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# Pronounced Momentum Patterns Ahead of Major Events

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Many technical analysts and commodity traders try to exploit momentum patterns in financial markets. The time series of many asset prices exhibit a short-term trend continuation bias on daily, weekly, or monthly frequencies; prices are more likely to keep moving in the same direction as before than to assume reversal patterns. For evidence in the bond market, see Ilmanen [1997] and Ilmanen and Sayood [2002].

Continuation frequencies typically differ only slightly from the 50/50 odds of a coin toss. For key yields and exchange rates, the normal frequency of a monthly rate rise or fall to be followed by another week of rising or falling rates is about 53%. Even this modest edge, though, can provide a useful basis for a diversified package of trend-following strategies.

To improve the profitability of these strategies, many market participants have tried to identify times that trends are exceptionally likely to occur or reversals to dominate. Our novel finding is that trend continuation is unusually likely in the run-up to major events (and less likely just after them). For example, the continuation frequency jumps to about 60% during the week the U.S. non-farm payroll report is released (193 monthly observations between 1986 and 2002).<sup>1</sup>

## I. CONTINUATION EFFECTS

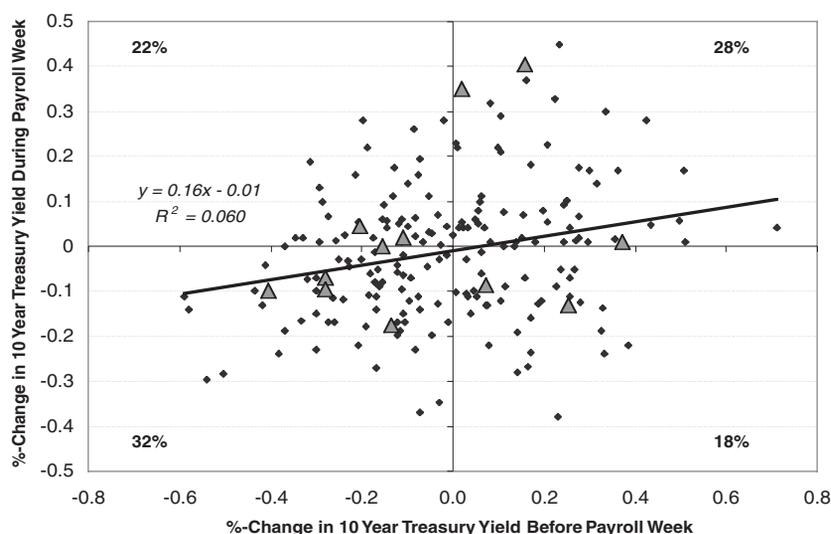
It is generally acknowledged that the most important regular event for bond markets is the U.S. non-farm payroll report typically published on the first Friday of each month. This report provides important and timely information about macroeconomic conditions, including employment growth and the unemployment rate. The report influences investor expectations and policymaker behavior alike.

Any surprises have an instantaneous market impact; the average absolute yield move is higher on the payroll day than on any other day of the month, including days that other economic announcements are made. (Note that our empirical analysis does not focus on yield reaction to the payroll report but rather yield movements before the announcement.)

Exhibit 1 provides a scatterplot of weekly yield changes for ten-year Treasuries during the payroll week (from the previous Friday close to the announcement day close) on the yield trend in the run-up to that week (until the previous Friday close). 60% of the monthly observations are in the top-right (28% up-up) and bottom-left (32% down-down) quadrants. The observations since our initial research report in September 2001, are marked with large triangles—8 out of 12 are in the quadrants where they would be expected.

## EXHIBIT 1

### Trend Continuation During Payroll Week 1986–2002—Ten-Year Treasuries



Monthly observations since July 1986.

Change before payroll week is two-month moving average.

Large triangles represent October 2001 to September 2002.

*Continuation tendency* or *momentum bias* is measured here by how often weekly rate changes have the same sign as the preceding rate trend. Simply put, if yields fall during a given week, and they also trended lower before that week, we count this as trend continuation (and the same for yield increases). The preceding trend can be measured in many ways; here we compare the yield level at the end of the preceding week to its moving average over the previous two months.<sup>2</sup>

The strength of a continuation effect can be seen in graphs like Exhibit 2-A. It shows the cumulative average yield move in ten-year Treasuries during the week before and the week after the payroll release for two subsets of data: payroll weeks that follow rising (up) or falling (down) yield trends over the preceding two months.

We see that uptrends in Treasury yields are followed by rising yields during the payroll week; the average yield increase up to the close of announcement day is 2.1 basis points. Conversely, downtrends are followed by falling yields; the average yield decline up to the close of the announcement day is 4.3 basis points.<sup>3</sup> The results are broadly similar in two subperiods (1986–1993, 1994–2002).

The range between average yield change after up/down months is arguably a better measure of the continuation effect than continuation frequency, because, in principle, a few

large reversals could more than offset frequent continuations. The gap of average yield moves during the payroll week following up/down months is much wider at 6.4 basis points (+2.1/–4.3) than the corresponding gap for the full sample (all days since mid-1986) at 1.2 bp (+0.4/–0.8).

More formally, a difference-in-means test shows that the difference between +2.1 bp and –4.3 bp means is statistically highly significant. The Z-value is 3.0, and a hypothesis of equal means can be rejected at significance levels well below 1%. The statistical results are roughly similar for the other yields and exchange rates analyzed below.<sup>4</sup>

Why is the momentum bias so pronounced during the payroll week? Our best explanation for this regularity is capitulation trades driven by psychological biases.<sup>5</sup>

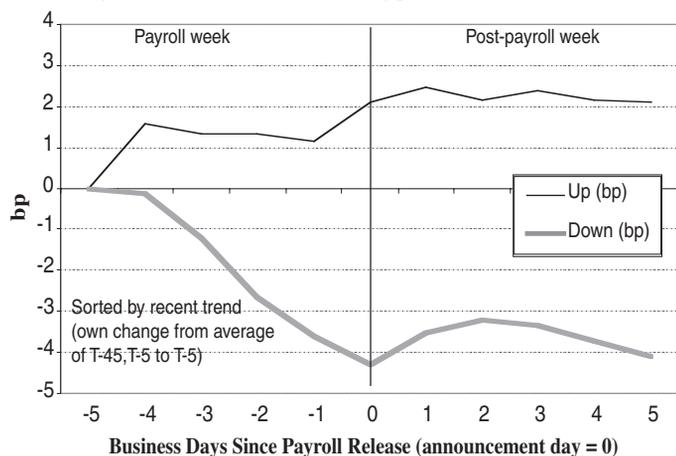
Predictable market-moving events loom large to bond investors, and may impact risk aversion level or sentiment. Traders positioned on the wrong side of the market are more likely to capitulate and close their (losing) positions before the event than those having profitable trades on. This asymmetry in trader reactions can exacerbate asset price moves in the run-up to big events.

In a falling rate environment, bulls are more confident and optimistic before the payroll report, while remaining bears are more likely to throw in the towel. The reverse is true in a rising rate environment.

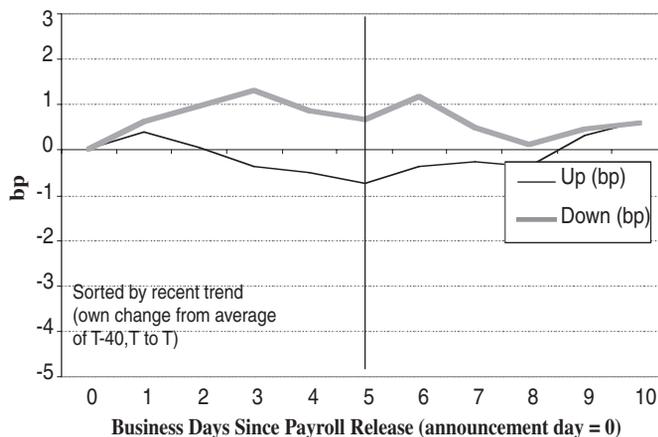
## EXHIBIT 2

### Cumulative Changes in Ten-Year Treasury Yield

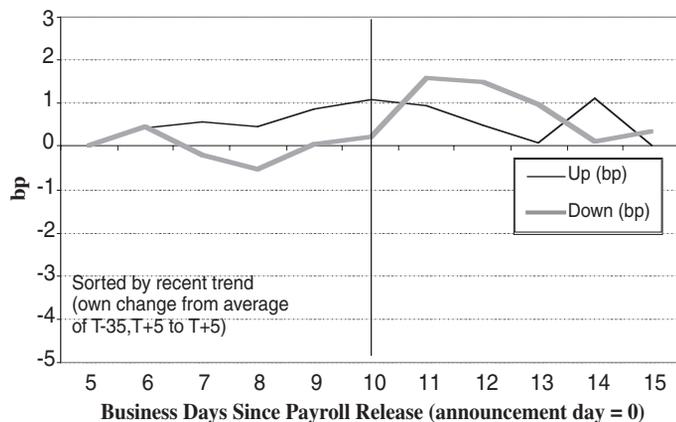
A. Strong continuation tendency during payroll week



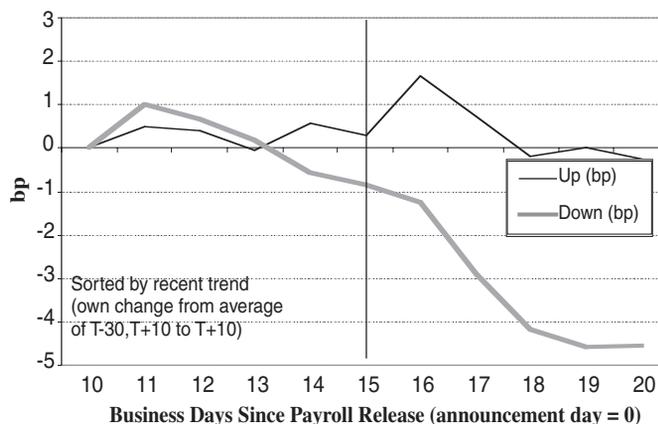
B. Reversal tendency next week



C. Mild momentum tendency in midmonth



D. Next payroll release approaches



Data since mid-1986.

A: One week before payroll day.

B: Close of payroll day.

C: One week after payroll day.

D: Two weeks after payroll day.

### Mild Post-Event Reversals

The idea that Treasury market moves extend through the payroll week would imply a likely reversal after the payroll release. Exhibit 2-B confirms that there is, on average, a mild reversal tendency after the payroll week (although not on the release date); here yields are sorted using data preceding the close of the payroll release day.

For completeness, Exhibits 2-C through 2-D sort yields until one and two weeks after the payroll release and show mild momentum patterns (except for the second week in Exhibit 2-D, which corresponds to the run-up to the next

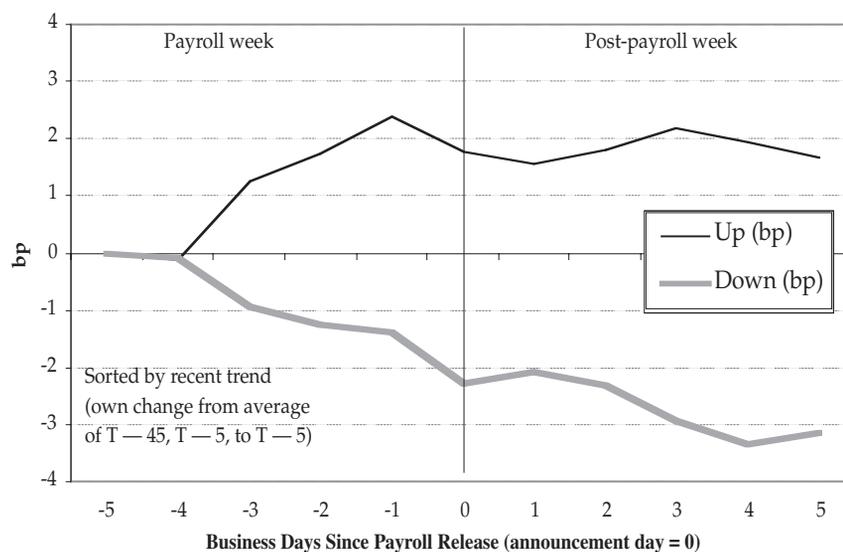
month's payroll release). The trend continuation frequencies for the four weeks are 60.0%, 48.7%, 53.3%, and 55.4%.

Thus, the average momentum pattern for the full sample (52.7%) conceals a pronounced continuation tendency during the payroll week (Exhibit 2-A) and an off-setting reversal tendency during the following week (Exhibit 2-B).

Taking an opposite perspective, we can examine the odds of a reversal in different situations. For any day in the full sample, the likelihood of a weekly reversal in the ten-year Treasury yield (one-week change with an oppo-

## EXHIBIT 3

### Ten-Year Bund—Continuation Into Payroll Week



site sign from the preceding two months' trend) is 47%. During the payroll week, this likelihood falls to 40%, while during the post-payroll week, the likelihood rises to over 51%. Moreover, in the subset of post-payroll weeks that follow payroll weeks with a successful continuation pattern (60% of the sample), the reversal odds are 56%.

### Economic Importance

As our sorting uses data before the payroll week, the apparent ability to distinguish between likely yield rise or fall during the payroll week is a sign of predictability. Traders could exploit this pattern by putting on trend-following strategies at the start of the payroll week, with above-average prospects of success. Traders may want close these positions just before the payroll report so as to capture the pure pre-event momentum and not suffer from the uncertainty related to surprises in the actual economic announcement. Since we do not have within-day data, we cannot judge whether profit prospects would also be enhanced.

Traders may also try to position for post-event reversals for the following week, but from both statistical and economic (trading) perspectives, the pre-event continuation is a more important regularity than the post-event reversal.

Finding 60/40 odds for any week's market directional move is exceptional, and these results can be used each month. Yet, our analysis is partial, and in any given month factors other than momentum are likely to dominate actual rate moves. Thus, the observed regularity may best be used

in conjunction with other information, whether other forecasting models or more discretionary market analysis.

Our findings are interesting not just because they provide one more trading rule or a regularity that should be taken into consideration in market-timing decisions. They also enhance our understanding of the prevalent momentum patterns and suggest other ideas—say, when momentum strategies might work especially well (continuations dominate) and less well (reversals dominate).

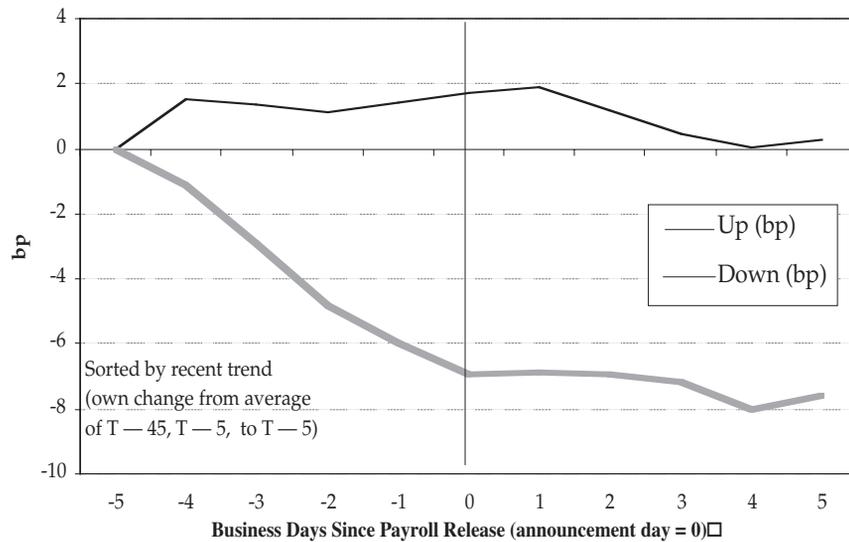
## II. RESULTS FOR VARIOUS ASSETS

There are payroll week momentum patterns for assets other than ten-year Treasuries, which we document in graphs similar to Exhibit 2-A. European government bond yields are highly correlated with Treasury yields and indeed are influenced by the U.S. payroll report more than by any European report. Exhibit 3 shows that the average Bund yield changes following up/down trends until the payroll week are +1.8/−2.3 bp, a much wider range than for the full sample period (+0.9/−1.0 bp). The frequency of continuation is 60%, compared to 54% for the full period (all days since mid-1986).

Exhibit 4 shows similar patterns for two-year Treasuries: average weekly moves of +1.7/−7.0 bp for the two subsamples (versus +1.3/−2.1 bp for the full period), and a frequency of continuation at 64% (versus 57% for the full period).

## EXHIBIT 4

### Two-Year Treasury—Continuation Into Payroll Week



## EXHIBIT 5

### \$/DEM (or euro) Exchange Rate—Continuation Into Payroll Week

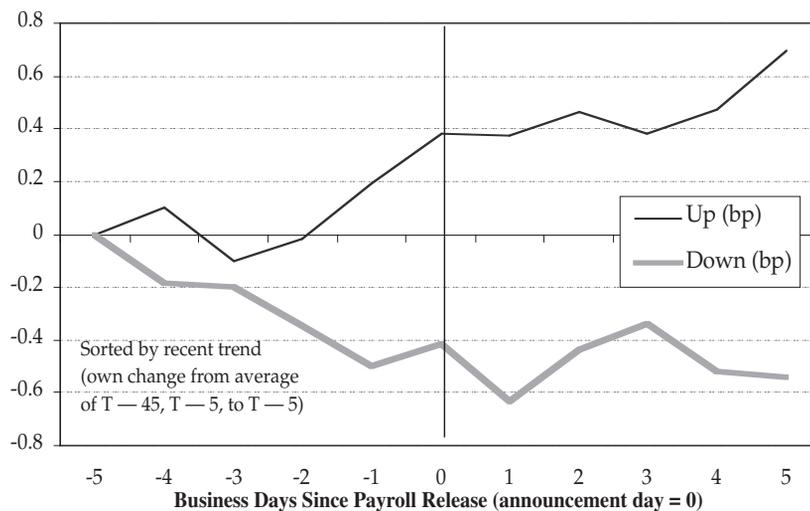


Exhibit 5 shows that the average changes in the dollar-deutschemark (dollar-euro after 1999) exchange rate following up/down trends until the payroll week are +0.4/-0.4 pfennigs (currency units), double the range for the full period. The frequency of continuation is 62% compared to 54% for the full period. The continuation patterns are similar if slightly weaker for the dollar-yen exchange rate in Exhibit 6.

The logic related to currency movements is that stronger economic data point to dollar appreciation, as they do to rising yields and potential monetary policy tightening. Preliminary analysis (not shown) indicates much weaker results for equities.

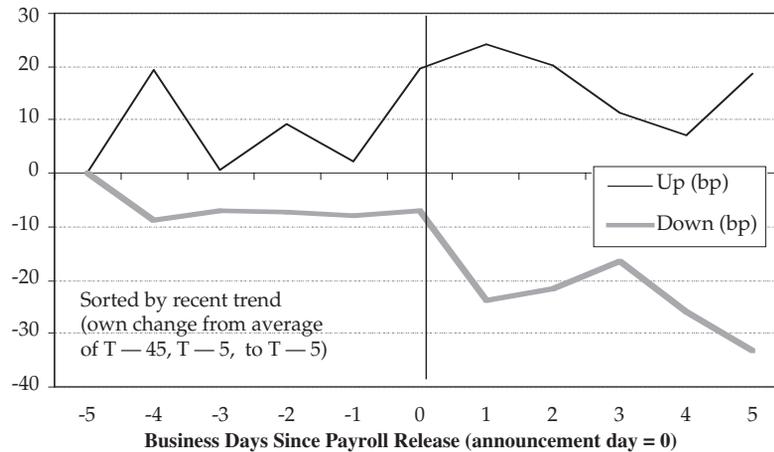
### III. RESULTS FOR OTHER EVENTS

The payroll report has been the most important macroeconomic release for financial markets since the mid-1980s. As a follow-up to payroll date analysis, though, we decided to explore the regular Federal Reserve Open Market Committee dates as another predictable market driver. This is an out-of-sample exercise to seek atypical continuation effects.

We examine regular FOMC dates since mid-1986, whether policy rates are changed or not (130 observations). Preliminary analysis confirms our suspicion that

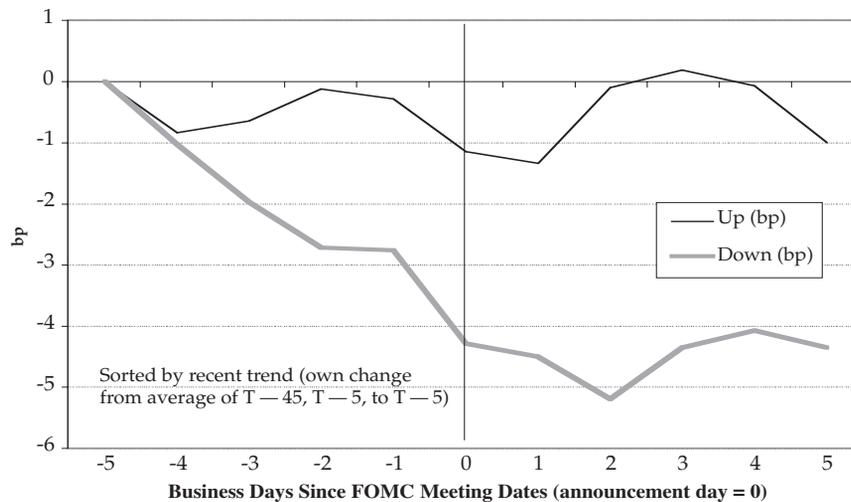
## EXHIBIT 6

### \$/Yen Exchange Rate—Continuation Into Payroll Week



## EXHIBIT 7

### Ten-Year Treasury Yield—Continuation Patterns Before FOMC Date (7/86–8/02 Average)



the results should be somewhat weaker; FOMC dates do not tend to influence markets as much as payroll dates, at least on average.

We find that yield volatility (average absolute daily yield move for 2s and 10s) on FOMC days is comparable to that on other days. This result is a testimony to Chairman Alan Greenspan's success in signaling the Fed's intentions in advance to financial markets and providing no surprises on meeting days (unless surprises are deliberate, as in inter-meeting rate cuts).

Nonetheless, we find similar—although weaker—pre-event continuation patterns, as with the payroll report. For all yields and exchange rates studied, we find above-

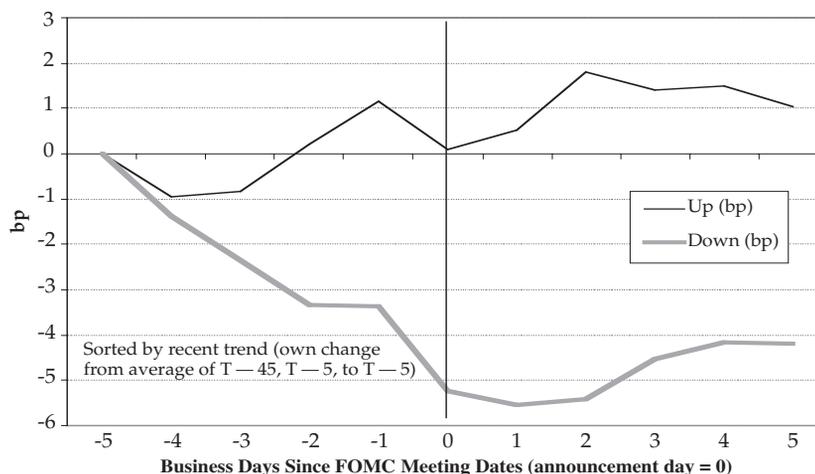
average continuation effects ahead of the FOMC meetings.

As before, we examine market moves one week before and after the event day, sorting each series into two subsamples based on momentum—change over the two months preceding the week before the FOMC meeting. For the ten-year Treasury yield, the frequency of continuation in the FOMC week is 59%.

Exhibit 7 shows that recent uptrends are followed by a flattish average yield move (-1.1 bp), while downtrends are followed by a clearer down movement (-4.3 bp). The patterns are highly asymmetric, partly because short rates almost halved from 7% during our sample period. For the week *after* the FOMC meeting, we again

## EXHIBIT 8

### Two-Year Treasury Yield—Continuation Patterns Before FOMC Date



## EXHIBIT 9

### Trend Continuation During Week Before Big Events—7/86–9/02

	10-Year Treasury	10-Year Bund	2-Year Treasury	DM/\$ FX	Yen/\$ FX
<b>Payroll Release</b> Previous trend is defined as yield □ before payroll week minus its □ moving average over two months	60.0%	60.0%	63.6%	61.5%	56.4%
□ <b>Payroll Release</b> Previous trend is defined as yield □ before payroll week minus yield □ one month earlier	60.0	61.0	62.1	58.5	60.5
<b>FOMC Meeting</b> Previous trend is defined as yield □ before payroll week minus its □ moving average over two months	58.5	53.1	60.8	61.5	54.6
<b>FOMC Meeting</b> Previous trend is defined as yield □ before payroll week minus yield □ one month earlier	59.2	55.4	60.8	56.2	53.1
<i>Normal frequency (benchmark)</i>	52.7	53.7	56.9	53.9	53.4

find a mild reversal pattern (48.5% continuation tendency if yields are sorted up to the FOMC day).

Exhibit 8 shows similar results for two-year Treasury yields as for 10s: uptrend followed by a 0.1 bp up movement, and downtrend followed by a clear down movement (–5.2 bp), on average. The frequency of continuation is 61%. For ten-year Bunds, the frequency of continuation is only 53% (not shown), but the continuation persists beyond five days. By the FOMC day, the up/down trend subsample average yield moves are +0.6 bp/–0.9 bp; another five days later they are +3.0 bp/–2.4 bp.

For the dollar-DEM exchange rate, an uptrend is followed by a +0.3 pf rise, and a downtrend is followed by a 0.7 pf fall, on average, with 62% frequency of continuation. For the dollar-yen rate, an uptrend is followed by a 20 sen rise, and a downtrend is followed by a 55 sen fall, on average, with 55% frequency of continuation (not shown).

Exhibit 9 summarizes the evidence across five assets and two events, with two definitions of trend. The results are broadly similar for all these assets and both events, and whether we use point-to-point rate change or a moving average to measure past trend.

We did some preliminary analysis of European events, considering the release of the IFO (Institut für Wirtschaftsforschung) business confidence indicator the most important. For data between 1999 and 2002, we find a pronounced pre-event continuation tendency, especially for two-year yields in Germany (67%), but also a moderate tendency for ten-year Bunds (56%) and the dollar/DEM exchange rate (58%).

Overall, the empirical regularity of a pronounced pre-event continuation bias appears quite robust.

## ENDNOTES

This article is largely based on research reports written for Schroder Salomon Smith Barney by Antti Ilmanen and Rory Byrne in 2001 and 2002. The original disclaimer applies: “Although the information in this report has been obtained from sources that Schroder Salomon Smith Barney believes to be reliable, we do not guarantee its accuracy, and such information may be incomplete or condensed. All opinions and estimates included in this report constitute our judgment as of the date of first publication and are subject to change without notice. This report is for information purposes only and is not intended as an offer or solicitation with respect to the purchase or sale of any security.”

<sup>1</sup>We thank Matti Ilmanen for highlighting the empirical regularity discussed in these reports. He noted in early 2000 that Treasuries and Bunds appear to regularly sell off in the run-up to the payroll release. This observation was true in the then-prevailing Federal Reserve interest rate-tightening environment. This prompted us to analyze market regularities during the payroll week, after distinguishing between bullish and bearish environments.

<sup>2</sup>In our original analysis, trend was proxied by the difference between yield 5 business days before the payroll date and yield 26 business days before the payroll date (that is, point-to-point monthly yield change). Here we focus on the difference between yield 5 days before the payroll date and the moving average of yields 45 to 5 business days before the payroll date (that is, detrending yield using two-month data).

We prefer this latter approach because the chosen window length is rather arbitrary (say, whether we use yield changes over the preceding fortnight, month, or quarter). Using a

moving average dilutes the impact of the arbitrary starting date.

In any case, we find similar backtesting results whether we compare a yield to the yield exactly one month ago or to an average of several observations during the past two months.

<sup>3</sup>The observed asymmetry (larger average down movements) partly reflects the 300 bp downtrend in yields since mid-1986, even though we tried to select a relatively trendless period.

<sup>4</sup>The only study we are aware of with somewhat similar results focuses on equity markets. Connolly and Stivers [2002] show that equity index momentum tendencies are higher in consecutive weekly returns when the latter week has unexpectedly high turnover and unexpectedly high dispersion in firm-level returns—typically weeks that experience more macroeconomic news releases.

<sup>5</sup>More general explanations for momentum patterns include underreactions or delayed reactions to particular events, positive feedback trading (trend-chasing, stop-loss limits, or extrapolative expectations), and wealth-dependent risk aversion or market sentiment. We find slightly lower momentum profits (more likely reversals) when market consensus is near either extreme (specifically, when the Market Vane survey on Treasury market bullishness is below 30 or above 70). Periods of especially high or low volatility, or recent success or failure of momentum strategies, do not seem to raise the frequency of continuation.

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