The Impact of Unanticipated US Weekly Money on the Path of the Dollar

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Evidence is presented on changes in the expected path of the US dollar versus the Canadian, induced by the unanticipated component of the Federal Reserve’s weekly money supply announcement. Between October 1979 and January 1984, whenever US long-term forward interest rate movements were positively correlated with money surprises, there is suggestive evidence that the market anticipated long-term US dollar depreciation from its preannouncement expected level. Thus, despite the tendency for the US dollar to appreciate at spot, the market seems to have revised upward long-term expected inflation.

Weekly money supply announcements of the Federal Reserve and their impact on financial markets have attracted the attention of numerous observers over the last several years. In part this is because no single hypothesis has been able to explain the stylized facts in a completely satisfactory way. The finding that interest rate movements were positively correlated with unexpectedly high monetary growth (or money surprises) admitted diametrically opposed interpretations. The “expected inflation” hypothesis argued that the Fed was expected to accommodate, at least partially, a positive surprise by raising monetary growth rates, thus causing nominal interest rates to rise.¹ On the other hand, the “policy anticipations” hypothesis granted the Federal Reserve a higher degree of public credibility: market participants believed that the Fed was serious about its targets and monetary restraint and would not allow the demand shock to be validated.² Given some degree of short-term price inflexibility, interest rates rose immediately in anticipation of higher future real interest rates.³

From October 1979, when the Fed served notice that it was serious about monetary restraint, until February 1984, when M1 targeting was deemphasized, evidence from foreign exchange markets strongly favored the policy anticipations view.⁴ The tendency for the US dollar to appreciate after money surprises indicated that it was (at least primarily) the real component of US interest rates that was increasing.⁵
One finding, however, that has troubled some observers was the fact that long-term forward interest rate movements also were (at times) positively correlated with money surprises.\textsuperscript{6} Gikas A. Hardouvelis \cite{hardouvelis83} proposed a "combination" hypothesis that synthesized policy anticipations and expected inflation. The argument was that short-term interest rates were dominated by real movements, but that long-term rates changed primarily due to revisions in expected inflation. There were implications for the long-term value of the dollar. If long-term expected inflation increased in response to positive surprises, then, despite any initial appreciation, there should have been a downward revision in the expected long-term value of the US dollar. In fact he found, using a February 1980–June 1982 sample, that his proxy for expected future spot exchange rates did indicate a decline in expectations (from preannouncement levels) for five years in the future. Note that the policy-anticipations hypothesis would predict that, after the initial US dollar appreciation, long-term expected exchange rates should settle back down asymptotically to preannouncement levels.\textsuperscript{7}

The sensitivity of interest rates to the Fed's announcement has varied over time.\textsuperscript{8} Using a November 1977–December 1985 sample, Jan G. Loeys \cite{loeys89} showed that money surprises pushed long-term forward interest rates higher for the first time after October 1979 (when the Fed dramatically changed course). By mid-1981, long-term forward interest rates were no longer affected by money surprises, but the positive correlation reappeared in mid-1982 (just before the October 1982 Fed shift in operating procedures to a borrowed reserves instrument with a concurrent deemphasis on M1 targeting). Arguing that the degree of market nervousness varied over time, he suggested the following scenario. If markets became nervous and, thus, disposed to treat a positive surprise as potentially implying an increase in long-run target growth levels, whenever the Fed changed course, even to a more stringent policy (as was the case in October 1979), then increased long-term forward rate responses were the natural result.\textsuperscript{9} As for the decrease in mid-1981 in forward rate sensitivity, this was argued to be due to the fact that the Fed had finally demonstrated its resolve to the public's satisfaction. With the October 1982 change, however, uncertainty returned.\textsuperscript{10}

If the combination hypothesis as formulated by Hardouvelis \cite{hardouvelis83} and Loeys \cite{loeys89} is correct, then, whenever US long-term forward interest rate movements are positively correlated with money surprises due to inflation nervousness, expected long-term depreciation of the US dollar from its preannouncement level should also be evident. The purpose of this article is to provide evidence on this issue using Canadian financial market data. In particular, changes in the expected path of the US dollar versus the Canadian dollar are estimated from the October 11, 1979, to the January 27, 1984, weekly Fed money supply release.\textsuperscript{11} This article departs from
previous work in examining the path of the exchange rate (rather than studying a single point in time), by utilizing more than one proxy for expected future values of the US dollar and by investigating the entire period of spot US dollar appreciation following US money surprises.18

In the second section, I describe the basic estimation model, data, and the proxies used for expected exchange rates. In the next section, changes in the expected path of the US dollar relative to the Canadian dollar are estimated and interpreted in light of the debate on market perceptions of Fed policy. The fourth section concludes the article.

SPECIFICATION, DATA, AND CHANGING FORWARD INTEREST RATE RESPONSES

Estimation Model and Proxies for Changes in Expected Exchange Rate

Financial market reactions to the Fed's weekly money supply announcement are typically estimated using the following regression equation:13

\[
\Delta MV_t = \beta_0 + \beta_1 (\Delta M_t - \Delta M^*) + \epsilon_t,
\]

where \(\Delta MV_t\) = change in market variable over an interval spanning money supply announcement at \(t\), \(\Delta M^*_t\) = rational expectation of change in the money supply, \(\Delta M_t\) = announced change in the money supply, \(\beta, \beta_1\) = intercept and slope parameters to be estimated, \(\epsilon_t\) = white noise error term. If the measurement interval can be made arbitrarily small, under rational expectations, \(\beta_0 \approx 0.14\)

Changes in the Canadian/US dollar forward foreign exchange rate following money surprises will serve as one proxy for changes in the expected path of the US dollar over the near term. Even if, as most evidence shows, risk premia separate forward rates and expected spots, as long as they are not perturbed by the shock, then the procedure is valid.15

To derive a second proxy for expected currency changes, following Hardouvelis [9], open interest parity (OIP) is invoked. Thus, changes in the expected value of the dollar \(n\) years in the future are derived by calculating movements in US and Canadian \(n\)-year bond yields and the Canadian/US dollar spot exchange rate and then solving for the change in the expected value of the US dollar versus the Canadian \(n\) years in the future. Once again, the implication is that open interest parity holds at every point in time, or, if a spread exists, it does not change over the announcement interval.

To summarize, the proxies are as follows:

(2a) \[\Delta EXSP(n) = \Delta FOR(n);\]

(2b) \[\Delta EXSP(n) = n \cdot [\Delta RCN(n) - \Delta RUS(n)] + \Delta SP;\]

where \(\Delta EXSP(n)\) = change at \(t\) in expected spot Canadian/US dollar exchange rate \(n\) years in future, \(\Delta FOR(n)\) = change at \(t\) in \(n\)-year forward Canadian/US dollar exchange rate, \(\Delta RCN(n)\), \(\Delta RUS(n)\) = change at \(t\) in
Canadian and US $n$-year bond yields, $\Delta SP_i = \text{change at } t$ in Canadian/US dollar spot exchange rate.

**Data**

The weekly money supply announcement, which during the sample was released to the public after the close of markets at approximately 4:15 p.m. is obtained from the Fed’s H.6 release. As with most empirical work in this literature, the median forecast of the change in narrow money, taken from the Money Market Services, Inc. survey of market professionals, is used to represent the market’s rational expectation. Following Richard Deaves, Angelo Melino, and James E. Pesando [6], the survey measure has been adjusted to eliminate its demonstrably spurious downward bias. Actual and expected changes are expressed in percentages.

Canadian/US dollar spot and forward exchange rates are taken from the Bank of Canada’s data base. For spot and 90-day forward contracts the measurement interval for changes is from noon to 4:30 p.m. the day of the announcement. For six-month and one-year forward rates, the interval was from 4:30 p.m. the day before the announcement to 4:30 p.m. on the announcement day.

Three- and six-month T-bill yields, and two-, five- and twenty-year constant-maturity bond yields were taken from the Federal Reserve’s H.15 release. Since quotes are taken at 3:30 p.m., the change in interest rates is measured from 3:30 p.m. the day of the announcement to the same time the following business day.

Yields of Government of Canada securities of the same maturity, also taken at 3:30 p.m., were gathered from quote sheets provided by the Bank of Canada. The two-, five- and twenty-year bond series were constructed by tracking individual bonds of approximately the appropriate maturity and then switching when necessary in order to come up with a synthetic series of approximately constant maturity.

**Shifts in US Forward Interest Rate Responses**

Table 1 presents estimates of Equation (1) with movements in the 15-year implicit forward interest rate beginning five years in the future as the dependent variable. The overall October 1979 to January 1984 sample is divided at June 1981 and October 1982.

A significant change in interest rate reactions to US money surprises following the Fed regime change in October 1982 has been previously identified. Following the method (and evidence) of Loys [13], in order to search for structural break between October 1979 and 1982, I determined on a split after the June 12, 1981, announcement. Wald test statistics in Table 1 test for significant changes in the coefficient of unexpected money from that of the subperiod immediately preceding. It is evident that between June 1981 and October 1982 the forward rate
Table 1
RESPONSES (IN BASIS POINTS) OF US 15-YEAR FORWARD INTEREST RATE FIVE YEARS AHEAD, US 90-DAY T-BILL YIELD AND CANADIAN/US DOLLAR SPOT EXCHANGE RATE TO US PERCENTAGE MONEY SURPRISES

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Chg. in Forward Interest Rate</td>
<td>0.050</td>
<td>(0.018)</td>
<td>0.044</td>
</tr>
<tr>
<td>Chg. in 90-day T-bill Yield</td>
<td>0.067</td>
<td>(0.040)</td>
<td>0.060</td>
</tr>
<tr>
<td>Chg. in Spot Exchange Rate</td>
<td>-0.008</td>
<td>(0.013)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

|                  | 8.299**                           | (5.232)                          | 27.747**                          |
|                  | (3.302)                           | (8.674)                          | (8.925)                           |
|                  | 0.17                              | 0.22                             | 0.58                              |
|                  | 0.08                              | 0.01                             | 0.11                              |
|                  | 2.22                              | 1.70                             | 1.73                              |
|                  |                                   | 3.89**                           |                                   |
|                  |                                   | 0.50                             |                                   |
|                  |                                   | 15.53**                          |                                   |
|                  |                                   |                                   |                                   |

Notes: Forward interest rates are calculated using Shiller's linearisation (see, for example, Schiller, Schoenholtz, and Campbell [18] which takes into account that long-term bonds are effectively “shortened” by semi-annual coupon payments). Estimation has been done using Equation (1). Standard errors (bracketed below coefficient estimates) are White's [21] that are heteroscedastic-consistent. W = Wald test statistic (χ²(1)) tests for change in slope coefficient from previous subperiod; significance at 5% is indicated by ** and at 10% by *.

The response was insignificantly different from 0. Before and after this span the 15-year forward interest rate increased by 8.3 and 11.0 basis points, respectively, in response to a 1 percent surprise. Both coefficients are significant at the 5 percent level.

It is useful to know how short-term interest rates and the US dollar were reacting to money surprises at the time. Table 1 also shows typical responses of the US 90-day T-bill yield and the Canadian/US dollar spot exchange rate to unexpectedly high week-to-week monetary growth. Note that the T-bill money surprise coefficients, which are always significantly positive, decline over the sample. There is, however, no evidence of an abrupt change. As for the US dollar, the extent of the appreciation induced by money surprises significantly differs in the three subperiods. The magnitude of the response is greatest for the June 1981–October 1982 subperiod when a nearly 19-basis-point increase typically followed a 1 percent surprise. The latter does not seem to be due to increased interest rate pressures, as 90-day T-bill rate movements induced by money surprises are not significantly different from those of the previous subperiod.35
EXPECTED PATH OF CANADIAN/US DOLLAR SPOT EXCHANGE RATE

Empirical Results

I next turn to Table 2 where Canadian/US dollar 90-day, 180-day, and 365-day forward exchange rate reactions to the unanticipated component of week-to-week monetary growth are estimated (using Equation (1)) for the three subperiods. In addition, responses of the open interest parity proxy for changes in the expected value of the Canadian/US dollar three months, six months, two years, five years and twenty years ahead are estimated.26

During the period October 1979–June 1981, for 180 days and beyond, both proxies have negative money surprise coefficients (indicating depreciation by the pertinent time). By two years (using the open interest parity proxy) the highly significant depreciation is on the order of nearly 38 basis points, but beyond this point there is no evidence of further US dollar depreciation.

For June 1981–October 1982 the results are rather different. Up until one year, all surprise coefficients are significantly positive (indicating continued appreciation) and beyond this point all reactions are insignificantly different from 0. Wald statistics indicate that changes in the expected path of the US dollar after surprises differ from October 1979–June 1981. All surprise coefficients up to two years in the future are significantly different (at 5 percent) from those of the previous subperiod.

The results for October 1982–January 1984 are mixed. Forward foreign exchange rate responses to surprises uniformly indicate appreciation (and significantly so up to six months). On the other hand, the open interest parity methodology implies depreciation by two years in the future, but none of these negative coefficients are significant at even 10 percent.27

Interpretation

Recall that, whenever long-term forward interest rates tend to increase after positive money surprises — a regularity that was present during October 1979–June 1981 and October 1982–January 1984, the combination hypothesis predicts expected eventual depreciation of the US dollar below levels previously anticipated during these subperiods (but not during June 1981–October 1982 when the dollar was not expected to decline).28

The policy anticipations hypothesis, however, predicts an asymptotic return of the US dollar to its preannouncement expected levels in all subperiods. Thus, for the purpose of hypothesis differentiation, the first and third subperiods are the crucial ones.

In general, the evidence, though far from strong, is more consistent with the combination hypothesis than policy anticipations. There is solid indication of eventual US dollar depreciation after positive surprises during October 1979–June 1981 (weakly from the forward exchange market and strongly from the open interest parity methodology). The evidence is
Table 2
RESPONSES (IN BASIS POINTS) OF PROXIES FOR EXPECTED FUTURE VALUES OF THE CANADIAN/US DOLLAR SPOT EXCHANGE RATE TO US PERCENTAGE MONEY SURPRISES

<table>
<thead>
<tr>
<th>Fut. Time/Proxy</th>
<th>(b_0)</th>
<th>(b_1)</th>
<th>SEE</th>
<th>(R^2)</th>
<th>DW</th>
<th>W</th>
</tr>
</thead>
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<tr>
<td>1. October 11, 1979–June 12, 1981</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90 Days ((\Delta F\text{OR}))</td>
<td>-0.003</td>
<td>2.755</td>
<td>0.12</td>
<td>0.02</td>
<td>2.14</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(2.050)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>180 Days ((\Delta F\text{OR}))</td>
<td>0.012</td>
<td>-3.724</td>
<td>0.22</td>
<td>0.01</td>
<td>1.85</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(3.461)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>365 Days ((\Delta F\text{OR}))</td>
<td>0.009</td>
<td>-5.918</td>
<td>0.23</td>
<td>0.02</td>
<td>1.88</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(3.753)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>90 Days ((O\text{IP}))</td>
<td>-0.016</td>
<td>-2.457</td>
<td>0.15</td>
<td>0.01</td>
<td>2.29</td>
<td>-</td>
</tr>
<tr>
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<td>(0.016)</td>
<td>(2.570)</td>
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<tr>
<td>180 Days ((O\text{IP}))</td>
<td>-0.041*</td>
<td>-10.504**</td>
<td>0.22</td>
<td>0.08</td>
<td>2.51</td>
<td>-</td>
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<tr>
<td></td>
<td>(0.023)</td>
<td>(3.720)</td>
<td></td>
<td></td>
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<tr>
<td>2 Years ((O\text{IP}))</td>
<td>0.001</td>
<td>-37.887**</td>
<td>0.45</td>
<td>0.21</td>
<td>2.56</td>
<td>-</td>
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<tr>
<td></td>
<td>(0.049)</td>
<td>(8.142)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5 Years ((O\text{IP}))</td>
<td>0.036</td>
<td>-33.882**</td>
<td>0.84</td>
<td>0.06</td>
<td>2.04</td>
<td>-</td>
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<tr>
<td></td>
<td>(0.089)</td>
<td>(13.457)</td>
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<tr>
<td>20 Years ((O\text{IP}))</td>
<td>0.299</td>
<td>-27.546</td>
<td>2.25</td>
<td>0.01</td>
<td>1.91</td>
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<td>(0.237)</td>
<td>(32.972)</td>
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<tr>
<td>90 Days ((\Delta F\text{OR}))</td>
<td>0.008</td>
<td>15.499**</td>
<td>0.14</td>
<td>0.23</td>
<td>2.20</td>
<td>13.54**</td>
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<td>(0.017)</td>
<td>(3.057)</td>
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<tr>
<td>180 Days ((\Delta F\text{OR}))</td>
<td>0.024</td>
<td>21.548**</td>
<td>0.29</td>
<td>0.12</td>
<td>1.77</td>
<td>8.29**</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(8.275)</td>
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<tr>
<td>365 Days ((\Delta F\text{OR}))</td>
<td>0.027</td>
<td>16.275*</td>
<td>0.50</td>
<td>0.07</td>
<td>1.77</td>
<td>5.33**</td>
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<tr>
<td></td>
<td>(0.036)</td>
<td>(9.076)</td>
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<tr>
<td>90 Days ((O\text{IP}))</td>
<td>-0.012</td>
<td>14.680**</td>
<td>0.16</td>
<td>0.17</td>
<td>2.07</td>
<td>15.44**</td>
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<td>(3.719)</td>
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<tr>
<td>180 Days ((O\text{IP}))</td>
<td>-0.046*</td>
<td>11.663**</td>
<td>0.21</td>
<td>0.07</td>
<td>2.12</td>
<td>12.47**</td>
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<td>(5.296)</td>
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<tr>
<td>2 Years ((O\text{IP}))</td>
<td>-0.057</td>
<td>12.208</td>
<td>0.45</td>
<td>0.02</td>
<td>2.34</td>
<td>12.61**</td>
</tr>
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<td>(11.911)</td>
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<tr>
<td>5 Years ((O\text{IP}))</td>
<td>-0.018</td>
<td>-1.977</td>
<td>0.75</td>
<td>0.00</td>
<td>2.28</td>
<td>2.71*</td>
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<td>(0.089)</td>
<td>(14.276)</td>
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<tr>
<td>20 Years ((O\text{IP}))</td>
<td>0.285</td>
<td>-16.616</td>
<td>2.62</td>
<td>0.00</td>
<td>1.81</td>
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<td>(0.512)</td>
<td>(60.751)</td>
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</table>

much weaker for October 1982–January 1984. The most one can say is that the sign of the surprise coefficients for two years or more in the future implies eventual depreciation.

The stronger results always arise from the open interest parity methodology, but there are reasons to be cautious in accepting findings that utilize it. It was noted earlier that, assuming open interest parity holds prior to the shock, a return to parity over the announcement interval in response to these shocks is assumed, or, even if a gap exists, it should not be perturbed over the announcement interval. It is instructive to consider the weaker case of covered interest parity (CIP). If doubt can be cast on covered interest parity being instantaneously reestablished at shorter
**Table 2 (continued)**

<table>
<thead>
<tr>
<th>Fut. Time/Proxy</th>
<th>$b_0$</th>
<th>$b_1$</th>
<th>SEE</th>
<th>$R^2$</th>
<th>DW</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. October 8, 1982-January 27, 1984</td>
<td>3. 0.011</td>
<td>8.750**</td>
<td>0.09</td>
<td>0.12</td>
<td>1.94</td>
<td>2.38</td>
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<td>180 Days ($\Delta XOR$)</td>
<td>-0.007</td>
<td>10.192**</td>
<td>0.13</td>
<td>0.08</td>
<td>2.02</td>
<td>1.60</td>
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<td>(0.015)</td>
<td>(4.129)</td>
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<tr>
<td>365 Days ($\Delta XOR$)</td>
<td>0.002</td>
<td>6.056</td>
<td>0.17</td>
<td>0.02</td>
<td>1.98</td>
<td>1.04</td>
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<td>(0.020)</td>
<td>(4.771)</td>
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<tr>
<td>90 Days (OIP)</td>
<td>-0.015</td>
<td>6.587*</td>
<td>0.10</td>
<td>0.06</td>
<td>1.79</td>
<td>2.50</td>
</tr>
<tr>
<td>(0.012)</td>
<td>(3.548)</td>
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<tr>
<td>180 Days (OIP)</td>
<td>-0.028**</td>
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<td>0.12</td>
<td>0.21</td>
<td>1.70</td>
<td>1.45</td>
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<td>(0.014)</td>
<td>(4.055)</td>
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<tr>
<td>2 Years (OIP)</td>
<td>-0.035</td>
<td>-8.920</td>
<td>0.20</td>
<td>0.03</td>
<td>2.50</td>
<td>2.34</td>
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<td>(0.024)</td>
<td>(6.965)</td>
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<tr>
<td>5 Years (OIP)</td>
<td>0.002</td>
<td>-20.544</td>
<td>0.43</td>
<td>0.03</td>
<td>1.46</td>
<td>0.87</td>
</tr>
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<td>(0.051)</td>
<td>(15.746)</td>
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<tr>
<td>20 years (OIP)</td>
<td>-0.073</td>
<td>-41.607</td>
<td>1.35</td>
<td>0.01</td>
<td>1.56</td>
<td>0.12</td>
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<tr>
<td>(0.160)</td>
<td>(42.498)</td>
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</tbody>
</table>

Notes: $\Delta FOR$ indicates use of change in pertinent forward exchange rate as a proxy for changes in expected value of the spot exchange rate at indicated future time (as in equation (2a)); similarly, $\Delta OIP$ indicates use of proxy based on open interest parity assumption (as in Equation (2b)). Estimation has been done using Equation (1); standard errors (bracketed below coefficient estimates) are White's [21] that are heteroscedastic-consistent; $W = \text{Wald test statistic} (\chi^2(1))$ tests for change in slope coefficient from previous subperiod; significance at 5% is indicated by ** and at 10% by *.

maturities where quoted forward rates exist, then even stronger doubt attaches itself to the open interest parity methodology. Consider the first subperiod. Using Equation (1), I regress changes in 90-day covered interest parity over the announcement interval (in basis points) on a constant and money surprises:

$$DCIP3M = 5.303 - 20.523(\Delta M - \Delta M_f) + \epsilon,$$

(3)  
$$R^2 = 0.10 \quad DW = 2.17$$

where $DCIP3M =$ change over announcement interval in Canadian 90-day T-bill yield minus change in US 90-day T-bill yield minus change in Canadian/US dollar annualized 90-day forward premium (standard errors are in brackets).

Clearly immediate reestablishment of covered interest parity is rejected, as Canadian interest rate changes lag those of the United States and currency movements. Note that this result need not imply unexploited profit opportunities due to the existence of political risk (as described in Robert Z. Aliber [1]) and transaction costs.29

This problem is likely to be worse for open interest parity, since an additional form of risk — foreign exchange risk — is present. In addition, since both foreign exchange and political risk are likely to be greater the longer is the horizon, even less faith should be placed in this methodology for predicting the exchange rate well into the future. If, as was the case
for covered interest parity, open interest parity is only partially reestablished
and Canadian interest rates lag US rates, the implication is that this proxy
might bias downward the estimated change in the expected future value
of the US dollar (perhaps falsely suggesting eventual US dollar deprecia-
tion). In fact, during all three subperiods, for 90 days and 180 days, the
open interest parity proxy always indicates greater depreciation (or less
appreciation) than the forward exchange rate proxy, which should be the
more reliable.50

CONCLUDING REMARKS

This article has contributed to the debate on market perceptions of the
Fed reaction function after weekly money supply announcements by
documenting changes in the expected path of the US dollar induced by
surprises. When long-term forward interest rate movements are positively
related with the unanticipated component of week-to-week monetary
growth, there is some evidence that eventual depreciation of the US dollar
is anticipated by the market indicating an upward revision in long-term
expected inflation.

The problem is that the strongest evidence utilizes the open interest
parity methodology, which is likely to bias the findings in the direction of
accepting US dollar depreciation. Thus, it is clear that the debate continues.
Additional empirical work perhaps using other non-US term structures,
as well as reactions of nearby to distant currency futures, would be welcome
contributions in clarifying this issue further.

NOTES

* The author wishes to thank James E. Pesando and Angelo Melino for helpful
  comments. All remaining errors are his own.
1. See, for example, Cornell [3]. As a verbal abbreviation, reference will often
   be made to typical market reactions to positive surprises. No asymmetries are
   implied.
2. It is important to note that these money surprises were shocks arising in
   the private banking system, since the level of the monetary base for the corre-
   sponding settlement week had been reported the previous week.
3. One proponent of this view is Roley [14]. Others, such as Siegel [19] and
   Huizinga and Leiderman [10], have argued for a view that abstracts from
   perceptions of central bank behavior. Sheehan [17] provides a survey of the
   literature and debate.
4. In October 1979 the Federal Reserve switched operating procedures from
   a federal funds rate to a nonborrowed reserves procedure. The subtext was
   clearly increased monetary restraint. In February 1984, the Fed moved from a
   lagged to a contemporaneous reserves requirement, but, at the same time, most
   observers felt that M1 targeting was being deemphasized.
5. For foreign exchange rate evidence see Hakko and Pearce [8]. They also
   showed that the US dollar was not affected by surprises prior to October 1979,
   and I showed [5] that after February 1984 the US dollar was no longer sensitive
to surprises.
6. This is documented by Shiller, Campbell, and Schoenholtz [18] among others.

7. This prediction is based on the belief (which best captures the spirit of the hypothesis) that the Fed will counteract over time the entire money surprise. Since long-run monetary levels are unchanged, there is no reason for the expected long-run level of the exchange rate to be altered.


9. This interpretation is probably more credible when the Fed moves from tight control to more relaxed, rather than in the opposite direction (as in October 1979).

10. For a conflicting view see Roley and Walsh [16].

11. These dates correspond to the first money supply announcement after the Fed regime change in October 1979, and the last before the February 1984 change. See note 4 for details.

12. Husted and Kitchen [12], for a February 1980–August 1982 sample, examined forward foreign exchange rate reactions (for the German mark and Canadian dollar) to money surprises, but only up to 180 days in the future. Roley [15] for a longer period estimated reactions in the yen/dollar 90-day forward exchange rate. Hardouvelis [9] utilized several foreign countries' currency and interest rate reactions to derive changes in the expected value of the US dollar. His results for Canada can be dismissed out of hand. Because Canadian (and Japanese) five-year bond rates were unavailable, he merely assumed that they did not move in response to US money surprises. In fact, I have shown [4] that Canadian long-term bond yields have consistently (over all subperiods examined here and beyond) and significantly moved in the same direction as US yields after US money surprises. As for the other nations' results, since the Eurobond series utilized by Hardouvelis are (administered) LIBOR rates (mid-morning interbank offer rates in London), these are likely to exhibit sluggish change over narrow intervals and, hence, would tend to underestimate the true response.

13. Often anticipated money is included as an additional explanatory variable as in:

\[ \Delta M_v = \beta_0 + \beta_1(\Delta M_r - \Delta M_t) + \beta_2 \Delta M_r' + \epsilon. \]

This is done with a view to testing the efficient markets hypothesis. In any case, due to the orthogonalization of unexpected and expected changes in money implicit in the adjustment of anticipated weekly money growth (described in note 17), the \( \beta \) estimates would be identical with or without the inclusion of the second explanatory variable.

14. Were this not the case, risk arbitrage activity would be elicited.

15. Boothe and Longworth [2] review the evidence. Most agree that the joint hypothesis of no risk premium and market efficiency is rejected by the data.

16. From the beginning of the sample to January 31, 1980, the announcement was scheduled for Thursday afternoons, while from February 8, 1980, to the end of the sample Friday announcements were the rule. The definition of narrow money used in this literature corresponds to that used in the market survey: M1B from February 8, 1980 to January 8, 1982, and M1 before and after. The survey forecast (taken on the Thursday before the announcement up to the January 31, 1980, release; Tuesday thereafter) is measured as a raw dollar change rather than in percentages. Conversion is made into percentage changes using log differences. The series of actual and expected (from the survey) changes in the money supply were made available to the author by Vance Roley.

17. In that article, we demonstrated that the presence of downward bias serves
to explain partially the anomalous negative (and often significant, particularly between October 1979 and October 1982) coefficients of expected monetary growth that have been observed by many authors. See, for example, Urich and Wachtel [20]. To remove the bias, fitted values from a regression of changes in money on the survey measure (and a constant) were used for expected money, with unanticipated money then being the residual.

18. Exchange rate changes — spot, forward and expected spot (using open interest parity) — are measured in percentages (using log differences), and then converted into basis points (percentage of percentages). If missing observations due to either Canadian or US holidays created gaps, the interval was lengthened. The same statement applies to the interest rate data.

19. These data were made available by DRI, Canada. T-bill yields have been converted to a true yield basis.

20. These data were made available by R. Hannah of the Securities Department of the Bank of Canada. It was possible to use a half-day window for Canadian 90-day Treasury bills. Yields at 3:30 p.m. the day of the announcement were taken from the Bank of Canada's data base, while the next day's mid-morning observations were taken from the Bank's quote sheets.

21. For example, the 20-year bond series was constructed from the heavily traded 9 & 1/2s of 2001 from October 1979 to October 1982 and, from October 1982 to January 1984, the 10 & 1/4s of 2004.

22. The 15-year forward rate five years ahead was derived using the linearization described in Shiller, Campbell, and Schoenholtz [18].

23. For example, see Roley [15] and Huizinga and Leiderman [10].

24. Responses of the fifteen-year forward rate five years ahead were sequentially reestimated between October 1979 and October 1982 with the inclusion of a slope dummy variable that shifted every two weeks. A point was sought such that the absolute value of the t-statistic of the dummy variable was maximized (t = -2.16). As for the second sample break, Loefs actually found this significant break occurring several months prior to October. I continue to use the more a priori defensible October 1982 however.

25. One possibility is that the percentage of the typical short-term interest rate change following surprises attributable to real rather than purely nominal effects increased after June 1981. This interpretation favors the combination hypothesis.

26. Note that the data used here are misaligned, since the exchange rate response is from noon to 4:30 p.m. the day of the announcement, while the Canadian T-bill yield change is from 3:30 p.m. to 10:30 a.m. and the US response is a full-day interval beginning at 3:30 p.m. the day of the announcement. This procedure is valid, since yield or price changes outside the narrowest announcement interval should be orthogonal (under efficient markets) to the changes induced by the surprises themselves.

27. Corrections for likely serial correlation had little effect on the results.

28. I am implicitly viewing forward interest rate changes after surprises as the sum of changes in the ex ante real rate and anticipated inflation. This may be appropriate, since Huizinga and Leiderman [11] were unable to reject constancy of term structure premia after surprises.

29. See Frenkel and Levich [7] for evidence that covered interest parity generally holds within a band whose width is a function of the relevant trading costs. Husted and Kitchen [12] test for maintenance of covered interest parity after money supply announcements and are unable to reject it, though their point estimates consistently point to only partial closure (as here).

30. At the 90-day and 180-day horizons and for all three subperiods, the standard deviations for both exchange rate change proxies are fairly close. This
implies that the correlation (with money surprises) is always lower for the open interest parity proxy, which is indeed the case.

REFERENCES


