbulence in foreign exchange markets. However, the size of these profitable opportunities is small. The largest two profitable arbitrage opportunities occur on (1) January 9, from pounds to dollars for the 3-months maturity and amounts to œ 469.4 on œ 1,000,000 arbitraged into dollars, and (2) February 27, 3-month pounds to dollars, which returns œ 490.1 on œ 1,000,000 arbitraged into dollars.

In general, the size of the arbitrage opportunities is larger for the 3-months maturity; the only profitable opportunities during the control period are in the 3-months maturity. In only one instance is profitable arbitrage indicated from dollars to sterling.

The results from Clinton's methodology during the turbulent period are reported in Table 3. They show that 96% of the observations for the 1-month maturity and 69% of the observations for the 3-months maturity fall outside the bounds of the neutral zone suggesting a high percentage of unexploited profit opportunities. However, the size of these profit opportunities is small with only two exceeding 0.9% (Jan 7 and Jan 14). During the control period (Table 4) the largest return opportunity is 0.7% for August 23. Interestingly, no maturity differences are indicated for the control period. However, for the turbulent period, one month maturities offer greater profit possibilities than 3-months maturities. Despite the greater number of profit opportunities using Clinton's approach, the magnitude of these opportunities is far smaller than those found with Taylor's formulation.

FINDINGS AND CONCLUSIONS

The results from both Taylor's and Clinton's methodologies indicate that profitable arbitrage opportunities arise more frequently during periods of turbulence in foreign exchange markets. While the Clinton results show a larger number of profitable opportunities during the control period, the size of profitable opportunities during the turbulent period is far greater. To the extent that all costs and returns are captured by these formulations, the findings indicate that the markets are not efficient during periods of turbulence and the hypothesis of no profitable opportunities can be rejected.

Another finding corroborates Taylor's conclusion that the size and frequency of arbitrage opportunities are a positive function of the length of maturity. The longer maturities (3-months in this paper) show greater returns using Taylor's approach. A frequently used explanation of greater profit opportunities at longer maturities is the liquidity preferences of market traders, especially related to banks giving dealers a credit limit. When this limit is met, no additional arbitrage can be done and these market traders may have to forego more profitable opportunities that arise while waiting for the longer outstanding maturities. Therefore, traders generally prefer to deal with shorter maturities to take advantage of other profitable opportunities that may arise. Moreover, the longer maturities are usually used by hedgers and speculators and not by "arbitragers". For these reasons, unexploited profit opportunities may be greater in size and frequency in the longer maturities.

Clinton's methodology however, reveals greater returns for shorter maturities during both the turbulent and the control periods. This may be partially explained by the fact that bid-ask spreads are generally larger in the longer maturities, which means that transactions costs are greater. Since transactions costs are subtracted from total deviations from covered interest rate parity, the remaining deviations are smaller in magnitude for the longer maturities. This rationale, of course, is inconsistent with that given above relating to the results based on Taylor's approach. Clinton's methodology shows a larger number but smaller magnitudes of positive returns than Taylor's approach although in both instances the magnitudes are so small that they do not necessarily imply the existence of excess profits. The important conclusion to be drawn is that transactions costs explain fewer of the deviations from parity than was previously believed. Even assuming precise measurement of transactions costs, other factors which may play a role in eliminating profitable trading opportunities such as political risk, differential tax impacts, liquidity factors, measurement errors, etc. preclude interpreting the results as being inconsistent with market efficiency.

Another finding is that overall, profitable opportunities seem to have substantially decreased in frequency over time compared to Taylor's results. This could be due to the fact that the number of market participants has been increasing over time and with it experience in market dealing has increased. In addition, the enormous advances in technology and computers have increased traders' ability and speed in processing greater amounts of information. These factors have helped to increase overall market efficiency over time.

On the other hand, this study found a greater percentage of profitable opportunities than Clinton found, although these arbitrage opportunities are very small in magnitude. This differing result may be explained by the fact that this study covers more extreme periods--turbulent and calm--than the period covered in Clinton's study. Further, the time periods considered in this paper are more recent than Clinton's, and the increased number of profit opportunities partially could be the result of structural changes in foreign exchange or money markets. As expected, larger magnitudes of profit opportunities were found in the turbulent period than in the calm period for the one-month maturity. However, for the three-months maturity, the magnitudes of profit opportunities were larger in the calm period than in the turbulent period. This finding is difficult to rationalize. Perhaps the greater level of activity of banks (who dominate the swap market) in the three-months maturity as compared to the one-month maturity instruments contributes to this unexpected result.

In conclusion, the two approaches investigated yield different and unexpected results. The use of swap rates increased the number but not the magnitude of profitable arbitrage opportunities over the analysis based on outright bid/ask quotes. Further, turbulence in foreign exchange markets caused greater deviations using Taylor's approach and smaller deviations using Clinton's approach than found in earlier studies. Further research is needed to clarify these conflicting findings.

TABLE 1
Arbitrage Opportunities (Taylor's Methodology)
Turbulent Period

DATE	1-MONTH £ RETURN	1-MONTH $ RETURN	3-MONTHS £ RETURN	3-MONTHS $ RETURN
02-Jan-91	-0.03768	-0.09115	-0.10089	-0.04992
03-Jan-91	-0.04609	-0.07221	-0.07352	-0.07128
04-Jan-91	-0.03077	-0.09343	-0.09003	-0.08788
07-Jan-91	**0.00641**	-0.12682	-0.07454	-0.07282
08-Jan-91	-0.03043	-0.09013	-0.10478	-0.04292
09-Jan-91	-0.05778	-0.06697	**0.04694**	-0.00892
10-Jan-91	-0.04084	-0.08510	-0.06335	-0.07621
11-Jan-91	-0.03503	-0.09078	-0.08498	-0.06241
14-Jan-91	**0.01357**	-0.13923	-0.08865	-0.08063
15-Jan-91	-0.00202	-0.12107	-0.12381	-0.08624
16-Jan-91	-0.01983	-0.10613	-0.07607	-0.06883
17-Jan-91	-0.05758	-0.05952	-0.11457	-0.03222
18-Jan-91	-0.05208	-0.06658	-0.09721	-0.04831
21-Jan-91	-0.01237	-0.10542	-0.10602	-0.03892
22-Jan-91	-0.01913	-0.10414	-0.06859	-0.11395
23-Jan-91	-0.03692	-0.08602	-0.06189	-0.08980
24-Jan-91	-0.03485	-0.08271	-0.05683	-0.08698
25-Jan-91	-0.04703	-0.07578	-0.03676	-0.12717
28-Jan-91	-0.07448	-0.04301	-0.06056	-0.08300
29-Jan-91	-0.09154	-0.03089	-0.08123	-0.06236
30-Jan-91	-0.09097	-0.02682	-0.09997	-0.05201
31-Jan-91	-0.10445	-0.02500	-0.08667	-0.07238
01-Feb-91	-0.10142	-0.01554	-0.10954	-0.03411
04-Feb-91	-0.10540	-0.01155	-0.10102	-0.07274
05-Feb-91	-0.10267	-0.01392	-0.11954	**0.00790**
06-Feb-91	-0.10714	-0.01103	-0.13271	-0.01738
07-Feb-91	-0.10044	-0.02066	-0.07785	-0.07931
08-Feb-91	-0.09295	-0.03368	-0.08709	-0.07590
11-Feb-91	-0.10977	-0.01122	-0.11454	-0.04299
12-Feb-91	-0.09372	-0.02770	-0.09000	-0.05778
13-Feb-91	-0.06145	-0.06460	-0.17704	-0.01733
14-Feb-91	-0.08228	-0.03945	-0.05016	-0.10728
15-Feb-91	-0.08515	-0.03707	-0.04113	-0.10152
18-Feb-91	-0.08987	-0.02537	-0.10033	-0.05909
19-Feb-91	-0.08040	-0.00199	-0.05103	-0.10804
20-Feb-91	-0.08474	-0.03880	-0.08617	-0.05846
21-Feb-91	-0.09320	-0.02722	-0.03325	-0.11003
22-Feb-91	-0.10332	-0.02037	-0.07036	-0.08935
25-Feb-91	-0.09810	-0.02433	-0.07096	-0.07500
26-Feb-91	-0.08751	-0.03506	-0.04239	-0.11095
27-Feb-91	-0.00248	-0.11730	**0.04901**	-0.19357
28-Feb-91	-0.04481	-0.08068	-0.04546	-0.10088
01-Mar-91	-0.03661	-0.08961	-0.07481	-0.12030
04-Mar-91	-0.00647	-0.11444	-0.03464	-0.11993
05-Mar-91	**0.02535**	-0.05042	**0.00632**	-0.05555
06-Mar-91	-0.04046	-0.09151	-0.01350	-0.13363
07-Mar-91	-0.03745	-0.15083	-0.04329	-0.11412
08-Mar-91	-0.04703	-0.07546	-0.06415	-0.09986

TABLE 2
Arbitrage Opportunities (Taylor's Methodology)
Control Period

DATE	1-MONTH £ RETURN	1-MONTH $ RETURN	3-MONTHS £ RETURN	3-MONTHS $ RETURN
31-Jul-91	-0.03584	-0.09911	-0.01538	-0.14591
01-Aug-91	-0.04607	-0.09586	-0.02103	-0.13367
02-Aug-91	-0.05709	-0.08364	-0.08154	-0.08021
05-Aug-91	-0.03691	-0.09627	-0.05381	-0.12123
06-Aug-91	-0.04272	-0.09612	-0.04412	-0.13054
07-Aug-91	-0.05421	-0.07886	**0.01645**	-0.18278
08-Aug-91	-0.04737	-0.08621	-0.01700	-0.15793
09-Aug-91	-0.05176	-0.08831	-0.02090	-0.14702
12-Aug-91	-0.02943	-0.10186	-0.04547	-0.11500
13-Aug-91	-0.03851	-0.09574	-0.04488	-0.10836
14-Aug-91	-0.05358	-0.08356	-0.00065	-0.15242
15-Aug-91	-0.05387	-0.08096	-0.04765	-0.10616
16-Aug-91	-0.04471	-0.09803	-0.03329	-0.13755
19-Aug-91	-0.05509	-0.14922	-0.05486	-0.23146
20-Aug-91	-0.03895	-0.10543	-0.02218	-0.14257
21-Aug-91	-0.05670	-0.08269	-0.05977	-0.14096
22-Aug-91	-0.05879	-0.07528	-0.05256	-0.10045
23-Aug-91	-0.00691	-0.13474	**0.02644**	-0.20170
27-Aug-91	-0.03182	-0.10344	-0.04235	-0.14996
28-Aug-91	-0.05251	-0.08220	-0.05452	-0.09923
29-Aug-91	-0.06474	-0.06769	-0.02650	-0.13474
30-Aug-91	-0.06385	-0.06887	-0.02467	-0.13687
02-Sep-91	-0.06384	-0.06858	-0.04696	-0.11451
03-Sep-91	-0.03794	-0.09644	-0.06288	-0.09826
04-Sep-91	-0.03076	-0.10338	-0.01520	-0.14513
05-Sep-91	-0.06456	-0.07320	-0.03582	-0.11722
06-Sep-91	-0.07281	-0.06726	-0.09609	-0.06492
09-Sep-91	-0.06577	-0.06621	-0.03901	-0.11912
10-Sep-91	-0.03034	-0.09879	-0.05019	-0.11548
11-Sep-91	-0.02796	-0.10132	-0.05891	-0.09943
12-Sep-91	-0.06543	-0.06605	-0.08198	-0.08199
13-Sep-91	-0.07193	-0.06547	-0.06663	-0.08371
16-Sep-91	-0.07183	-0.05919	-0.09281	-0.06483
17-Sep-91	-0.03864	-0.09202	-0.06715	-0.08998
18-Sep-91	-0.04618	-0.08531	-0.04111	-0.10898
19-Sep-91	-0.06031	-0.07739	-0.06574	-0.09259
20-Sep-91	-0.06839	-0.06950	-0.06573	-0.09244
23-Sep-91	-0.06542	-0.06531	-0.05164	-0.10532
24-Sep-91	-0.03495	-0.09886	-0.03996	-0.10921
25-Sep-91	-0.04409	-0.09315	-0.04933	-0.10080
26-Sep-91	-0.04727	-0.08420	-0.03864	-0.11139
27-Sep-91	-0.05038	-0.07837	-0.04777	-0.10981

TABLE 3
Arbitrage Opportunities (Clinton's Methodology)
Turbulent Period

DATE	1-MONTH £ RETURN	3-MONTHS £ RETURN
02-Jan-91	0.00392348	-0.00016080
03-Jan-91	0.00290741	0.00003360
04-Jan-91	0.00451616	-0.00065120
07-Jan-91	0.00917224	0.00007320
08-Jan-91	0.00483359	0.00024170
09-Jan-91	0.00135140	0.00108470
10-Jan-91	0.00343491	0.00031490
11-Jan-91	0.00410305	-0.00037380
14-Jan-91	0.00989645	-0.00075580
15-Jan-91	0.00838882	-0.00124070
16-Jan-91	0.00596123	-0.00001520
17-Jan-91	0.00145086	0.00067750
18-Jan-91	0.00217942	0.00005540
21-Jan-91	0.00681492	0.00043090
22-Jan-91	0.00582604	0.00089360
23-Jan-91	0.00370217	0.00056600
24-Jan-91	0.00411088	0.00054930
25-Jan-91	0.00246596	0.00152470
28-Jan-91	-0.00057121	0.00043150
29-Jan-91	0.00055077	-0.00034980
30-Jan-91	0.00127268	0.00011350
31-Jan-91	0.00155850	-0.00028970
01-Feb-91	0.00260615	0.00072420
04-Feb-91	0.00312813	-0.00014220
05-Feb-91	0.00283947	0.00078830
06-Feb-91	0.00306807	0.00154960
07-Feb-91	0.00230183	-0.00011270
08-Feb-91	0.00049845	-0.00055950
11-Feb-91	0.00339114	0.00072410
12-Feb-91	0.00092062	-0.00022760
13-Feb-91	0.00067249	0.00220870
14-Feb-91	0.00023742	0.00094090
15-Feb-91	0.00054552	0.00100750
18-Feb-91	0.00149095	0.00013050
19-Feb-91	0.00228436	0.00094640
20-Feb-91	-0.00004796	-0.00013290
21-Feb-91	0.00166404	0.00133490
22-Feb-91	0.00266046	0.00023220
25-Feb-91	0.00211978	-0.00003580
26-Feb-91	0.00083555	0.00120710
27-Feb-91	0.00775654	0.00453920
28-Feb-91	0.00309009	0.00092960
01-Mar-91	0.00361912	-0.00049120
04-Mar-91	0.00734471	0.00151870
05-Mar-91	0.00542115	0.00104230
06-Mar-91	0.00330343	0.00216850
07-Mar-91	0.00684300	0.00141270
08-Mar-91	0.00255706	0.00050290

TABLE 4
Arbitrage Opportunities (Clinton's Methodology)
Control Period

DATE	1-MONTH £ RETURN	3-MONTHS £ RETURN
31-Jul-91	0.00397869	0.00211490
01-Aug-91	0.00274845	0.00175900
02-Aug-91	0.00133334	-0.00046320
05-Aug-91	0.00372041	0.00086560
06-Aug-91	0.00293604	0.00123480
07-Aug-91	0.00165843	0.00339590
08-Aug-91	0.00250378	0.00224790
09-Aug-91	0.00194155	0.00196388
12-Aug-91	0.00451100	0.00087938
13-Aug-91	0.00358695	0.00076539
14-Aug-91	0.00197185	0.00247141
15-Aug-91	0.00181005	0.00065178
16-Aug-91	0.00292960	0.00153493
19-Aug-91	0.00569513	0.00199447
20-Aug-91	0.00370290	0.00183381
21-Aug-91	0.00161506	0.00109325
22-Aug-91	0.00116808	0.00044193
23-Aug-91	0.00732805	0.00370462
27-Aug-91	0.00442760	0.00161609
28-Aug-91	0.00193985	0.00039135
29-Aug-91	0.00036405	0.00161199
30-Aug-91	0.00048514	0.00169110
02-Sep-91	0.00046099	0.00081871
03-Sep-91	0.00362726	0.00020172
04-Sep-91	0.00436521	0.00202661
05-Sep-91	0.00045627	0.00107500
06-Sep-91	-0.00071123	0.00016837
09-Sep-91	0.00007186	0.00105917
10-Sep-91	0.00412735	0.00075668
11-Sep-91	0.00439300	0.00027352
12-Sep-91	0.00008786	-0.00064223
13-Sep-91	-0.00076462	-0.00019083
16-Sep-91	-0.00038181	0.00014711
17-Sep-91	0.00324256	-0.00007245
18-Sep-91	0.00239132	0.00080023
19-Sep-91	0.00065109	0.00001088
20-Sep-91	-0.00028201	0.00000328
23-Sep-91	0.00008187	0.00053325
24-Sep-91	0.00377165	0.00082933
25-Sep-91	0.00257389	0.00047819
26-Sep-91	0.00227525	0.00088608
27-Sep-91	0.00175718	0.00070809

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