An Anatomy of Futures Returns: Risk Premiums and Trading Strategies

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Abstract

This paper analyzes trading strategies which capture the various risk premiums that have been distinguished in futures markets. On the basis of a simple decomposition of futures returns, we show that the return on a short-term futures contract measures the spot-futures premium, while spreading strategies isolate the term premiums. Using a broad cross-section of futures markets and delivery horizons, we examine the components of futures risk premiums by means of passive trading strategies and active trading strategies which intend to exploit the predictable variation in futures returns. We find that passive strategies which capture the spot-futures premium do not yield abnormal returns, in contrast to passive spreading strategies which isolate the term premiums. The term structure of futures yields has strong explanatory power for both spot and term premiums, which can be exploited using active trading strategies that go long in low-yield markets and short in high-yield markets. The profitability of these yield-based trading strategies is not due to systematic risk. Furthermore, we find that spreading returns are predictable by net hedge demand observed in the past, which can be exploited by active trading. Finally, there is momentum in futures markets, but momentum strategies do not outperform benchmark portfolios.

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1 Introduction

Futures contracts are known to demand risk premiums in various ways. First, as the price of a futures contract will converge to the spot price of the underlying asset, we can expect that the risk factors that drive the underlying asset returns will also generate risk premiums in the corresponding futures returns. These spot-futures premiums have been analyzed for instance by Bessembinder (1992), who investigates whether futures markets and asset markets are integrated and finds that premiums for systematic risk factors in equity markets and 22 different futures markets are very similar. Although Dusak (1973) finds that for three different agricultural contracts the CAPM-beta is basically zero, Jagannathan (1985) finds that for the same three contracts the consumption-based CAPM does imply significant risk premiums and finds market prices of risk that coincide with those found in equity markets. Bessembinder and Chan (1992) report that instrumental variables known to possess forecast power in equity and bond markets also possess forecast power for prices in agricultural, metals, and currency futures markets. This evidence of predictability is consistent with the existence of time-varying risk premiums in futures markets.

Second, using a simple cost-of-carry relationship between the spot and the futures price, the term structure of futures prices depends on the term structure of the cost of carry, or yield.[1] Similarly to the term structure of interest rates, the term structure of yields can be expected to contain term premiums that show up in the expected futures returns. DeRoon, Nijman, and Veld (1998) analyze the yields of five different futures contracts and show that they contain term premiums that lead to predictable variation in returns on spreading strategies (i.e., combined long and short positions in futures contracts on the same underlying asset but with different maturities.) Earlier research by Fama (1984) and Fama and French (1987) has shown that the level of the yield also contains information about the spot-futures premium. This implies that the yield is not only relevant because it gives rise to term premiums, but also because it is linked to the spot-futures premium. Furthermore, Bessembinder, Coughenour, Seguin, and Smoller (1995) find a negative relation between futures yields and the spot price of the underlying asset, which is indicative of an anticipated mean reversion in asset prices.

Finally, without differentiating with respect to futures' maturities, there is an extensive literature that shows that the net hedge demand for futures

[1] The yield of a futures contract is defined as the annualized percentage spread between the futures price and the spot price of the underlying asset.

contracts induces risk premiums in futures markets. This is known as the hedging pressure effect. Although the description of the hedging pressure effect dates back to Keynes (1930) and Hicks (1939), the empirical relevance of the effect has only been documented during the last two decades in Carter, Rausser, and Schmitz (1983), Chang (1985), Bessembinder (1992), and DeRoon, Nijman, and Veld (2000). These studies find that the net position of hedgers in futures indeed results in significant and time-varying risk premiums, an effect that is especially strong in commodity futures markets, and to a lesser extent in financial futures markets. Also, as DeRoon, Nijman, and Veld (2000) show, there appear to be spillover effects of hedging pressure from one market to another caused by cross-hedging.

This paper analyzes trading strategies that intend to capture the various premiums in futures markets. We study the cross-section of futures returns over different markets and different delivery horizons, and link the differences in returns to the various risk premiums that have been distinguished in these markets. The paper therefore provides a link between different parts of the futures literature, and it translates futures premiums into implementable trading strategies.

We start by analyzing the unconditional mean returns of futures contracts. This amounts to an analysis of static futures-only strategies. These strategies are of interest in themselves because they provide an understanding of passive strategies that may serve as a benchmark for hedge funds and commodity trade advisors (CTAs) that are active in those markets. Although such passive strategies serve a purpose of their own, it may very well be that the underlying factors are already captured by equity and bond markets. Therefore, we also analyze the performance of passive futures strategies relative to equity, bond, and currency benchmarks, similar to the ones used by Fung and Hsieh (1997, 2000) in analyzing the performance of hedge funds and CTAs. To the extent that futures returns and asset returns are generated by the same risk factors (as documented by Bessembinder (1992)), we may expect that there will be no outperformance of equity and bond portfolios by passive futures trading. Indeed, we find that, generally, unconditional mean returns are zero after correcting for these benchmarks. We do, however, find evidence of non-zero average returns for passive spreading strategies which go long in long-term contracts and short in the nearest-to-maturity contract.

We proceed by analyzing active trading strategies that exploit the predictable variation in futures returns. We study predictability from three sources: the term structure of futures yields, the hedging pressure effect, and past returns or momentum. The forecast power of yields, previously documented in Fama (1984) and Fama and French (1987), is re-examined using contracts that cover a wider range of futures contracts and of the term structure of futures prices than before. Next, we investigate whether the hedging pressure effect can explain the variation in spot and term premiums. Finally, we examine whether futures returns are forecastable by past returns. We find that futures yields across a wide range of maturities have substantial forecast power for both short and spreading returns. These returns are also predictable by past hedging pressure, while momentum is only present in spreading returns.

In order to exploit forecastability of futures returns, we use active trading strategies along the lines of Jegadeesh and Titman (1993) and Fama and French (1992, 1995). These trading strategies sort futures markets every period on a particular characteristic into groups, and then take long positions in one group and short positions in another. For instance, the information in the yields is used to construct a portfolio of long positions in a group of low-yield futures markets, and short positions in a group of high-yield futures markets. The returns on the nearest-to-maturity contracts in this periodically updated spreading portfolio exploit the spot-futures premium, while the returns on longer-maturity contracts also capture the term premium. Using information variables such as yields, hedging pressure, and past returns in futures markets is similar in nature to using information variables such as dividend yields or price-earnings ratios in equity markets. As with the passive strategies, we also analyze the performance of the active strategies relative to equity, bond, and currency benchmarks. Our results show that predictability in both spot and spreading returns can be exploited using yield-based trading strategies. Strategies based on past hedging pressure also outperform benchmark portfolios. Finally, in contrast with results in equity markets, momentum strategies do not appear to pay in futures markets. Our findings seem to hold up under a number of robustness tests.

The paper proceeds as follows. Section 2 shows a simple decomposition of futures returns that enables us to isolate the different elements of the expected futures returns. Moreover, it describes how we construct active trading strategies on the basis of predictable futures returns. Section 3 describes the data and provides empirical results for the passive futures strategies. Section 4 analyzes the active strategies based on futures yields, hedging pressure, and momentum. In Section 5 we examine the robustness of the empirical results by splitting up the sample period, by varying the investment horizon, and by taking into consideration transaction costs. Section 6 concludes.

2 Methodology

2.1 A decomposition of futures returns

We start our analysis with a simple decomposition of futures returns that highlights the different premiums that are present in futures markets. Denoting by S_t the spot price of the underlying asset, and by $F_t^{(n)}$ the futures price for delivery at time $t+n$, we use the storage model or cost-of-carry relation, which dates back to Working (1949) and Brennan (1958), to define the *yield* $y_t^{(n)}$:

$$F_t^{(n)} = S_t \exp\{y_t^{(n)} \times n\}. \tag{1}$$

Thus, $y_t^{(n)}$ is the per-period yield for maturity n, analogous to the n-period interest rate. It is also the slope of the term structure of (log) futures prices, as is readily seen by solving (1) for $y_t^{(n)}$. This yield consists of the n-period interest rate, and possibly other items such as dividend yields, foreign interest rates, storage costs, and convenience yields, depending on the nature of the underlying asset.

From the one-period expected log-spot return we define the spot risk premium $\pi_{s,t}$ as the expected spot return in excess of the one-period yield,

$$\begin{aligned} E_t\left[r_{s,t+1}\right] &= E_t\left[\ln(S_{t+1}) - \ln(S_t)\right] = E_t\left[s_{t+1} - s_t\right] \\ &= y_t^{(1)} + \pi_{s,t}, \end{aligned} \tag{2}$$

where we take expectations E_t conditional on the information available at time t and use lower cases to denote log prices. The spot premium $\pi_{s,t}$ can be interpreted as the expected return in excess of the short-term yield, similar to stock returns in excess of the short-term interest rate and dividend yield. It is easy to show that the spot premium is also the expected return of the short-term futures contract, $r_{f,t+1}^{(1)}$, i.e., the return on the futures contract that matures at time $t+1$. This follows from applying the cost-of-carry relation in (1) to such a contract and from the fact that the futures price converges to the spot price at the delivery date:

$$\begin{aligned} E_t[r_{f,t+1}^{(1)}] &= E_t[s_{t+1} - f_t^{(1)}] \\ &= E_t[s_{t+1} - s_t - y_t^{(1)}] = \pi_{s,t}. \end{aligned} \tag{3}$$

Next, we define a term premium $\pi_{y,t}^{(n)}$ similarly to DeRoon, Nijman, and Veld (1998), as the (expected) deviation from the expectations hypothesis of the term structure of yields:

$$ny_t^{(n)} = y_t^{(1)} + (n-1)E_t[y_{t+1}^{(n-1)}] - \pi_{y,t}^{(n)}. \tag{4}$$

DeRoon, Nijman, and Veld (1998) estimate the term premiums for five different futures contracts, using one-factor models for the yields similar to the Vasicek-model and the Cox-Ingersoll-Ross model for the term structure of interest rates. Without imposing any structure on the term structure of yields, it is important to note that the term premium $\pi_{y,t}^{(n)}$ also shows up in the expected return on a futures contract for delivery at time $t+n$. This follows from the log return on such a contract and applying the cost-of-carry relation again. Using the definitions of $\pi_{s,t}$ and $\pi_{y,t}^{(n)}$ in (2) and (4) it is easily seen that the expected one-period futures return for a contract that matures at time $t+n$ is:

$$\begin{aligned} E_t[r_{f,t+1}^{(n)}] &= E_t[f_{t+1}^{(n-1)} - f_t^{(n)}] \\ &= \pi_{s,t} + \pi_{y,t}^{(n)} \equiv \pi_{f,t}^{(n)}. \end{aligned} \tag{5}$$

Thus, the expected one-period return on an n-period futures contract consists of the futures premium $\pi_{f,t}^{(n)}$ only, which can be separated in a spot premium $\pi_{s,t}$ and a term premium $\pi_{y,t}^{(n)}$. Notice that it follows immediately from (3) that $\pi_{y,t}^{(1)} = 0$, i.e., the short term futures contract does not contain a term premium.

This decomposition of the futures premium into a spot premium and a term premium is a useful starting point for our analysis. From (3) we have that the spot premium can be identified with a long position in a short-term futures contract. Using spreading strategies it is also possible to isolate the term premium. Combining a long position in an n-period futures contract with a short position in an m-period futures contract on the same underlying asset, the expected return on this portfolio is

$$E_t[r_{f,t+1}^{(n)} - r_{f,t+1}^{(m)}] = \pi_{y,t}^{(n)} - \pi_{y,t}^{(m)}. \tag{6}$$

If $m = 1$, i.e., if we combine a long position in a long-term contract with a short position in the short-term contract, then the expected return on the spreading strategy is generated by one term premium $\pi_{y,t}^{(n)}$ only. Otherwise the expected return is a combination of two term premiums.

The decomposition in (5) is important, because the two risk premiums $\pi_{s,t}$ and $\pi_{y,t}^{(n)}$ are likely to compensate for different risk factors. For instance, in case of index futures, $\pi_{s,t}$ reflects equity market risk, whereas $\pi_{y,t}^{(n)}$ reflects interest rate risk. In case of oil futures the spot premium reflects the oil price risk, whereas the term premium mainly reflects the risk that is present in the convenience yield. Therefore, we will focus on short-term futures trading strategies and on spreading strategies in order to capture the expected returns generated by the different risk factors, i.e., to capture both the spot premiums and the term premiums.

2.2 Predictability and active trading strategies

We now show how predictable variation in futures returns can be used to construct simple, implementable active trading strategies. Suppose that the spot-futures premium $\pi_{s,t}$ in a particular market can be forecast by an instrument x_t, observable at time t, through the following simple linear relation:

$$\pi_{s,t} = \alpha + \beta x_t, \tag{7}$$

and suppose that β is positive. As mentioned before, the spot premium is the expected return on the short-term futures contract; see Equation (3). Thus, investors could take a long position in the short-term contract whenever the instrument has a high value, and a short position otherwise. Such an active trading strategy would yield a return that is on average higher than the return on a passive strategy which is long in the contract at any given time. If markets are efficient, this higher expected return compensates for additional risk involved in the active strategy.

Similar trading strategies can be constructed if term premiums can be explained by observable variables. In that case, we use the fact that the n-th term premium $\pi_{y,t}^{(n)}$ is the expected return on a spreading strategy which takes a long position in the n-period futures contract combined with a short position in the short-term contract; see Equation (6). Denoting again by x_t the forecast variable, and assuming a positive relation between the term premium and the forecast variable, a simple active trading strategy would be to take a long position in the long-term contract combined with a short position in the short-term contract whenever the instrument has a high value, and a short position in the long-term contract combined with a long position in the short-term contract otherwise.

In this paper we focus on predicability of returns using instruments which are observed in all futures markets, such as futures yields, hedgers' positions, and past returns. This allows us to construct trading strategies along the lines of Jegadeesh (1990), Lehmann (1990), and Jegadeesh and Titman (1993) which operate in multiple markets. These studies analyze the returns on momentum strategies in equity markets. Momentum strategies are spreading strategies which buy stocks that have performed well in the past and sell stocks that have performed poorly in the past. Similarly, trading strategies based on, for instance, futures yields can be formed by ranking futures markets on their yields at a given point in time, and taking positions in high-yield contracts (for instance, the one-third highest yield contracts) combined with offsetting positions in low-yield contracts (the one-third lowest yield contracts). At a later date, the futures portfolio is updated by sorting the markets again on the then prevailing yields, and adapting positions accordingly; and so on. Note that this type of strategy depends on the rank order statistics of the forecast variable (in this case the futures yields), and, hence, requires the use of market-specific instruments. Forecast variables which are not directly related to futures markets, such as the equity and bond market variables used by Bessembinder and Chan (1992), are not applicable here.

In Section 4 we analyze the time variation of both components of the futures premium using futures yields, hedging pressure, and past returns as explanatory variables, and we examine if any explanatory power found can be exploited using the simple type of trading strategy sketched above. First, however, we analyze the performance of passive futures strategies.

3 Data, descriptive statistics, and passive trading

We analyze a data set consisting of semi-monthly observations of 23 U.S. futures markets over the interval January 1986 to December 2000 obtained from the Futures Industry Institute (FII) Data Center. Using the classification of Duffie (1989), the data can be divided into 16 commodity futures contracts and seven financial futures contracts. The commodities include grains (wheat, corn, and oats), soybean complex (soybeans, soybean oil, and soybean meal), livestock (live cattle, feeder cattle, and live hogs), energy (crude oil and heating oil), metals (gold, silver, and platinum), and foodstuffs (coffee and sugar). The financial contracts include interest rates (Eurodollars), foreign currencies (Swiss francs, British pounds, Japanese yen, and Canadian dollars), and equity indices (S&P 500 and NYSE composite). These markets have relatively large trading volumes and provide a broad cross-section of futures markets. Details about the delivery months and the exchanges where these futures contracts are traded are in Table I.

Following common practice in the literature (see, for example, Fama and French (1987), Bessembinder (1992), Bailey and Chan (1993), Bessembinder, Coughenour, Seguin, and Smoller (1995) and DeRoon, Nijman, and Veld (2000)), we construct continuous series of futures returns by using rollover strategies. For the nearest-to-maturity series a position is taken in the nearest-to-maturity contract until the delivery month, at which time the

Table I: **Futures exchanges and Delivery Months**

Contract	Exchange	Delivery months
Commodities		
Grains		
Wheat	Chicago Board of Trade	3 5 7 9 12
Corn	Chicago Board of Trade	
Oats	Chicago Board of Trade	3 5 7 9 12[a]
Oil & Meal		
Soybeans	Chicago Board of Trade	1 3 5 7–9 11
Soybean oil	Chicago Board of Trade	1 3 5 7–10 12
Soybean meal	Chicago Board of Trade	1 3 5 7–10 12
Livestock		
Live cattle	Chicago Mercantile Exchange	2 4 6 8 10 12
Feeder cattle	Chicago Mercantile Exchange	1 3–5 8–11
Live (lean) hogs	Chicago Mercantile Exchange	2 4 6–8 10 12
Energy		
Crude oil	New York Mercantile Exchange	All
Heating oil	New York Mercantile Exchange	All
Metals		
Gold	Commodity Exchange, Inc.	2 4 6 8 10 12[b]
Silver	Commodity Exchange, Inc.	2 4 6 8 10 12[b c]
Platinum	New York Mercantile Exchange	1 4 7 10
Foodstuffs		
Coffee C	Coffee, Sugar & Cocoa Exchange	3 5 7 9 12
Sugar #11	Coffee, Sugar & Cocoa Exchange	1[d] 3 5 7 9[e] 10
Financials		
Interest Rates		
Eurodollars	International Monetary Market	3 6 9 12[f]
Foreign Currencies		
Swiss franc	International Monetary Market	3 6 9 12
Pound Sterling	Chicago Mercantile Exchange	3 6 9 12
Japanese yen	International Monetary Market	3 6 9 12
Canadian dollar	International Monetary Market	3 6 9 12
Indices		
S&P 500	International Monetary Market	3 6 9 12
NYSE Composite	New York Futures Exchange	3 6 9 12

[a]November 2000 and January 2001 contracts also traded; [b]All delivery months traded in 1995–2000; [c]Except November 1998; [d]January contracts traded until 1990; [e]September contracts traded until 1987; [f]All delivery months traded in November 1995–June 2001.

position changes to the contract with the following delivery month, which is then the nearest-to-maturity contract. In this way we are able to derive return series for second nearby contracts, third nearby contracts, et cetera. Prices of futures observed in the delivery month are excluded from the analysis to avoid obligatory delivery of the physical asset. At least four different return series exist for each contract, up till 12 series for the oil contracts. Depending on the delivery dates during the year, the different series are for delivery one to three months apart. We obtain a maximum of 376 observations per series.

Since the delivery dates are more than two weeks apart for all contracts, and since for many futures the delivery dates are not evenly spread over the year, it is not possible to get the exact short futures returns on regular time intervals. Assuming that the term premium is relatively unimportant for the nearest-to-maturity contracts, we use the returns on those contracts as a proxy for the short futures returns, $s_{t+1} - f_t^{(1)}$. The first column of Table II gives the average returns of the nearest-to-maturity contracts for the different futures. These are estimates of the unconditional spot-futures premiums $E[\pi_{s,t}]$. Except for oats, which has an estimated premium of -15.5 percent on an annual basis, and the equity indices, which require compensations of 8.6 and 7.8 percent, the hypothesis that the mean short futures return is zero cannot be rejected for any of the futures markets at the 5 percent level, indicating that most of the markets considered do not demand significant spot premiums.[2] Similar evidence is found in, e.g., Bessembinder (1992), Bessembinder and Chan (1992), and DeRoon, Nijman, and Veld (2000) who also study broad cross-sections of futures markets using various sample periods that only partially overlap with our sample period. However, as Bessembinder and Chan (1992) point out, "while zero-mean returns are consistent with the absence of risk premia, they are also consistent with the existence of time-varying risk premia." Hence, the fact that returns are zero on average does not preclude non-zero conditional premiums.

The next columns of Table II show the average returns on passive spreading strategies which combine a long position in a longer-maturity contract with a short position in the nearest-to-maturity contract. Using (6) and assuming that the term premium on the short contract is approximately zero, the average returns on the spreading strategies give us estimates of the unconditional term premiums $E[\pi_{y,t}^{(n)}]$ for various maturities. Significant term premiums are found for many markets, in particular grains, soybean

[2] All statistical tests were conducted using White's (1980) heteroskedasticity-consistent standard errors, unless stated differently.

complex, heating oil, and Eurodollar futures. For many futures there is also a clear pattern in the average spreading returns, implying an average term structure of futures prices that is either upward or downward sloping. Except for the financial futures, the estimated term premiums often have the opposite sign of the corresponding spot premiums. As is clear from (5), an estimate of the total unconditional futures premium is obtained by adding the average short return to the average spreading return.

The standard deviations also show a clear structure over the different maturities, where the volatility of the spreading strategies is always increasing in the maturity of the contract. The volatility of the short-term futures contract is always higher than than the volatility of the spreading strategies for the same underlying asset, implying that spot price risk is larger than yield or basis risk. However, for many commodity markets the yield or basis risk is as high as the spot price risk of the index futures and even higher than the spot price risk of the Eurodollar futures as well as some currency futures.

Thus, Table II illustrates the relevance of both spot premiums and term premiums as components of the average returns on passive, futures-only strategies. We analyze the underlying factors that determine these premiums by examining the relative performance of these passive strategies with respect to several benchmarks. First, we test whether the returns can be explained by the Capital Asset Pricing Model. We consider as a benchmark the return on the MSCI U.S. equity index in excess of the risk-free rate as measured by the one-month Eurodollar deposit rate. The first column of Table III gives Jensen's unconditional measure of performance—Jensen's alpha—for the nearest-to-maturity contracts. Apart from the index futures, the nearest-to-maturity alphas do not differ much from their unconditional means. Indeed, the corresponding CAPM-betas (not reported here) are close to zero. This is consistent with Dusak's (1973) finding that for wheat, corn, and soybean futures systematic risk is basically zero. As expected, the CAPM captures the factors underlying the spot premium in the index futures well, with betas close to 1.0 and alphas indistinguishable from zero. However, the significant spot premium in the short-term oats contract cannot be explained by domestic equity market risk.

The alphas of the spreading strategies are reported in the next columns of Table III. The futures markets that showed significant term premiums also have non-zero alphas, which are similar to their unconditional means. Indeed, the CAPM-betas for the spreading strategies are basically zero, implying that the term premiums in futures markets cannot be accounted for by the market portfolio. Most futures show an upward or downward sloping term structure of Jensen's alphas.

As an alternative to the CAPM we consider a six-factor model which includes, apart from the excess returns on the MSCI U.S. equity index, five other benchmarks. They are: the excess returns on non-U.S. equities (from MSCI), U.S. and non-U.S. government bonds (from J.P. Morgan), emerging market stocks (from IFC), and the U.S. dollar (from the U.S. Federal Reserve). These benchmarks are similar to the ones used by Fung and Hsieh (1997, 2000) in analyzing the performance of hedge funds and CTAs. The remaining columns of Table III present the unconditional multi-factor alphas for the short futures returns and the returns on the spreading strategies. By and large the same pattern emerges; non-zero alphas are found in the same markets as before (grains, soybean oil and meal, heating oil, silver, and Eurodollars), and they are of the same sign and order of magnitude as in the CAPM case.

To sum up, Table III demonstrates that passive rollover trading strategies, which go long in the nearest-to-delivery futures contract, do not outperform or are not outperformed by the market portfolio, except in one or two cases. There is somewhat more evidence that passive, short-term trading produces abnormal returns relative to a set of equity, bond, and currency benchmarks. Passive spreading strategies, which capture the term structure of futures prices, do yield abnormal returns in a significant number of markets, both with respect to the market and multiple benchmarks.

4 Active trading strategies

We now turn to an analysis of the time variation in the spot and term premiums of futures returns. Our goal is to examine whether the predictable variation in either component can be exploited in simple, active trading strategies explained in Section 2.2. Three sources of predictability are considered: futures yields, hedging pressure, and past returns.

4.1 Yield-based strategies

Using (1), the yield on the m-th nearby futures contract is defined as the spread between the m-th nearby log futures price and the log spot price of the underlying asset, divided by the remaining time to maturity,

$$y_t^{(m)} = \frac{f_t^{(m)} - s_t}{T^{(m)} - t}, \tag{8}$$

where $T^{(m)}$ is the delivery date of the m-th nearby contract.[3] Since the moment of settlement within the delivery month is often at the option of one of the contract participants or not easily determined due to market-specific regulations, we cannot measure the time to maturity of the contract exactly. To solve this problem, we assume that contracts are settled at the 15-th of each delivery month. This assumption may potentially result in some measurement error, in particular for the nearest-to-delivery contracts, since the relative effect of errors will be largest on the shortest maturity, whereas it vanishes for longer-maturity contracts. It is important to note, however, that the results for the yield-based trading strategies are not likely to be affected by the exact measurement of the futures yields, since only the order statistics of the relative yields—not their nominal value—play a role in the trading strategies.

Table IV shows the average annualized yields of the first to the sixth nearby contract for every futures market along with the standard deviations. Upward as well as downward sloping term structures are common in futures markets, apparently independent of the classification given in Table I. Yields tend to be larger in absolute value and more variable for agricultural futures (grains, soybean complex, livestock, and foodstuffs) than for energy and metal futures. Financial futures have even smaller yields and show the least variability. For most commodity futures, there is either an upward or a downward sloping term structure of yields, while index and currency futures show a flat term structure.

The theory of storage—which predicts that a futures' yield equals the interest rate plus the marginal storage cost, less the marginal convenience yield from holding the underlying asset—can help us interpret these figures. Convenience yields and storage costs are important for many commodities, and they are likely to be more important and variable for agricultural futures than for energy and metal futures; see, e.g., Bessembinder, Coughenour, Seguin, and Smoller (1995). For the currency and index futures, no storage cost or convenience yield is likely to be included in the yield to maturity. Theory predicts that the yield on currency futures is equal to the differential between domestic and foreign interest rates. For instance, for Japanese yen futures, the positive mean yield implies that U.S. interest rates were, on average, higher than Japanese interest rates by about 3.0 percent per year. The relatively constant term structure of yields observed for the currency futures implies that there have been, on average, little differences between

[3] Note the difference in notation with Section 2. The number in brackets now refers to the order of maturity, not the actual time to maturity of the contract.

interest rate differentials across different maturities. For index futures, the yield on the n-th nearby contract reflects the domestic interest rate of the same maturity. The flat yield term structure implies that the term structure of interest rates was relatively flat on average.

Documenting predictability from yields

Previous research has examined the forecast power of yields for futures returns. Fama (1984) shows that the current short-term futures-spot differential, or basis, i.e., the numerator in (8), has power to predict the future change in futures prices in a number of currency futures markets. Fama and French (1987) find that the short-term basis in agricultural and metal markets also contains information about the variation in futures premiums, both the spot-futures premium as well as longer-term futures premiums. DeRoon, Nijman, and Veld (1998) find that the spreads between futures and spot prices have power to explain term premiums for gold and soybean contracts.

We re-examine the forecast power of futures yields using not only the short-term yield but the entire term structure of futures yields. For each futures markets, we regress the semi-monthly return on the nearest-to-maturity contract on the current yield of the m-th nearby contract,

$$r^{(1)}_{f,t+1} = \alpha_{1m} + \beta_{1m} y^{(m)}_t + \varepsilon^{(1,m)}_{t+1}, \tag{9a}$$

for $m = 1, \ldots, 6$. Deviations of β_{1m} from zero imply that the spot-futures premium can be explained by the m-th nearby yield. Analogously, we regress the return on spreading strategies which go long in the n-th nearby contract and short in the nearest-to-maturity contract on the m-th nearby yield,

$$r^{(n)}_{f,t+1} - r^{(1)}_{f,t+1} = \alpha_{nm} + \beta_{nm} y^{(m)}_t + \varepsilon^{(n,m)}_{t+1}, \tag{9b}$$

for $n = 2, \ldots, 6$ and $m = 1, \ldots, 6$. Evidence of non-zero β_{nm} indicates that the m-th nearby yield has explanatory power for the n-th term premium in futures prices.

Equations (9a) and (9b) lead to 36 regressions for each of the 23 markets under scrutiny. Table V summarizes the results of these regressions. Panel A reports for all (n, m) combinations the p-value for a test that the slope coefficients are zero in all markets. Clearly, this hypothesis is rejected in many cases. In particular, the short yield has strong forecast power for short as well as most spreading returns, and the term structure of yields appears to contain information about both short returns and second, fourth, and sixth nearby spreading returns. Panel B of Table V shows for each (n, m) pair the number of markets for which predictability is found, i.e., the number of slope coefficients which differ significantly form zero at the 10 percent level. Predictability seems to be strongest for the short return using the short yield—significance is found in eight out of 23 markets.

Moreover, a clear pattern emerges from the signs of the slope coefficients, which are marked by a + or − in Panel B of Table V. All markets in which predictability of the short return is found have negative yield coefficients, whereas virtually all markets with predictable spreading returns have positive yield coefficients. Hence, for a significant number of contracts, current yields tend to have a negative impact on the spot-futures premium and a positive impact on term premiums. The negative effect of yields on the spot-futures premium is also found by Fama (1984) and Fama and French (1987). Research on the relation between yields and term premiums is scarce; DeRoon, Nijman, and Veld (1998) examine five markets using observation from March 1970 until December 1993, and detect a significant relation for gold and soybean contracts, which is negative rather than positive. We do not find reliable forecastability for these contracts in our sample period, which only partly overlaps with theirs.

Exploiting predictability from yields

The negative relation between futures yields and short-term returns suggests that a simple, active trading strategy, which goes long in the nearest-to-maturity contract if current yields are low, and short if current yields are high, would yield a positive expected return. Similarly, profits could be made using a trading strategy which takes a long position in a long-term contract combined with a short position in the nearest-to-maturity contract if current yields are high, and opposite positions if current yields are low. By constructing cross-market portfolios of offsetting positions in low-yield and high-yield markets, one may exploit the predictability of returns in futures markets as a whole.

Analogously to the work by Jegadeesh (1990) and others on momentum strategies, and the work by Fama and French (1992, 1995) on size and book-to-market factors in equity markets, we sort all 23 futures contracts on their short yield at every date in the sample into three groups of about equal size: a low-yield group, a high-yield group, and a group with intermediate yields.[4] We then form a simple spreading portfolio of equally-weighted long positions

[4]The low-yield group and the high-yield group each consist of the nearest integral value of $N_t/3$ contracts, where N_t is the number of markets for which price data is observed.

in the low-yield group combined with as many equally-weighted short positions in the high-yield group. Portfolios are updated in this way every period. Similar portfolios are constructed using yields of longer maturities.

The first column of Table VI shows the averages, standard deviations, and Jensen's alphas (both CAPM and multi-factor based) for the nearest-to-maturity returns on these active trading strategies. Clearly, the average portfolio returns are positive and significantly different from zero. The average return increases from 7.4 percent on an annual basis for the short yield-based strategy to 12.9 percent per year as the maturity of the yield goes up, but this also leads to a higher risk as measured by the standard deviation of the return. The performance of the yield-based strategies is little changed after correcting the returns for market risk. Moreover, the hypothesis that Jensen's alphas are zero is strongly rejected for all maturities. If, instead of the CAPM, we use a six-factor benchmark, the results are only slightly less powerful.

The next columns of Table VI present the results for active trading strategies which combine two spreading strategies: one spreading strategy takes long positions in long-term contracts and short positions in short-term contracts in the high-yield group; the other takes short positions in the long-term contracts and long positions in the short-term contracts in the low-yield group. As expected, mean returns and standard deviations are lower than for the nearest-to-maturity returns. There is a clear upward sloping term structure in the expected returns and standard deviations of the trading strategies. All average returns differ significantly from zero at the 10 percent level, while many differ significantly from zero at the 5 and even the 1 percent level. Again, the size and significance of the results hardly changes if returns are corrected for market risk. A multi-factor correction dampens the results somewhat, but most alphas remain significant at the 10 percent level, with results being particularly strong for the longer-maturity term-spreading returns.

4.2 Strategies based on past hedging pressure

Next, we investigate the time variation of risk premiums through the hedging pressure effect. The hedging pressure effect implies that the net demand for futures contracts induces risk premiums in futures markets. Previous studies find that the empirical relevance of the effect is substantial. Carter, Rausser, and Schmitz (1983) analyze the weekly returns on contracts of different delivery months in wheat, corn, soybean, cotton, and cattle markets, and provide strong statistical evidence that returns are a function of speculators' net positions. They are unable to distinguish between spot and term premiums, because they use returns on contracts of a fixed delivery month rather than a fixed time-to-maturity. Bessembinder (1992) analyzes the variation in the spot-future premium by using nearest-to-maturity returns in 22 futures markets including agricultural, metal, foreign currency, and (other) financial contracts. He finds that mean returns depend on net hedging, particularly in non-financial futures markets. DeRoon, Nijman, and Veld (2000) use nearest-to-maturity as well as second nearby contracts and they also find significant and time-varying risk premiums. Moreover, they find evidence for spillover effects of hedging pressure from one market to another.

These studies do not make a distinction between the spot-futures premiums and term premiums in futures markets. It is not clear a priori if net hedge demand has the same influence on spot premiums as on term premiums. We examine the relevance of the hedging pressure effect for both spot and term premiums. Furthermore, previous studies have used current measures of net hedging to explain the variation in expected futures returns. However, data on hedge positions, which are published in the Commitment of Traders reports issued by the Commodity Futures Trading Commission (CFTC), only become available at a time lag of at least three days.[5] Hence, information on hedge positions is only observable to investors after a reporting lag, and therefore cannot be used as a conditioning variable in an active trading strategy. We examine whether the hedging pressure effect, which has been shown to have strong explanatory power for futures returns if no reporting lag is taken into account, also contains information about returns if net hedging is lagged one period. Moreover, we analyze whether predictability, if any, can be exploited using active trading.

Following previous works, we define the hedging pressure variable in a futures market as the difference between the number of short hedge positions and the number of long hedge positions by large traders, relative to the total number of hedge positions by large traders in that market,

$$q_t = \frac{\#\text{ of short hedge positions} - \#\text{ of long hedge positions}}{\text{total }\#\text{ of hedge positions}}, \tag{10}$$

where positions are measured by the number of contracts in the futures market. Hedging pressures are calculated from the aforementioned Commitment of Traders reports, which were available semi-monthly (and every two weeks

[5]The Commission reports on her website that "[t]he Commitments of Traders reports are released at 3:30 pm Washington D.C. time. The [...] reports are usually released Friday. The release usually includes data from the previous Tuesday."

as of October 1992) in our sample period. The first two columns of Table VII show the averages and standard deviations of the hedging pressure variables for all futures markets. Both net short and net long hedging are common, and variability is considerable. These figures are in line with results reported by, e.g., DeRoon, Nijman, and Veld (2000). The next columns show the autocorrelation of the hedging pressure variables at the first four lags. Clearly, hedging pressure is strongly persistent for every market. The pattern resembles that of a first-order autoregressive model. One may expect that due to this strong persistence, return predictability is not much affected by lagging the hedging pressure measure.

Documenting predictability from past hedging pressure

Panel A of Table VIII documents the predictability of nearest-to-maturity and term-spreading returns using lagged hedging pressure. It summarizes the results of six regressions for every market, i.e., one regression of the nearest-to-maturity return on past hedging pressure, and five regressions of spreading returns on past hedging pressure:

$$r^{(1)}_{f,t+1} = \alpha_1 + \beta_1 q_{t-1} + \varepsilon^{(1)}_{t+1} \tag{11a}$$

$$r^{(n)}_{f,t+1} - r^{(1)}_{f,t+1} = \alpha_n + \beta_n q_{t-1} + \varepsilon^{(n)}_{t+1}, \tag{11b}$$

for $n = 2, \ldots, 6$. The first line of Panel A shows the p-value for a joint test that all slope coefficients are zero. For the short returns, the hypothesis that slopes are zero is rejected at the 10 percent level; evidence of non-zero slopes is much stronger for the spreading returns, indicating that past hedging pressure explains the variation in term premiums much better than the variation in spot premiums. The weak forecast power found for the short-term returns is striking in the light of the strong, positive effect of hedging pressure found by studies which do not take into account a reporting lag, particularly given the high level of persistence in the hedging pressure variables. One possible explanation for this result is that there is a negative relation between past hedging pressure and the forecast errors of the regressions which use current instead of lagged hedging pressure. Indeed, we find a large negative covariance between these variables for each market which cancels out (and in some cases dominates) the effect of persistence in the hedging pressure variable.

Exploiting predictability from past hedging pressure

Panel A of Table VIII also reports the number of markets in which we find significant slope coefficients, broken down according to sign. In most cases where predictability of the short returns is found, past hedging pressure has a negative effect on returns. This is opposite to the effect documented for current hedging pressure for the reasons mentioned above. In contrast, the much stronger effect of past hedging pressure on the variation in the term premium is in almost all cases negative. This suggests that trading strategies which go long in contracts which have had high hedging pressure in the past and short in contracts which have had low hedging pressure in the past, could be profitable. Panel B of Table VIII shows that this is indeed the case. Significant abnormal returns can be achieved by trading according to a strategy which sorts futures markets every period into three equal-sized groups according to lagged hedging pressure, and takes (equally weighted) long positions in long-term contracts combined with short positions in the nearest-to-maturity contract in markets with high lagged hedging pressure, and opposite positions in markets with low lagged hedging pressure. The higher the maturity of the long-term contract, the higher the expected return (but also the risk) of the trading strategy. As expected, the strategy which is designed to exploit the (weak) predictability in the variation of the spot premium does not outperform the market or the six-factor benchmark.

4.3 Momentum strategies

Finally, we examine the presence of the momentum effect in futures markets and we analyze the performance of momentum strategies. From equity markets we know that stocks that have performed well in the past are likely to perform well in the future, while stocks that have performed poorly in the past are likely to perform poorly in the future. Such predictability in equity markets has been shown to be exploitable using spreading strategies. Early works include Jegadeesh (1990), Lehmann (1990), and Jegadeesh and Titman (1993) who show that strategies which buy past winners and sell past losers generate significant positive abnormal returns. In a recent paper, Jegadeesh and Titman (2001) show that, contrary to other stock market anomalies, momentum profits have continued in the 1990s. Whether momentum is also present and profitable in futures markets is an open question.

Documenting momentum

If futures returns are autocorrelated over time, then this is evidence of momentum in futures markets. Historically, little evidence has been found of autocorrelation in futures returns. For instance, Dusak (1973) reports semi-monthly serial correlations at up to 10 lags for the returns on wheat, corn, and soybean contracts during the 1950s and 1960s, and finds that hardly any differ significantly from zero. In a sample of 12 agricultural, foreign currency, and metal futures markets in the 1970s and 1980s analyzed by Bessembinder and Chan (1992), no appreciable autocorrelation is found either. We also find little evidence of autocorrelation in the subsequent years among an even more extensive cross-section; only silver ($-.15$) and sugar (.16) contracts show significant semi-monthly serial correlation in the nearest-to-maturity returns at the 1 percent level, while soybeans ($-.12$) and crude oil (.11) also show significant autocorrelations at the 5 percent level. Equally weak (or even weaker) results are found for the serial correlations at further lags, largely confirming the evidence documented in previous studies.

The autocorrelation coefficient of futures returns coincides with the slope coefficient in a forecast regression of current on past returns. Panel A of Table IX summarizes the results of such regressions for the nearest-to-maturity returns and the returns on term-spreading strategies using semi-monthly lags. As noted before, hardly any momentum is found at this horizon for the nearest-to-maturity contracts. The hypothesis that all slope coefficients, i.e., all autocorrelation coefficients, are zero cannot be rejected at all conventional confidence levels. This implies that the variation in spot premiums cannot be explained by its own history.

We do, however, find significant results for the term premiums. A substantial number of futures markets shows momentum in the spreading returns at all delivery horizons, while the hypothesis that autocorrelations are zero is rejected in all cases (at the 5 percent level) and strongly rejected (i.e., at the 1 percent level) in most. Momentum therefore induces term premiums in futures markets, a result that has to our knowledge not been documented previously. There is, however, no clear pattern in the direction of the predictability. In some markets, past returns have a positive effect on future returns, while in others a negative effect is found. This finding suggests that the active trading strategies discussed earlier have a lesser chance of performing abnormally.

Exploiting momentum

Indeed, Panel B of Table IX shows that there are no significant (abnormal) returns to be made from taking long positions in futures markets with low past returns and short positions in markets with high past returns. Therefore, the momentum effect, which is clearly present in the term structure of futures prices, does not appear to be exploitable using such simple trading rules. Hence, the profitability of momentum strategies in equity markets does not translate to futures markets. However, we do retain the pattern of average returns, standard deviations, and alphas increasing with maturity observed for yields and past hedging pressure.

5 Robustness of the results

For convenience, we briefly recapitulate the conclusions of the previous sections here. Firstly, we find zero-mean unconditional spot-futures premiums in virtually all markets, while unconditional term premiums are non-zero for some markets. Basically the same results are obtained after correcting for market or multi-factor risk, except for the financial index spot-futures premiums, which appear to be largely due to market risk. Both premium components can be explained by futures yields and past hedging pressure, while the momentum effect appears to have explanatory power for the term premiums only. Momentum is not found for the spot premiums. Finally, predictability in both spot and term premiums is found to be exploitable using yield-based strategies, while strategies based on past hedging pressure are only profitable using the term premiums. Momentum strategies do not yield (abnormal) returns.

To test the robustness of these conclusions, we perform a number of sensitivity tests. First, we investigate the possibility that the size and predictability of futures premiums changes over the sample period by splitting the sample period in half and redoing the entire analysis for each subperiod. Second, we examine whether our findings stay the same if, instead of semi-monthly returns, we use returns with longer horizons. Finally, we test whether the active trading strategies which were found to outperform benchmarks, are still profitable if transaction costs are taken into account.

5.1 Subperiod results

The sample period is split up into two intervals of about equal size. The first subperiod consists of semi-monthly data from January 1986 to December 1993, and the second subperiod is from January 1994 to December 2000.

The average returns and volatilities of the nearest-to-maturity contracts and the spreading strategies are about the same size in each of the subperiods as in the entire sample. We find about the same number of non-zero mean returns, albeit that some of markets in which they are obtained differ across subperiods. Similar results are obtained for the unconditional Jensen's alphas.

Furthermore, we find that futures yields have strong forecast power in both periods, albeit slightly less than in the entire sample. However, while the first subperiod shows a clear pattern of negative regression coefficients for the spot premium and positive coefficients for the term premiums, the results are mixed in the second subperiod. Nevertheless, the yield-based trading strategies produce significant and positive returns in both periods, with constant volatilities across time. Moreover, the strategies outperform the market to a similar degree in both periods. However, they do not outperform the six-factor benchmark in the first subperiod, whereas they do in the second.

The hedging-pressure forecast regressions show similar results across the two subperiods. As in the entire sample, we find strong predictability for the term premiums, while only weak predictability is found for the spot premium. Again, the predictability in the term premiums turns out to be exploitable using active trading strategies. In fact, in the first subperiod positive abnormal returns are obtained for the spreading strategies which use the third, fourth, and fifth nearby contracts, while the strategies which use the second and third nearby contracts yield positive abnormal returns in the second subperiod.

Finally, there is a momentum effect in both periods which is comparable to the momentum effect in the entire sample. We find that term premiums are predictable by past term premiums, with positive and negative coefficients in each subperiod. As in the large sample, no predictability is found for the spot premiums. Also, the momentum effect does not appear to be exploitable in either subperiod.

To sum up, although there are differences between mostly individual premiums across time, the forecast power of yields, hedging pressure, and past returns, and the extent to which active trading strategies can exploit forecastability, are obtained consistently through time.

5.2 Multi-period returns

The results so far are based on semi-monthly returns as in, for example, DeRoon, Nijman, and Veld (2000). However, other authors have used different horizons to analyze futures premiums. Fama (1984), Fama and French (1987), Chang (1985), and Bessembinder and Chan (1992) examine monthly returns, while Carter, Rausser, and Schmitz (1983) use weekly returns, and Bessembinder (1992) and Bessembinder, Coughenour, Seguin, and Smoller (1995) analyze daily returns. DeRoon, Nijman, and Veld (1998) analyze both daily returns and returns over longer, contract-specific holding periods. To test the resiliency of our results in this dimension, we repeat all analysis for different return horizons. The semi-monthly frequency at which we observe the hedging pressure data dictates the minimum return horizon we can use. Hence, the basic holding period is half a month. We construct multi-period returns by adding semi-monthly (log) returns over multiple periods. We consider two-period (monthly), three-period (semi-quarterly), and four-period (bi-monthly) returns.[6]

In the interest of conciseness, rather than repeat all empirical results for the multi-period returns, we briefly summarize the main conclusions here.[7] The multi-period short and spreading returns from passive trading show little difference from the one-period results; we obtain unconditional futures premiums which are similar in size and in statistical significance. The same is true for the CAPM and multi-factor alphas. Interestingly, the forecast power of yields found for the semi-monthly returns is even stronger for returns over longer horizons. A re-examination of yield-based predictability for monthly returns as in Table V shows that nearly all joint tests for zero slopes result in p-values smaller than 5 percent, with most being well below 1 percent. On average, we find that the number of predictable markets is increased by half. The results for the semi-quarterly and bi-monthly returns are only slightly weaker but still considerably stronger than for the semi-monthly returns. As for the multi-period returns on the yield-based trading strategies, we find similar averages, standard deviations, and alphas compared to the one-period case. Only the strategies using semi-quarterly returns seem to produce even stronger statistical significance.

Multi-period versions of the forecast regressions and the trading strategies based on hedging pressure and momentum also confirm the qualitative results found for the one-period returns. The forecast power of hedging pressure is found to be consistent over all holding periods, with the exception of the one-month horizon, in which case predictability is somewhat stronger. Predictability from past returns—the momentum effect—is about equally strong for all horizons. Finally, the trading strategies which aim to exploit predictability from hedging pressure or momentum produce similar results for all horizons.

[6]To minimize loss of data, we use overlapping series of multi-period returns. As a consequence, the innovations in the forecast regressions will be autocorrelated. We use the method of Newey and West (1987) to correct the covariance matrix of the innovations for heteroskedasticity and autocorrelation.

[7]The results for the multi-period returns are available from the authors on request.

5.3 Transaction costs

As a final robustness test, we investigate whether the active trading strategies which we found to outperform the benchmark portfolios, still yield abnormal returns after correcting for transaction costs. Active trading, contrary to passive trading, involves regular updating of long and short positions, and such updating is costly. These transaction costs, which comprise brokerage commissions, exchange and clearing fees, taxes, the bid-ask spread, etc., vary by type of trader, type of transaction, type of market, as well as through time. Hence, it is not easy to estimate transaction costs and incorporate them in the returns on trading strategies. Instead, we compute for each active strategy a critical transaction cost, defined as the average transaction cost per contract, expressed as a percentage of the futures price, for which the (abnormal) return on the strategy is just significantly different from zero at a given confidence level.[8] Thus, the critical transaction cost is the maximum transaction cost for which the strategy is still profitable.

The total transaction costs of an active trading strategy depend on the proportion of futures positions which need to be replaced with new positions each period. Panel A of Table X shows the average replacement rates for the long positions and the short positions of the yield-based strategies. The average replacement rate of 25 percent for the long positions of the semi-monthly updated short-yield strategy means that, on average, one in four long positions is substituted with a new long position every half month. Each substitution involves one "round trip," i.e., closing an existing long position by selling a contract, and taking a new long position by buying a new contract. Likewise, 23 percent of all short positions is replaced with new ones every half month. Average replacement rates for the semi-monthly updated yield-based strategies vary between 12 and 25 percent. More contracts need to be replaced as the return horizon increases.

Table XI shows the critical transaction costs for the semi-monthly mean returns and alphas on the yield-based strategies corresponding to a 95 percent confidence level. Clearly, the short-yield strategies and the long-term spreading strategies permit the largest per-contract transaction costs for the strategies to remain profitable. For instance, the strategy based on the second nearby yields will still be profitable when transaction costs are un-

[8]Note that for our simple, equally-weighted trading strategies, the costs of updating futures positions only involves the costs of replacing one position by an other, and not the additional costs of changing portfolio weights. On the other hand, we abstract from the trading costs resulting from rolling over contracts when they approach maturity (or when the order of maturity changes).

der 54 basis points per trade. After correcting for market risk, the critical transaction costs are only slightly lower at 51 basis points, while correcting for multiple benchmarks reduces the critical cost to 33 basis points. More generally, critical transaction costs hardly change from average returns to CAPM alphas, but they go down quickly for the multi-factor alphas.

An individual trading small quantities is likely to pay more than these critical transaction costs in brokerage fees alone. Hence, the abnormal returns on yield-based trading may vanish. Large traders, on the other hand, may be able to mitigate this cost; however, it may be difficult to trade large quantities at once without moving the price a few basis points. Hence, the outperformance of benchmark portfolios by yield-based trading strategies with a semi-monthly return horizon may disappear once we include transaction costs, whether they be due to commissions and fees or market impact.

The critical transaction costs found for the other semi-monthly updated spreading strategies are even lower, and they go down as maturity decreases. The average returns on the strategies using the shortest maturities are far too small to tolerate transaction costs. Again, critical transaction costs are about the same for the average returns as for CAPM alphas, and considerably lower for the multi-factor alphas.

We also computed the critical transaction costs for the yield-based strategies with longer return periods. Again, we find the same pattern: low critical costs for the short-term spreading returns, and higher critical costs for the short-term returns and the long-term spreading returns. While critical transaction costs differ across return horizons, they seldom exceed one hundred basis points. The yield-based strategies which use semi-quarterly returns allow for the highest transaction costs, even though average replacement rates are relatively high. This is explained by the fact that these are also the strategies which produce the strongest evidence for outperformance of benchmark returns, as noted before.

Panel B of Table X shows the average replacement rates for the trading strategies based on past hedging pressure and on momentum. Average replacement rates for the hedging-pressure strategies are of the same order of magnitude as for the yield-based strategies, showing the same pattern of rates going up with the return horizon. The momentum strategies, on the other hand, require considerably higher replacement rates (implying larger total transaction costs), and they remain constant across return periods. Critical transaction costs for these active trading strategies (not shown here) suggest that positive abnormal returns disappear for reasonable values of the transaction costs.

6 Conclusion

This paper has analyzed trading strategies which capture the various risk premiums that have been distinguished in futures markets. On the basis of a simple decomposition of futures returns, we showed that the return on a short-term futures contract measures the spot-futures premium, while spreading strategies isolate the term premiums. Using a broad cross-section of futures markets and delivery horizons, we examined the components of futures risk premiums by means of passive trading strategies and active trading strategies which intend to exploit the predictable variation in futures returns.

We find that passive strategies which capture the spot-futures premium do not yield abnormal returns, in contrast to passive spreading strategies which capture the term premiums. The term structure of futures yields has strong explanatory power for both spot and term premiums, which can be exploited using active trading strategies that go long in low-yield markets and short in high-yield markets. The profitability of these yield-based trading strategies is not due to systematic risk. However, transaction costs may eliminate these gains, in particular for the strategies which capture short-term premiums.

Furthermore, we find that spreading returns are predictable by net hedge demand observed in the past, which can be exploited by active trading, but only if transaction costs are relatively low. Finally, there is momentum in futures markets, but momentum strategies do not outperform benchmark portfolios.

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Table II: **Summary statistics for short and spreading returns**

Returns are calculated from semi-monthly data for the period January 1986 to December 2000. Average returns and standard deviations are annualized and in percentages. The short return is defined as the return on the nearest-to-maturity contact. The n-th spreading return is the return on a strategy which takes a long position in the n-th nearby contract and a short position in the nearest-to-maturity contract.

	Averages						Standard deviations					
	Short return $r_f^{(1)}$	Spreading returns $r_f^{(n)} - r_f^{(1)}$					Short return $r_f^{(1)}$	Spreading returns $r_f^{(n)} - r_f^{(1)}$				
		$n=2$	$n=3$	$n=4$	$n=5$	$n=6$		$n=2$	$n=3$	$n=4$	$n=5$	$n=6$
Wheat	−5.4	2.7**	5.0**	5.1**	5.9**	9.5**	21.2	5.2	8.1	9.7	11.0	13.7
Corn	−8.4	1.4	3.1*	4.3**	6.6***	8.4***	21.7	4.7	7.2	8.6	10.0	12.2
Oats	−15.1**	3.6*	5.4*	7.7**	6.6	.	30.4	8.2	11.4	13.9	16.8	.
Soybeans	−2.3	−1.4*	−1.3	−1.0	−0.1	1.5	19.8	3.0	5.0	5.9	6.5	7.7
Soy oil	−9.2*	0.4	1.8***	3.1***	4.1***	5.0***	21.8	1.7	2.7	3.8	5.0	5.9
Soy meal	5.7	−3.4***	−5.4***	−5.8***	−6.1***	−5.5**	21.4	3.9	6.5	7.9	9.1	10.3
Live cattle	5.3*	−0.8	−3.0	−2.7	−3.9*	−3.8	12.5	5.7	7.3	8.2	8.6	9.2
Feeder cattle	3.9	−0.7	−0.6	−0.5	−0.3	−0.7	12.0	2.9	4.1	5.1	5.7	6.3
Live hogs	6.4	0.6	−2.1	−3.1	−4.5	−2.9	23.9	9.6	14.4	16.7	18.5	19.8
Crude oil	7.8	0.2	−1.0	−1.9	−2.6	−3.0	34.5	7.1	10.2	12.5	14.3	15.8
Heating oil	13.1	−8.1***	−9.3**	−8.7**	−8.6*	−9.2*	33.5	10.3	14.6	16.4	17.9	18.8
Gold	−6.2*	−0.1	0.0	−0.1	−0.1	−0.2	13.0	0.4	0.6	0.8	1.0	1.2
Silver	−8.8	0.4	0.4	1.0*	0.9	1.1	22.9	1.3	1.8	2.3	2.8	3.1
Platinum	1.9	0.4	−0.5	−1.0	.	.	19.7	2.1	3.0	3.2	.	.
Coffee	−8.4	−0.6	−1.5	−1.5	−0.3	−1.4	37.7	7.2	10.2	12.4	14.6	16.2
Sugar	1.8	2.6	1.2	0.4	0.8	−2.7	39.4	19.6	21.4	22.7	23.9	26.2
Eurodollar	0.5*	0.2**	0.4***	0.5***	0.5**	0.4**	1.1	0.4	0.6	0.7	0.8	0.8
Swiss franc	−0.1	−0.1	−0.2	.	.	.	11.9	0.3	0.8	.	.	.
British pound	2.6	−0.1	−0.2	.	.	.	10.0	0.4	0.8	.	.	.
Japanese yen	0.8	0.0	−0.1	0.1	.	.	12.4	0.3	0.6	1.0	.	.
Can. dollar	0.6	−0.1	0.0	0.0	−0.1	.	4.7	0.4	0.8	1.1	1.4	.
S&P 500	8.6**	0.0	0.0	−0.2	.	.	14.4	0.3	0.6	0.8	.	.
NYSE	7.8**	0.1	0.1	.	.	.	13.9	0.3	0.7	.	.	.

*/**/*** indicates significance at the 10/5/1 percent level. No result is reported if more than one-third of the data is missing.

Table III: **Unconditional Jensen's alphas**

The unconditional Jensen's alpha in the Capital Asset Pricing Model is the intercept in a regression of the short return (or a spreading return) on the return of the market portfolio in excess of the risk-free rate. The market portfolio is measured by the MSCI U.S. equity index, and the risk-free asset is the one-month Eurodollar deposit. The multi-factor alphas are implied by a six-factor model including U.S. and non-U.S. equities, U.S. and non-U.S. government bonds, emerging market stocks, and the U.S. dollar. All alphas are annualized and in percentages.

	Capital Asset Pricing Model						Multi-factor model					
	Short return	Spreading returns $r_f^{(n)} - r_f^{(1)}$					Short return	Spreading returns $r_f^{(n)} - r_f^{(1)}$				
	$r_f^{(1)}$	$n=2$	$n=3$	$n=4$	$n=5$	$n=6$	$r_f^{(1)}$	$n=2$	$n=3$	$n=4$	$n=5$	$n=6$
Wheat	−5.7	2.8**	5.2***	5.2**	6.1**	9.7**	−8.5	2.8**	5.6***	6.1**	7.2**	11.6***
Corn	−8.1	1.3	3.2*	4.2**	6.4**	8.0***	−6.5	1.6	3.5*	4.4**	6.2**	8.3**
Oats	−15.0**	3.3	5.1*	7.4**	7.0	.	−20.3***	3.3*	6.6**	9.4***	11.2**	.
Soybeans	−2.1	−1.1	−0.8	−0.7	0.2	1.6	−3.3	−0.9	−0.4	−0.4	0.3	1.9
Soy oil	−8.8	0.4	1.7**	3.0***	3.9***	4.8***	−8.9	0.4	1.6**	2.9***	3.8***	4.8***
Soy meal	6.3	−3.2***	−5.1***	−5.5***	−6.0**	−5.5**	3.8	−2.3**	−3.7**	−3.9**	−4.5**	−4.0
Live cattle	4.5	−1.0	−2.8	−2.4	−3.6*	−3.6	3.3	−0.2	−1.8	−1.2	−2.1	−2.2
Feeder cattle	3.4	−0.7	−0.6	−0.5	−0.2	−0.6	3.5	−1.1	−1.5	−1.1	−0.7	−1.1
Live hogs	6.5	1.0	−1.3	−2.3	−3.7	−2.3	3.8	1.3	0.8	−0.3	−2.0	0.3
Crude oil	9.9	0.2	−1.2	−2.3	−3.1	−3.6	15.1*	0.3	−1.1	−2.3	−3.3	−4.0
Heating oil	14.4*	−7.7***	−8.9**	−8.4**	−8.4*	−9.1*	19.1**	−7.0**	−8.4**	−7.9*	−8.2*	−8.9*
Gold	−4.9	−0.1	−0.1	−0.1	−0.1	−0.2	−6.8*	−0.1	0.0	0.0	0.0	−0.1
Silver	−8.9	0.5	0.4	1.1*	1.1	1.2	−8.9	0.5	0.5	1.3*	1.3*	1.6*
Platinum	1.1	0.4	−0.4	−0.8	.	.	2.3	0.3	−0.7	−1.3	.	.
Coffee	−7.4	−0.8	−2.0	−2.1	−1.0	−1.7	−2.7	−0.7	−2.2	−2.7	−2.0	−2.6
Sugar	1.8	2.7	1.7	1.0	1.2	−1.9	4.9	−0.3	−1.2	−2.7	−2.3	−7.1
Eurodollar	0.4	0.2*	0.3**	0.4**	0.4*	0.3	0.1	0.1	0.3**	0.3**	0.3*	0.2
Swiss franc	1.1	−0.1	−0.2	.	.	.	−2.1*	−0.1	−0.1	.	.	.
British pound	3.1	−0.1	−0.1	.	.	.	1.2	−0.1	−0.1	.	.	.
Japanese yen	1.2	0.0	−0.1	0.1	.	.	−1.2	0.0	0.1	0.2	.	.
Canadian dollar	0.2	−0.1	0.0	0.0	−0.1	.	−0.7	−0.1	−0.1	0.0	−0.1	.
S&P 500	−0.2	0.0	−0.1	−0.2	.	.	−0.3	0.1**	0.1	0.0	.	.
NYSE	−0.5	0.0	0.1	.	.	.	−0.3	0.1**	0.3**	.	.	.

*/**/*** indicates significance at the 10/5/1 percent level. No result is reported if more than one-third of the data is missing.

Table IV: **Summary statistics for futures yields**

The yield on the m-th nearby futures contract is defined as the difference between the log price of the m-th nearby futures contract and the log spot price divided by the estimated time to maturity. Settlement is assumed to take place on the 15-th of the delivery month on average. Yields are calculated from semi-monthly data for the period January 1986 to December 2000. Averages and standard deviations are annualized and in percentages.

	Averages						Standard deviations					
	Short yield	2nd nearby yield	3rd nearby yield	4th nearby yield	5th nearby yield	6th nearby yield	Short yield	2nd nearby yield	3rd nearby yield	4th nearby yield	5th nearby yield	6th nearby yield
Wheat	24.3	9.0	5.2	4.1	4.0	3.7	13.5	6.1	4.8	3.9	3.1	2.8
Corn	44.2	20.3	15.6	12.6	10.5	9.1	10.6	5.1	4.0	3.4	2.9	2.6
Oats	−117.8	−28.8	−13.9	−8.1	−4.5	.	22.2	4.9	3.4	3.0	2.6	.
Soybeans	21.0	9.2	6.8	5.6	4.9	4.4	5.3	3.1	2.6	2.1	1.8	1.5
Soy oil	14.3	9.7	8.4	7.4	6.6	6.0	8.2	3.7	2.7	2.3	2.1	2.0
Soy meal	12.4	3.5	2.1	1.9	1.9	1.9	14.3	7.2	5.2	4.1	3.5	3.0
Live cattle	11.9	0.9	−0.7	−1.1	−1.2	−1.0	9.5	4.7	3.2	2.4	1.9	1.5
Feed. cattle	−117.0	−49.1	−31.6	−22.2	−16.9	−14.4	17.4	6.0	3.4	2.4	2.0	1.7
Live hogs	102.5	41.5	26.9	18.8	15.0	11.9	39.1	17.1	12.1	9.7	7.9	6.5
Crude oil	0.1	−3.3	−4.4	−4.8	−4.9	−4.8	1.6	2.9	3.2	3.1	3.0	2.9
Heating oil	−7.9	−8.4	−6.6	−5.6	−5.2	−4.9	11.4	9.6	7.9	6.7	5.8	5.1
Gold	3.1	4.3	4.5	4.6	4.6	4.7	1.7	0.6	0.4	0.4	0.3	0.3
Silver	−6.4	1.7	3.8	4.7	5.1	5.3	3.6	1.4	0.9	0.6	0.6	0.5
Platinum	0.5	0.8	1.2	1.9	.	.	2.0	1.0	0.8	0.5	.	.
Coffee	43.7	14.5	10.4	8.6	7.6	6.9	26.8	8.9	6.3	5.2	4.4	3.9
Sugar	−22.0	−5.1	−3.6	−2.8	−2.1	−1.6	14.7	4.7	3.3	2.8	2.4	2.3
Eurodollar	−0.1	−0.3	−0.4	−0.5	−0.6	−0.6	0.3	0.3	0.2	0.2	0.2	0.1
Swiss franc	1.9	1.9	1.9	.	.	.	0.8	0.6	0.5	.	.	.
Br. pound	−2.3	−2.3	−2.1	.	.	.	0.6	0.5	0.4	.	.	.
Jap. yen	3.0	3.1	3.2	3.4	.	.	0.8	0.5	0.5	0.5	.	.
Can. dollar	−1.1	−1.0	−1.0	−1.0	−0.9	.	0.5	0.4	0.3	0.3	0.3	.
S&P 500	3.0	3.2	3.2	3.3	.	.	0.7	0.3	0.3	0.3	.	.
NYSE	2.7	2.9	3.0	2.9	.	.	0.7	0.3	0.3	0.3	.	.

No result is reported if more than one-third of the data is missing.

Table V: **Yield-based forecast regression scoreboard**

For each futures market, semi-monthly short and spreading returns are regressed on the short yield. The analysis is repeated using yields of other maturities, i.e, the yield on the second nearby contract, the yield on the third nearby contract, et cetera. If, for a particular regression, more than one-third of the sample days has missing observations, the market is excluded from the analysis. Panel A gives the p-value for a test that the slope coefficients are equal to zero for all markets. Panel B shows the number of markets with slope coefficients which differ significantly from zero at the 10 percent level. The sign ($+/-$) indicates whether these coefficients are positive or negative. Between parentheses is the total number of analyzed markets, i.e., markets with sufficient data.

	Short return $r_f^{(1)}$	Spreading returns $r_f^{(n)} - r_f^{(1)}$				
		$n=2$	$n=3$	$n=4$	$n=5$	$n=6$
A. Test: all slope coefficients zero (p-value)						
Short yield	0.000	0.012	0.006	0.001	0.263	0.005
2nd yield	0.000	0.124	0.147	0.005	0.485	0.004
3rd yield	0.000	0.457	0.600	0.054	0.750	0.054
4th yield	0.000	0.011	0.140	0.151	0.671	0.135
5th yield	0.001	0.015	0.249	0.418	0.646	0.088
6th yield	0.127	0.051	0.102	0.320	0.357	0.155
B. Number of predictable markets and sign of predictability (total number of markets)						
Short yield	8−(23)	4+(23)	6+(23)	3+(21)	2+(17)	2+(15)
2nd yield	6−(23)	3+(23)	3+(23)	2+(21)	2+(17)	3+(15)
3rd yield	6−(23)	2+(23)	2+(23)	0 (21)	0 (17)	0 (15)
4th yield	6−(21)	1+(21)	1+(21)	0 (20)	0 (17)	0 (15)
5th yield	2−(17)	2[a](17)	2[a](17)	1[b]−(17)	0 (17)	1[b]−(15)
6th yield	1−(15)	2[a](15)	2[a](15)	1[b]−(15)	0 (15)	1[b]−(15)

[a] One negative sign (silver) and one positive sign (soybean meal).

[b] Silver.

Table VI: **Yield-based trading strategies**
At each date, futures markets are sorted on the short yield into three groups of about the same size. Averages, standard deviations, and alphas (all annualized and in percentages) are reported for the short returns on trading strategies which take long positions in the low-yield group and as many short positions in the high-yield group. The analysis is repeated for yields of other maturities, as well as for the (term-)spreading returns on trading strategies which go long in high-yield markets and short in low-yield markets.

	Short returns $r_f^{(1)}$	Spreading returns $r_f^{(n)} - r_f^{(1)}$				
		$n=2$	$n=3$	$n=4$	$n=5$	$n=6$
	Averages					
Short yield	7.4**	1.9**	3.3***	3.6**	4.9**	7.5***
2nd nearby yield	10.4***	1.9**	3.5***	4.0***	5.5***	8.4***
3rd nearby yield	11.0***	2.1**	3.2***	3.8**	5.2***	8.0***
4th nearby yield	11.7***	2.3**	3.1**	3.6**	5.2***	7.8***
5th nearby yield	11.8***	2.2*	3.3**	3.7**	4.4**	6.5**
6th nearby yield	12.9***	2.3*	3.1*	3.8*	3.7*	4.9*
	Standard deviations					
Short yield	12.0	3.8	5.0	6.1	7.5	9.4
2nd nearby yield	12.4	3.7	5.0	6.0	7.3	9.1
3rd nearby yield	12.9	3.7	4.9	6.0	7.3	9.2
4th nearby yield	14.0	4.2	5.5	6.4	7.8	9.3
5th nearby yield	16.7	4.8	6.3	7.2	8.3	10.1
6th nearby yield	18.5	5.4	6.9	7.9	8.9	10.3
	CAPM alphas					
Short yield	7.5**	1.9**	3.3***	3.6**	4.7**	7.4***
2nd nearby yield	10.3***	1.9**	3.5***	4.0***	5.3***	8.3***
3rd nearby yield	10.8***	2.1**	3.2***	3.8**	5.1***	7.9***
4th nearby yield	11.6***	2.3**	3.0**	3.5**	5.2***	7.7***
5th nearby yield	11.6***	2.2*	3.3**	3.7**	4.4**	6.4**
6th nearby yield	13.1***	2.3*	3.1*	3.8*	3.8*	4.9*
	Multi-factor alphas					
Short yield	5.2	1.8*	2.8**	2.6	3.3	6.4**
2nd nearby yield	9.0***	1.8*	3.0**	3.3**	4.3**	7.7***
3rd nearby yield	10.0***	1.9*	2.7**	3.2**	4.0**	7.1***
4th nearby yield	10.3***	2.0*	2.5*	3.0*	4.0*	7.0***
5th nearby yield	9.9**	1.7	2.3	2.6	3.0	5.7**
6th nearby yield	11.6**	1.6	1.9	2.6	2.4	3.5

*/**/*** indicates significance at the 10/5/1 percent level.

Table VII: **Summary Statistics for Hedging Pressures**

The hedging pressure variable is defined as the number of short hedge positions minus the number of long hedge positions divided by the total number of hedge positions. Hedging pressures are calculated from semimonthly data for the period January 1986 to December 2000. Averages and standard deviations are in percentages. ρ_τ denotes the autocorrelation at lag τ.

	Avg.	Std.	ρ_1	ρ_2	ρ_3	ρ_4
Wheat	17.1	20.3	0.78	0.63	0.54	0.44
Corn	−0.9	15.6	0.88	0.76	0.67	0.58
Oats	38.4	15.9	0.87	0.71	0.56	0.44
Soybeans	17.0	20.6	0.89	0.82	0.78	0.71
Soy oil	12.7	19.8	0.84	0.72	0.62	0.55
Soy meal	13.2	15.5	0.79	0.64	0.56	0.50
Live cattle	14.6	17.4	0.94	0.88	0.82	0.77
Feeder cattle	−11.5	24.3	0.91	0.78	0.66	0.55
Live hogs	2.3	24.0	0.79	0.61	0.51	0.45
Crude oil	0.2	6.8	0.79	0.64	0.49	0.42
Heating oil	9.1	9.4	0.79	0.56	0.39	0.26
Gold	−3.1	21.7	0.80	0.65	0.53	0.46
Silver	43.0	15.9	0.87	0.76	0.69	0.66
Platinum	35.7	23.7	0.84	0.68	0.57	0.51
Coffee	17.9	14.5	0.75	0.53	0.36	0.28
Sugar	20.0	19.8	0.87	0.74	0.62	0.51
Eurodollar	−3.2	5.4	0.92	0.86	0.80	0.75
Swiss franc	−7.8	43.5	0.74	0.49	0.35	0.22
British pound	0.5	41.3	0.66	0.37	0.26	0.13
Japanese yen	−10.1	37.3	0.79	0.62	0.52	0.46
Canadian dollar	14.2	39.2	0.75	0.57	0.44	0.36
S&P 500	−5.1	6.7	0.84	0.73	0.63	0.56
NYSE	−14.4	45.0	0.76	0.65	0.55	0.46

Table VIII: **Hedging pressure-based forecast regression scoreboard and trading strategies**

Caption as in Tables V and VI.

	Short return $r_f^{(1)}$	Spreading returns $r_f^{(n)} - r_f^{(1)}$				
		$n=2$	$n=3$	$n=4$	$n=5$	$n=6$
A. Forecast regression scoreboard						
Test: all zero (p-value)	0.066	0.000	0.000	0.000	0.000	0.000
Predictable markets (+)	1	8	8	8	6	5
Predictable markets (−)	4	1	0	1	0	0
Number of markets	(23)	(23)	(23)	(20)	(17)	(15)
B. Trading strategies						
Average	4.2	2.1***	3.0***	3.8***	4.9***	5.7**
Standard deviation	12.6	3.1	3.9	5.2	7.0	10.9
CAPM alpha	3.5	2.1***	3.0***	3.8***	4.9***	5.7**
Multi-factor alpha	4.7	1.9**	3.0***	3.6**	4.5**	5.8*

*/**/*** indicates significance at the 10/5/1 percent level.

Table IX: **Momentum-based forecast regression scoreboard and trading strategies**

Caption as in Tables V and VI.

	Short return $r_f^{(1)}$	Spreading returns $r_f^{(n)} - r_f^{(1)}$				
		$n=2$	$n=3$	$n=4$	$n=5$	$n=6$
A. Forecast regression scoreboard						
Test: all zero (p-value)	0.211	0.008	0.000	0.003	0.032	0.000
Predictable markets (+)	1	3	2	0	1	1
Predictable markets (−)	3	2	6	4	3	2
Number of markets	(23)	(23)	(23)	(19)	(17)	(15)
B. Trading strategies						
Average	2.7	−0.3	−0.5	0.2	1.0	1.7
Standard deviation	15.0	3.6	4.8	6.5	8.4	10.3
CAPM alpha	2.9	−0.3	−0.4	0.3	1.3	2.0
Multi-factor alpha	1.8	−0.8	0.0	1.0	1.3	2.9

*/**/*** indicates significance at the 10/5/1 percent level.

Table X: **Average replacement rates**

The average replacement rate is the average proportion of long or short contracts replaced by new contracts every period (semi-monthly, monthly, etc.) for a given trading strategy.

A. Yield-based trading strategies

	Semi-monthly		Monthly		Semi-quarterly		Bi-monthly	
	long	short	long	short	long	short	long	short
Short	25%	23%	26%	26%	31%	28%	31%	31%
2nd	15%	17%	18%	21%	22%	25%	25%	27%
3rd	12%	16%	15%	19%	19%	23%	21%	25%
4th	13%	25%	18%	36%	22%	33%	26%	42%
5th	15%	21%	20%	26%	23%	30%	27%	31%
6th	17%	21%	22%	29%	26%	33%	31%	34%

B. Trading strategies based on past hedging pressure

Semi-monthly		Monthly		Semi-quarterly		Bi-monthly	
long	short	long	short	long	short	long	short
19%	19%	26%	26%	31%	33%	31%	37%

C. Momentum strategies

Semi-monthly		Monthly		Semi-quarterly		Bi-monthly	
long	short	long	short	long	short	long	short
64%	63%	64%	64%	62%	63%	64%	65%

Table XI: **Critical transaction costs for the yield-based strategies**
The critical transaction cost is the average replacement cost for which the hypothesis that the mean return or alpha on an active trading strategy is zero is just not rejected at the 5 percent level. The table displays critical transaction costs for the yield-based strategies with a semi-monthly return horizon. Transaction costs are measured in basis points of the futures price.

	Critical transaction costs					
	Short return $r_f^{(1)}$	Spreading returns $r_f^{(n)} - r_f^{(1)}$				
		$n = 2$	$n = 3$	$n = 4$	$n = 5$	$n = 6$
Yield-based trading strategies						
	Averages					
Short yield	13	1	7	5	10	25
2nd nearby yield	54	1	14	14	24	50
3rd nearby yield	69	3	12	12	24	52
4th nearby yield	52	2	4	4	14	34
5th nearby yield	41	.	3	1	4	18
6th nearby yield	41	.	.	.	.	.
	CAPM alphas					
Short yield	11	1	7	5	8	24
2nd nearby yield	51	1	14	13	22	49
3rd nearby yield	64	4	12	12	22	50
4th nearby yield	49	2	4	4	14	34
5th nearby yield	39	.	2	1	3	17
6th nearby yield	42	.	.	.	.	.
	Multi-factor alphas					
Short yield	.	.	1	.	.	12
2nd nearby yield	33	.	5	1	6	36
3rd nearby yield	47	.	1	0	2	33
4th nearby yield	33	.	.	.	.	22
5th nearby yield	14	.	.	.	.	2
6th nearby yield	20	.	.	.	.	.