The Economic Value of Linkages between Spot and Futures Market

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Abstract

In this paper we study the economic value of predicting the equity risk premium using market variables that reflect the positions of traders in futures and derivatives market. The economic value is ascertained by studying the performance of market timing strategies that use the positions of commercial hedgers and small speculators as predictive variables. Our market timing strategies have high positive Sharpe ratios over the 1999-2007 period compared to a Sharpe ratio of almost zero for the market index. They avoid losses during major downturns and have significant positive alphas, in contrast to timing strategies based on business cycle variables which under-perform the index over this period. The predictive ability seems to originate from a response to changes in fundamentals ahead of the market for large hedgers and from herding among small speculators. Overall these results indicate that market variables could play an important and economically significant role in predicting the equity risk premium.

JEL Classifications: G11, G12, G15

Key Words: Return Predictability, Hedging Pressure, Timing Strategies.

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1. Introduction

Predicting the equity risk premium and stock returns has been the focus of much recent research. The in-sample statistical evidence is controversial due to a number of statistical issues while the performance of most predictive variables declines significantly out-of-sample. Several recent studies have instead explored the economic significance of return predictability, by analyzing the effect on the asset allocation decisions of a mean variance investor. Kandel and Stambaugh (1996) and Wachter and Warusawitharana (2007) find that even small levels of predictability can lead to successful market timing, while Avramov and Chordia (2006) show that business cycle variables lead to improvements in out-of-sample portfolio performance even in periods where they have little forecasting power for the equity premium. Campbell and Thompson (2007) show that low out-of-sample $R^2$ are the norm, but that even such small $R^2$ are relevant for investors as they can lead to large improvements in portfolio performance.

In this paper we consider a new set of predictive variables for the S&P 500 based on the actions of market participants. These variables are motivated by noisy rational expectations models based on asymmetric information among market participants, such as Working (1958) and Grossman and Stiglitz (1980). These models imply that price discovery is influenced by the actions of informed traders, leading to gradual and frequent price changes and this tendency of gradual price changes could result in very short-term predictability. Recent empirical research has focused on the evidence of predictability based on the actions of traders in the spot market (Diether, Lee and Werner (2009), Akbas et. al. (2008)) and the options market (Pan and Poteshman (2006), Zhang, Zhao, Xing (2009)). At the other extreme a growing body of literature finds that the actions of small traders also appear to have predictive power for future stock returns (Barber, Odean and Zhu (2008) and Hvidkjaer
(2008)). We focus on the actions of traders in the S&P 500 futures market and the economic value of return predictability in this context. Our main predictive variable is “hedging pressure”, which links the spot and futures markets and is defined as the fraction of traders in any given futures market who are long, relative to the total open interest in this market. It may also be regarded as a proxy for non-marketable risks which, in an incomplete market, should affect the expected returns on assets (as implied for example by the CAPM with non-tradable assets, as discussed in Mayers (1976))\(^2\). We focus on the actions of large hedgers and small speculators\(^3\). We consider large hedgers as they are large traders who use futures markets to hedge their underlying equity exposure and thus have a consistent hedging motive\(^4\) and appear to be the best proxy for informed traders, while small speculators play the role of noise traders. In addition to hedging pressure, we also consider the level of the VIX\(^5\), a derivatives market variable which recent studies (for example Connolly, Stivers, and Sun (2005) and Copeland and Copeland (1999)) have found useful for stock-bond diversification as well as market timing.

We consider unconditionally efficient maximum return strategies that optimally utilize the conditioning information. These are designed to be dynamically efficient, thus using tactical asset allocation to attain a strategic objective (i.e. unconditional efficiency)\(^6\). Each period, the strategies allocate funds between the risky asset, the S&P 500 index, and a conditionally risk-

\(^2\) Hedging pressure was first considered in the context of commodity futures markets (Keynes (1930)). The hedging pressure theory of Keynes (1930) assumes that hedges use commodity futures markets to transfer risks to speculators who demand a risk premium for bearing these risks. A number of empirical studies, most recently Bessembinder (1992) and De Roon, Nijman and Veld (2000) find that hedging pressure appears to be a determinant of the risk premiums on futures returns across a number of futures markets, mostly commodity and foreign exchange.

\(^3\) These correspond to Commercial Hedgers and Non Reportable traders according to the CFTC classification.

\(^4\) The CFTC classifies other large traders as Non Commercial and these traders do not necessarily have any underlying exposure to the equity market, and hence do not have a consistent motive for using the futures market. Thus there is no a priori reason why their aggregate positions should have informational value.

\(^5\) The VIX is an implied volatility index, constructed and published by the CBOE. It is calculated as a weighted average (weighted to reflect a hypothetical 30-day term to maturity) of the implied volatilities of the nearest two months out-of-the-money SPX options.

\(^6\) These strategies were first studied by Ferson and Siegel (2001) and further analyzed in Abhyankar, Basu and Stremme (2007).
free asset (3-month Treasury bills) and may thus be regarded as market timing strategies. Predictive information is updated and portfolios re-balanced at a weekly frequency and we consider the out of sample performance of the strategies are over the 1999-2007 period.

Over 1999-2007 the S&P 500 had an average annualized return of 3.5% and a volatility of 16.4%, leading to an annualized Sharpe ratio of -0.02. In contrast, a dynamic market-timing strategy using commercial hedging pressure achieves a Sharpe ratio of 0.78 and a statistically significant alpha of 10.4% relative to the market index. The performance of the strategy seems to be driven by being able to avoid losses, particularly during the market downturn in 2001-2003, and also in 2007. The strategy based on non-reportable hedging pressure performs well also, leading to a Sharpe ratio 0.74 and a statistically significant alpha of 12.9%. This latter strategy is in the market more often than the former, and while it succeeds in avoiding losses over the 2001-2003 period, it does sustain some losses in 2007. The VIX however does not have much market timing ability by itself but adding it to the non-reportable hedging pressure improves the strategy performance a little. Equally weighting the strategies with the VIX and each of the hedging pressures leads to the highest overall Sharpe ratio. Adding the ten year Treasury bond as an additional asset leads to higher Sharpe ratios, but this is due more to ‘spreading’ between the short-term Treasury bill and the 10 year bond, rather than timing between the index and the bond. All of the above strategies are “active alpha” strategies in that they have positive (in most cases statistically significant) alphas and very low betas with respect to the market index. All of the strategies time the major downturn of 2000-2003 successfully and make frequent small moves, a characteristic of successful market timing strategies noted in Chance and Helmer (2001). In contrast, timing strategies based on
business cycle variables\textsuperscript{7} react to the major downturn well after it has passed and also make sudden moves in and out of the market.

In order to obtain qualitative insights about the timing performance of the predictive variables we construct simple strategies that mimic the performance of the more complicated optimal ones. We find that a strategy that goes long the index if lagged commercial hedging pressure is above the 80\textsuperscript{th} percentile of the previous year’s commercial hedging pressure, short if it is below the 10\textsuperscript{th} percentile and in the risk free asset otherwise generates a Sharpe ratio of 0.73. For non-reportable hedging pressure going short if the lagged variable is above the 70\textsuperscript{th} percentile of the previous year’s hedging pressure and long if it is below the 20\textsuperscript{th} percentile generates a Sharpe ratio of 0.82. These results indicate that for commercial hedging pressure, only large deviations from its moving average are informative for market-timing, while for non-reportable hedging pressure smaller changes can be significant. All the dynamic strategies have annualized transaction costs of less than 60 basis points and hence, given the magnitude of their out-performance, would have been profitable in practice.

Overall, our results suggest that hedging pressure is an economically significant predictor of the equity risk premium, consistent with the CAPM in incomplete markets. The success of the strategies based on commercial hedging pressure suggests that the actions of these informed traders creates short term predictability consistent with Working (1958) and Grossman and Stiglitz, and somewhat different from the risk transfer based hedging pressure hypothesis of Keynes (1930). The success of non-reportable hedging pressure indicates that herding behavior among small investors has predictive power for the market index, consistent with the

\textsuperscript{7} In this paper we use the short rate of interest, the term spread (the difference in yield between long-term and short-term Treasury bonds), and the credit spread (the difference in yield between AAA-rated corporate bonds and the corresponding Treasury bond).
findings of Barber, Odean and Zhu (2008) and Hvidkjaer (2008). The contrarian nature of non-reportable hedging pressure as a predictive variable is also consistent with the disposition effect (Shefrin and Statman (1985), Odean (1998)). Overall, our results indicate that futures market variables play an important role in predicting the equity risk premium, allowing investors to achieve significant economic gains. These results thus contribute to the growing literature that analyzes the impact of informed and uniformed traders on market prices.

The remainder of this paper is structured as follows: Section 2 outlines the methodology and describes the data used in our analysis. The results of our empirical analysis are presented in Section 3. Section 4 concludes.

2. Methodology and Data

2.1 Methodology

Most of the existing literature on predictability and market-timing focuses on `myopically optimal' (conditionally efficient) strategies. In contrast, we focus here on `dynamically optimal', i.e. unconditionally efficient strategies, as studied in Ferson and Siegel (2001), and Abhyankar, Basu, and Stremme (2007). While the portfolio weights of the former are determined on the basis of the conditional return moments, the weights of the latter are determined \textit{ex-ante} as functions of the predictive instruments. In this sense, dynamically optimal strategies are truly actively managed, while myopically optimal strategies can be thought of as sequences of one-step-ahead efficient static portfolios. Because dynamically optimal strategies are designed to be efficient with respect to their long-run unconditional

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8 Non-reportable hedging pressure may thus be regarded as a measure of market sentiment and our results are also consistent with the behavioral theory of Shefrin and Statman (1994).

9 The disposition effect in our context would be the tendency of small investors to sell too quickly when the market is rising and hold on while the market is falling.
moments, they display a more `conservative' response to changes in the predictive instruments. This is an important consideration in particular with respect to transaction costs. The weights of our strategies are functions of our predictive variables, based on a simple predictive regression $r_{t+1} = \alpha + \beta.z_t + \epsilon_{t+1}$, where $z_t$ is the vector of predictive variables. The precise specifications of the weights of these dynamically efficient strategies are provided in the Appendix and we consider unconditionally efficient maximum return strategies designed to maintain a constant level of volatility. Minimum variance strategies that are designed to track a given level of mean return tend to perform less well as market timing strategies, as there tends to be more volatility in the conditional mean than the conditional variance.

As base assets, we use weekly returns on the S and P 500 and the 10 year Treasury bond over the 1993-2007 period. The data are obtained from the CBOE. Returns are calculated based on closing prices and we record them on the date they are made public. For the return on the risk-free asset we use the return on the 1 month Treasury bill.

Our futures markets predictive variables are commercial hedging pressure and non reportable hedging pressure as our derivative market predictive variable is the VIX, which aggregates implied volatilities of S&P 500 (SPX) index options. The hedging pressure for a given category of traders is defined as total long positions divided by the sum of long and short positions in that category. These data are obtained from the CFTC's “Commitment of Traders” report (see following section).

2.2 The CFTC's ‘Commitment of Traders’ Report
The Commodity and Futures Trading Commission (CFTC) is a regulatory body that is entrusted with preserving the US futures markets' key economic role, namely that of price discovery and risk sharing or hedging. The CFTC runs a comprehensive market surveillance program that monitors trading activity in US futures markets on a daily basis in order to ward against price manipulation, market squeezes, and other abusive practices. In doing so, it compiles a large-trader report (LTR) showing the futures and options positions that a reporting firm (i.e. clearing members, futures commission merchants, foreign brokers, and traders) holds over and above specific reporting levels set by the commission. For instance, for S&P 500 futures, a reporting firm needs to maintain a position in excess of 1,000 contracts for it to be included in the LTR. The aggregate position of all reporting firms typically makes up for about 70-90 percent of the open interest and thus gives a fairly comprehensive overview of trading activity in any given futures market monitored by the CFTC. Futures positions that are held for other purposes than pure hedging, such as speculation or arbitrage, are subject to speculative limit rules (e.g. for the S&P 500 futures the speculative limit is 20,000 contracts). Because of this, the CFTC classifies reporting firms as “commercial” when a trader uses a particular futures contract for hedging as defined in the Commission's regulations and as “non-commercial” otherwise. Of course, reporting firm that trade in multiple markets simultaneously may be classified as commercial in one and as non-commercial in another one. Also, the Commission routinely reviews these classifications. For instance, on June 2, 2006 the CFTC reports, “As part of this ongoing review process, Commission staff recently interviewed several traders who were classified as Commercial and had significant open contracts in at least one of the foreign currency futures markets. Based on information obtained in these interviews, several traders have been reclassified from Commercial to Noncommercial because their hedging or risk management activities, although present, did not constitute a significant part of their overall market position”
The daily LTR are not publicly available. Instead, the CFTC publishes a commitment of traders (COT) report every Friday afternoon at 3.30 p.m. Eastern time which details the preceding Tuesday's aggregate number of long and short positions of commercial and non-commercial traders, together with the residual long and short positions of the non-reportable firms, for markets in which 20 or more reportable firms are active. For non-commercial firms, the COT report also includes the number of long contracts that are offset by short contracts, known as “spreading” positions. As pointed out by Haigh, Hranaiova, and Overdahl (2005), among others, this data is highly aggregated. Still, in this paper we show that it contains valuable information for the purpose of portfolio allocation decisions.

There are thus three types of hedging pressure, commercial, non-commercial and non-reportable. We choose to focus on the first and third as predictive variables as they represent the actions of a cohesive group of traders. Commercial hedging pressure represents the actions of hedgers whose objectives are clearly outlined by the CFTC and non-reportable hedging pressure seems to represent the actions of small speculators, whose actions appear to have predictive power for stock returns (Barber, Odean and Zhou (2008), Hvidkjaer (2008)). In contrast, non-commercial hedging pressure represents the actions of large speculators, ranging from investment banks to hedge funds and there appears to be no consistent objectives in this category.
3. Results

3.1 Descriptive Statistics for the Variables

3.1.1 Predictive Regressions

In order to assess whether there is indeed a predictive relationship between the lagged market variables (hedging pressure and/or the VIX) and next period’s return on the market index, we consider a predictive regression of the form \( r_{t+1} = \alpha + \beta'z_t + \epsilon_{t+1} \), where \( r_{t+1} \) is the return on the market index, and \( z_t \) is the (vector of) lagged predictive instrument(s). For this preliminary investigation, we estimate the predictive regression using the full sample (from 1993 to 2007) of data, and we use either commercial or non-reportable hedging pressure on their own or either hedging pressure variable in combination with the VIX, as predictive instruments. The results are reported in Table 1.

In the full-sample regression, we find that the return on the S&P 500 is positively related to lagged commercial hedging pressure, with the F-statistic of the regression being significant, although the \( R^2 \) is only around 1%. Adding the VIX as predictive instrument improves the \( R^2 \) slightly (from 1.03% to 1.11%), although the slope coefficient for the VIX is not significant. In contrast, S&P 500 returns are negatively related to lagged non-reportable hedging pressure, with the F-statistic for the predictive regression being significant and a similar \( R^2 \) of around 1.3%. In this case, adding the VIX as predictive instrument improves the predictive \( R^2 \) by a slightly bigger margin (from 1.27% to 1.45%) than for commercial hedging pressure, but again the slope coefficient on the VIX is not significant. Such a weak predictive relation could nonetheless affect optimal asset allocation and portfolio performance, as noted in Kandel and Stambaugh (1996).
3.1.2 Relationship with the Business Cycle

The positive (and significant) slope coefficient indicates that an increase in commercial hedging pressure is typically followed by an increase in market returns, while the opposite is true for non-reportable hedging pressure. To shed some light on the nature of the predictive relation, we estimate the correlations between our market variables (hedging pressure and the VIX) and a set of macro variables that are commonly used as (leading) indicators of the business cycle. For the latter we use the short rate (proxied by the 1-month Treasury bill rate), the term spread (defined as the difference in yield of the 30-year and 1-year Treasury bonds), and the credit spread (given as the difference between the average yield of 10-year AAA-rated corporate bonds and the yield of the corresponding Treasury bond). Table 2 reports the correlations.

The two hedging pressure variables exhibit a high negative correlation of -0.87, which is the highest in absolute value among all the variables. It is hence unsurprising that the correlations between any one of the other variables (except term spread) and either of the hedging pressure variables have opposite signs. The VIX is negatively correlated with commercial hedging pressure and negatively correlated with non-reportable hedging pressure, although the correlation coefficients are considerably lower in magnitude. The hedging pressure variables are most strongly correlated with the credit spread, with the relation being negative for commercial hedging pressure and positive for non-reportable hedging pressure. As credit spreads tend to widen in an economic downturn, this seems to indicate that commercial hedgers correctly anticipate a downward trend and hence tend to be net short in the market. In contrast, non-reportable hedging pressure seems to move counter-cyclically. The correlations with the VIX are consistent with this story, as it is well-known that volatility tends to increase during a market decline. As the VIX and credit spread are negatively
correlated with stock returns these results further indicate that commercial hedging pressure is likely to be a leading indicator of market rises while non-reportable hedging pressure is likely to be a leading indicator of market declines.

Figure 1 shows normalized plots of the hedging pressures and the VIX, and we see that commercial hedging pressure was above its long term mean over the 1993-1999 period and moved below its mean over the 2000-2003 period, while non-reportable hedging pressure exhibits the opposite behavior over this period. The VIX was relatively low over the 1993-1997 boom period, considerably higher over the 1997-2003 period (which spans the collapse of the “dot.com” bubble), and lower again after 2003. The relationship between the two hedging pressure variables seems very stable over time (with one behaving like a “mirror-image” of the other), while that between the hedging pressure variables and the VIX seems to exhibit considerable time variation. During 2007 the VIX was above its long term mean while both hedging pressures were below theirs. Finally, in joint regressions of the S&P on both market variables and business cycle variables, the market variables always drive out the business cycle variables.

**3.2 Performance of the Market-Timing Strategies**

The results of the preceding sections indicate that hedging pressure, and possibly also the VIX, may be leading indicators of changes in market return. We now examine if, using the predictive information contained in lagged values of these variables, it is possible to construct successful market-timing strategies. To avoid any “look-ahead” bias, we estimate the
predictive model over the period from 1993 to 1998\textsuperscript{10}, then form unconditionally efficient market-timing strategies on the basis of the estimated model (the precise specification of these strategies is given in the appendix), and then assess the performance of these strategies during the out-of-sample period from 1999 to 2007. We use various combinations of the predictive variables, and also compare the performance of the resulting strategies with that of strategies based on business cycle indicators alone. We consider maximum-return strategies constrained to have a volatility of 15\%. We prefer these to minimum-variance strategies as any positive average return target would have been difficult to meet due to the S&P having a negative return over this period. Over the 1999-2007 period the S&P 500 had an average annualized return of 3.5\% with an (annualized) volatility of 16.4\%, leading to an annualized Sharpe ratio of -0.02 (the average annualized return on Treasury bills during this period was about 3.9\%). The out-of-sample performance of the market-timing strategies is summarized in Table 3.

3.2.1 Commercial Hedging Pressure

We first consider commercial hedging pressure as the single predictive variable and find from Column (1) of Table 3 that the dynamic market-timing strategy based on lagged commercial hedging pressure achieved a positive mean of 15.3\% and came close to meeting the volatility constraint, with a realized volatility of 13.3\%. The annualized Sharpe ratio is 0.78; the strategy has a very low beta of 0.05 with respect to the market index, and a statistically significant positive (annualized) alpha of 10.4\%. The cumulative returns to the strategy as well as the portfolio weights are shown in Figure 2. The strategy avoids losses during the 2001-2003 bear market by shorting the S&P 500 in 2001 and continuing to be short until the end of 2006. After 2006, the strategy switches frequently between the market index and the

\textsuperscript{10}The autocorrelations for commercial hedging pressure, non commercial hedging pressure and the VIX over the 1993-1998 period were 0.94, 0.92 and 0.92 respectively and the R\textsuperscript{2} are less than 1\%. Ferson, Sarkissian and Simin (2003) suggest that these levels of autocorrelation and R\textsuperscript{2} are unlikely to lead to spurious regression biases in the predictive regressions.
risk-free asset, thus avoiding any significant losses while capturing a higher rate of growth than the market index during this period. However, the performance of the strategy seems to be driven mainly by its ability to avoid losses, while it does not out-perform the index in the post-2003 bull run. In a nutshell, the strategy behaves almost like an index-tracker in buoyant markets, while successfully decoupling itself from the market in times of crisis.

3.2.2 Non-Reportable Hedging Pressure

The results of the timing strategy using non-reportable hedging pressure are shown in Column (3) of Table 3. This strategy has a higher average return of 18.1% but also a higher volatility of 17.3%, resulting in a slightly lower Sharpe ratio of 0.75. It has a small negative beta and a statistically significant alpha of 12.9%. The cumulative return and weights of the strategy are shown in Figure 3, and we see that the strategy shorts the index over the 2001-2003 period but goes back into the market during the post 2003 bull run and thus outperforms the strategies using commercial hedging pressure over the 2003-2006 period. However, in contrast to the strategy based on commercial hedging pressure (which shorts the index in 2007), the strategy based on non-reportable hedging pressure actually increases its leverage in the market, thus sustaining some losses in 2007. Overall, although the strategy achieves a slightly higher return, it also picks up some additional volatility because it fails to decouple itself from the market during the period after 2006, which was marked by higher volatility and small losses in the market.

3.2.3 Does the VIX Help?

Using the VIX on its own as predictive variable does not lead to successful market timing, as the resulting strategy has an average return of only -3.4% in the out-of-sample period. There are considerable variations in the portfolio weights, but these do not always match the up or
down moves of the market index. This indicates that the VIX is useful for anticipating times of increased market activity, but fails to predict the direction of market moves.

Next we consider the effect of adding the VIX to either of the two hedging pressure variables. Adding the VIX to commercial hedging pressure leads to a slight increase in mean return but almost the same Sharpe ratio as with commercial hedging pressure alone, a slightly higher beta and alpha which is still statistically significant (Column 2 of Table 3). Combining the VIX with non-reportable hedging pressure increases the strategy’s average return to 20.6% and its Sharpe ratio to 0.85 (Column 4 of Table 3). This timing strategy has a beta of 0.15 and a higher alpha of 15% which is statistically significant. It appears that, while the VIX on its own does not help predict market movements (in particular, it does not seem to work successfully as a “fear indicator” as has often been claimed), it does seem to improve the informational content of hedging pressure as a predictive signal. All of the strategies considered above share two main characteristics: a low (in magnitude) beta relative to the market index, and a high positive alpha. They can thus be classified as “active alpha” strategies.

### 3.2.4 Combining the Strategies

The different profiles of the timing strategies based on commercial and non-reportable hedging pressure suggest that combining them might lead to better performance. There are two possibilities, including both variables in the predictive regression and forming a single strategy based on all variables, or constructing separate strategies based on either set of variables and then combining these strategies in a portfolio. We try both approaches, where for the latter we construct first the strategy based on commercial hedging pressure and the VIX, and then forming an equally-weighted portfolio of this and the strategy based on the
VIX and non-reportable hedging pressure. Using all predictive variables together does not improve performance; both behavior and performance of the resulting strategy closely resemble those of the strategy based on commercial hedging pressure and the VIX. In contrast, the equally-weighted strategy (formed from the two strategies based on the VIX and either of the hedging pressure variables, respectively) does improve performance (see Column 5 of Table 3), achieving a Sharpe ratio of 0.86 and a significantly positive alpha of 13.5%.

3.2.5 Including Bonds in the Asset Universe

The choice of ‘safe’ asset has been the 1-month Treasury bill for the strategies considered above. Traditional asset allocation typically involves also fixed-income investments, and so we include the ten year Treasury bond. These timing strategies using commercial hedging pressure and non-reportable hedging pressure as predictive variables have similar performance to those with only the T bill as safe asset. However adding the VIX as a predictive variable improves their performance, as illustrated in columns 2 and 4 of Table 4. The timing strategy using the VIX and commercial hedging pressure has a mean of 22% with a volatility of 16.3% leading to a Sharpe ratio of 1.00. The alpha of the strategy is 16.2% with a t-statistic of 3. Using the VIX and non-reportable hedging pressure leads to a mean of 24.3% and a volatility of 17.7% with a Sharpe ratio of 1.02. The alpha is now 18% with a t-statistic of 3.1. The cumulative returns and portfolio weights of these strategies are shown in Figures 4 and 5. We see that underperformance of the bond over the out of sample period relative to the T bill leads to the strategy taking a large ‘spread’ position in these two assets while the position in the S and P is more moderate, short over the 2001-2003 period and long afterwards. The improved performance is not due to timing between the index and the bond. These strategies also involve much larger long and short positions than those with the T bill alone and are likely to incur higher transaction costs. Using all the predictive variables or
equally weighting the strategies as before does not lead to any major improvements in performance.

3.2 How Do the Strategies Work?

The timing strategies considered above are able to time market downturns and also make frequent smaller moves in and out of the market, a characteristic of successful market timing strategies, as noted by Chance and Helmer (2001). In contrast the index weights of strategies based on business cycle variables such as the short rate, term spread and credit spread are unable to respond to the major downturn in 2001 until well after it had begun and tended to maintain their long or short position for a while and then make sudden sharp moves (details available on request), leading to all of them having negative Sharpe ratios over this period.

3.2.1. Simplified “Switching” Strategies

The strategies constructed above are optimal in a mean-variance sense with their portfolio weights being parametric functions of the predictive variables, and thus could have been implemented quite easily in real time by a portfolio manager. Nonetheless, the portfolio weights are still non-linear functions of the predictive variables and are difficult to describe as simple ‘rules’, which could provide further qualitative insights into the relationship between the predictive variables and the market index. To that end we endeavor to construct simpler strategies, using the optimal portfolio weights as a guide. We use commercial and non-reportable hedging pressure singly, with the market index as the sole risky asset. The positive slope coefficient in the predictive regression of the market index on commercial hedging pressure implies a positive correlation between the timing strategy weights and commercial
hedging pressure and in fact this correlation is quite high (0.82). The negative slope coefficient with non reportable hedging pressure implies a negative correlation which is even higher (-0.94). An increase in commercial hedging pressure could be seen as a signal to go long the index while a decrease a signal to go short, and vice-versa for non reportable hedging pressure. This motivates the construction of a pair of simple timing rules. In the case of commercial hedging pressure we go long the index in a given week when the commercial hedging pressure two weeks prior was above a given percentile of the previous year’s commercial hedging pressure and we go short if it was below a certain percentile of the previous year’s commercial hedging pressure. The rule is the opposite for non-reportable hedging pressure, go short if non reportable hedging pressure two weeks prior was above a certain percentile of the previous year’s non-reportable hedging pressure and long if it was above a given percentile. Our goal is to see if we can find various percentile levels that will allow us to match the performance of the optimal strategies using these variables, over the 1999-2007 period. Using commercial hedging pressure we find that a strategy that goes long the index if lagged commercial hedging pressure is above the 80th percentile of the previous year’s commercial hedging pressure, short if it is below the 10th percentile and in the risk free asset otherwise generates a Sharpe ratio of 0.73 (Column 1 of Table 5). This strategy has a mean of 11.8% and a volatility of 10.8% and is thus less volatile than the optimal maximum return strategy. It has an alpha of 7.9%, significant at the 5% level, and a low beta of 0.07. For non-reportable hedging pressure going short if the variable two weeks ago is above the 70th percentile of the previous year’s hedging pressure, long if it is below the 20th percentile and in the risk free asset otherwise, generates a Sharpe ratio of 0.82 (Column 2 of Table 5). The strategy mean is 14.22% with a volatility of 12.7% again lower than that for the optimal maximum return strategy. It has an alpha of 11.0%, significant at the 1% level, and a low beta of -0.04. The strategy that combines the two signals by going long when commercial hedging
pressure is above its 80th percentile and non reportable hedging pressure is below its 20th percentile and short if commercial hedging pressure is below its 10th percentile and non reportable hedging pressure is above its 70th percentile has a higher Sharpe ratio of 0.95 with a mean of 12.5% and a volatility of 9.1% (Column 3 of Table 5). It has a significant alpha of 8.66% and a beta of -0.01. The elementary strategies thus retain the ‘active alpha’ nature of the optimal timing strategies. The maximum Sharpe ratio attained using once lagged commercial hedging pressure is 0.65, for the 65th percentile levels (long) and 20th percentile level (short). For once lagged non reportable hedging pressure, the elementary strategy based on the 85th percentile level (short) and 20th percentile (long) achieves a Sharpe ratio of 0.85. Thus qualitatively and quantitatively similar results can be achieved with both twice and once lagged hedging pressures, indicating that the variables may be capturing fundamental economic shocks.

Around 30% of the index weights for the optimal maximum return strategy using commercial hedging pressure are between -30% and 30%, that is most of the weight is in the risk free asset about 30% of the time. The elementary timing strategy is in the risk free asset 60% of the time and achieves a similar Sharpe ratio suggesting that commercial hedging pressure is most successful as a timing indicator when it has moved sharply above or below its long term trend. In contrast for non reportable hedging pressure only 15% of the optimal index weights are in the -30% to 30% range and the elementary timing strategy is in the risk free asset 40% of the time. This in turn suggests that smaller moves in non reportable hedging pressure are significant for market timing. The elementary strategy using commercial hedging pressure achieves 55% of weekly up moves in the S and P higher than 2% and 34% of those less than -2%. For the elementary strategy using non reportable hedging pressure the corresponding percentages are 72% and 47% respectively. Those for the combined signal strategy, which is
in the risk free asset around 75% of the time, are 38% and 14% respectively. This difference between the percentages of up and down moves captured appears to be crucial to the performance of the elementary strategies as these up moves constituted 14% of the S and P returns while these down moves 15%. The commercial hedging pressure strategy was more successful in avoiding the downside while the non reportable was more successful in capturing the up side. The combined strategy achieved the highest Sharpe ratio by avoiding the downside, although it stayed in the risk free asset too often to be considered a practical investment strategy. Leveraging the elementary strategies or using the 10 year bond as the safe asset does not lead to any major changes in Sharpe ratio. The analysis of the elementary strategies provides qualitative insights into the timing properties of the various hedging pressure variables.

3.2.2. Performance of the Simplified “Switching” Strategies in 2008

The elementary strategies are in-sample strategies in that the estimation of percentile levels is based on the full sample period. It is natural to examine their performance in the available out of sample period, and we choose to focus on the calendar year 2008. Over this period the S&P 500 had an annualized return on -39.2% with a volatility of 35%. The twice lagged elementary strategy\(^{11}\) using commercial hedging pressure achieved a mean of -12.4% with a volatility of 26%, considerably worse than its performance over the 1999-2007 period, but considerably better than the S&P. The once lagged strategy though performed considerably better with a mean of 7.25% and a volatility of 33%. The twice lagged elementary strategy using non reportable hedging pressure has a mean return of -15.8% and a volatility of 24.4%, while the once lagged strategy achieves a positive mean return of 0.7% with a volatility of 20.3%.

\(^{11}\) We use the percentile levels from the previous section.
Both sets of elementary strategies thus did better than the S&P consistent with our findings over the 2000-2002 period, if only in avoiding the huge losses of the index. However the commercial hedging pressure based strategies clearly outperformed those based on non reportable hedging pressure, suggesting that in this crisis period following the informed traders was a better trading strategy. Once lagged commercial hedging pressure appeared to have provided a reliable short signal with the short only strategy based on once lagged commercial hedging pressure being short about 40% of the time over 2008, achieving a mean return of 23.1% with a volatility of 32.0%.

3.3 Why Do the Strategies Work?

Overall, our findings seem to support the theory that hedging pressure is an economically significant determinant of the equity risk premium as suggested by the CAPM in incomplete markets (Mayers (1976)). Commercial hedgers, who in theory have a common objective, may be able to respond more quickly to a change in market fundamentals than the overall market and their actions could lead to these small levels of predictability, with larger moves in their positions being more significant for market timing. This interpretation suggests that commercial hedgers may play the role of informed traders, as outlined in Working (1958) or Grossman and Stiglitz (1980), and our results are broadly consistent with their noisy rational expectation models in which price discovery is influenced by the action of informed traders. Our results show that the predictability implied by these models, although small in a statistical sense, leads to successful market timing. Our results suggest a different role for commercial hedging pressure from that envisaged in the original hedging pressure theory of Keynes (1930) which focuses on the role of risk transfer from hedgers to speculators.
The timing ability of non-reportable pressure over the 1999-2007 period is consistent with the findings of Barber, Odean and Zhu (2008) and Hvidkjaer (2008) who document that herding by small investors has predictive power for individual stock returns. This herding effect also appears to be present at the index level as non-reportable hedging pressure increased sharply over the 2000-2003 period and slowly declined after that, and appears to have provided a reliable contrarian indicator for market timing. In this case, as for commercial hedging pressure, it is deviations from the trend that provide the most reliable indicators for getting in or out of the market. Our results are also consistent with the disposition effect (Shefrin and Statman (1985), Odean (1998)), as small traders may tend to sell too quickly when the market is rising and not soon enough when the market is falling, which could be the source of predictability for non-reportable hedging pressure. Our results also fit with the model of Shefrin and Statman (1994) which considers interactions between informed traders and noise traders leading to value and sentiment as drivers of security prices. Market timing is thus possible if sentiment has a predictable component and findings suggest that non-reportable hedging pressure may be a proxy for investor sentiment. Overall, our results fit in with the recent work on the economic value of return predictability such as Campbell and Thompson (2007) and Wachter and Warusawitharana (2007), following Kandel and Stambaugh (1996), who find that small levels of out-of-sample predictability can have considerable economic value.

### 3.4 Transaction Costs

As all our strategies are dynamic strategies that move in and out of the risky asset, occasionally quite aggressively, the issue of transaction costs is quite relevant. For the market
index we estimate transaction costs at 5 basis points a transaction as there is a large and active futures market. For the optimal maximum return strategies using the hedging pressures alone as predictive variables leads to transaction costs between 30 and 40 basis points a year. Adding the VIX increases these to between 50 and 60 basis points. Given that the average annual return (and indeed alpha) are well over 10%, these transaction costs do not adversely affect their profitability. For the elementary strategies the transaction costs are between 45 and 55 basis points and do not adversely affect their profitability. The low level of transaction costs for the optimal strategies are due to the conservative response of the portfolio weights to large changes in the predictive variables. This was first noted by Ferson and Siegel (2001) and leads to portfolio weights that are not too extreme, thus keeping transaction costs low. For the elementary strategies the absence of leverage keeps the costs low as well. Thus all our timing strategies are likely to be profitable in practice.

4. Conclusions

This paper examines the economic value of predicting the equity risk premium using market variables. We do so by studying the performance of market timing strategies using variables drawn from the futures and options markets. The futures market variables reflect the positions of commercial hedgers and small investors, while the options market variable is the level of the VIX. We find that market timing strategies based on the positions of traders perform well over the 1999-2007 and are particularly good at avoiding losses during downturns. In contrast, strategies based on business cycle variables perform worse than the index over this period. The timing ability of the predictive variables seems to reflect a delayed response to changes in fundamentals for large speculators while herding among small investors leads to it being a
reliable contrarian timing indicator. Overall these results indicate that market variables could play an important and economically significant role in predicting the equity risk premium.
References


Table 1:
Full-Sample Predictive Regression

<table>
<thead>
<tr>
<th>Instrument(s)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHP</td>
<td>0.066**</td>
<td>0.078**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHP + VIX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRHP</td>
<td>-0.031**</td>
<td>-0.038**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRHP + VIX</td>
<td></td>
<td></td>
<td>0.019</td>
<td></td>
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</table>

Coefficients

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>CHP</td>
<td>0.066**</td>
<td>0.078**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRHP</td>
<td>-0.031**</td>
<td>-0.038**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIX</td>
<td>0.015</td>
<td></td>
<td></td>
<td>0.019</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²</td>
<td>1.03%**</td>
<td>1.11%**</td>
<td>1.27%**</td>
<td>1.45%**</td>
</tr>
</tbody>
</table>

This table shows the coefficients and $R^2$ of the predictive regression

$$r_{t+1} = \alpha + \beta'z_t + \epsilon_{t+1},$$

of returns on the S&P 500 index ($r_{t+1}$) on various (sets of) lagged predictive instruments ($z_t$), estimated over the full sample period (1993-2007). The data are at weekly frequency, and the predictive instruments are commercial hedging pressure (CHP, Column 1), non-reportable hedging pressure (NRHP, Column 3), and each of the hedging pressure variables combined with the VIX (Columns 2 and 4), respectively. See Section 2 for a detailed description of these instruments.
Table 2:

Correlations between Market and Business Cycle Variables

<table>
<thead>
<tr>
<th>Instrument</th>
<th>CHP</th>
<th>NRHP</th>
<th>VIX</th>
<th>TB1M</th>
<th>TSPR</th>
<th>CSPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHP</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRHP</td>
<td>-0.875</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIX</td>
<td>-0.369</td>
<td>0.437</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TB1M</td>
<td>0.159</td>
<td>-0.368</td>
<td>0.018</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSPR</td>
<td>0.156</td>
<td>0.178</td>
<td>-0.060</td>
<td>-0.739</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CSPR</td>
<td>-0.499</td>
<td>0.610</td>
<td>0.336</td>
<td>-0.518</td>
<td>0.352</td>
<td>1</td>
</tr>
</tbody>
</table>

This table shows the correlations between the market instruments (commercial hedging pressure CHP, non-reportable hedging pressure NRHP, and the VIX), and the business cycle variables (the one-month Treasury Bill rate TB1M, the term spread TSPR, which is the difference in yield between the 30-year bond and the 1-year Treasury Bond, and the credit spread CSPR, which is the difference between the average yield on 10-year AAA rated corporate bonds and the yield on the corresponding Treasury bond. These correlations are computed using weekly data over the entire 1993-2007 period. A detailed description of the market variables is given in Section 2.

12 The US Treasury suspended issuance of the 30-year bond between 2002 and 2006, and hence for this period the 30-year yield is extrapolated on the basis of shorter-maturity bonds. More specifically, from February 18, 2002, to February 9, 2006, the US Treasury published a factor for adjusting the nominal 20-year constant maturity rate in order to estimate the 30-year nominal rate. The historical adjustment factor can be found at www.treas.gov/offices/domestic-finance/debt-management/interest-rate/ltcompositeindexhistorical.shtml.
This figure shows the time series plots of commercial hedging pressure (heavy-weight line), non-reportable hedging pressure (dotted line) and the VIX (light-weight line) over the period from 1993 to 2007. All series are normalization by subtracting the unconditional mean from the respective variable and dividing by the unconditional standard deviation.
Table 3:
Performance of Timing Strategies,
using the S&P 500 and Risk-Free T-Bills as Base Assets

<table>
<thead>
<tr>
<th>Instrument(s)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CHP</td>
<td>CHP</td>
<td>NRHP</td>
<td>NHRP</td>
<td>EW</td>
</tr>
<tr>
<td>Mean Return</td>
<td>15.28%</td>
<td>16.87%</td>
<td>18.14%</td>
<td>20.60%</td>
<td>15.61%</td>
</tr>
<tr>
<td>Volatility</td>
<td>13.34%</td>
<td>15.12%</td>
<td>17.28%</td>
<td>17.50%</td>
<td>15.12%</td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>0.78</td>
<td>0.78</td>
<td>0.75</td>
<td>0.85</td>
<td>0.86</td>
</tr>
<tr>
<td>Beta</td>
<td>0.05</td>
<td>0.30</td>
<td>–0.07</td>
<td>0.15</td>
<td>0.23</td>
</tr>
<tr>
<td>Alpha</td>
<td>10.43%</td>
<td>11.90%</td>
<td>12.85%</td>
<td>15.00%</td>
<td>13.45%</td>
</tr>
<tr>
<td></td>
<td>(2.34**)</td>
<td>(2.36**)</td>
<td>(2.23**)</td>
<td>(2.57**)</td>
<td>(3.02**)</td>
</tr>
</tbody>
</table>

This table shows the out-of-sample performance of the timing strategies using the S&P 500 and the risk-free asset as base assets. The predictive instruments are commercial hedging pressure (CHP, Column 1), non-reportable hedging pressure (NRHP, Column 3), and each of the hedging pressure variables combined with the VIX (Columns 2 and 4), respectively. For each (set of) instrument(s), the predictive model is estimated over the 1993-97 (“in-sample”) period. Based on the estimated model coefficients, dynamic market-timing strategies are constructed (as described in Section 2 and Appendix A.1). The strategies are then “run” throughout the 1999-2007 (“out-of-sample”) period, re-balanced weekly in response to any changes in the predictive instruments, and their performance is measured on the basis of their realized out-of-sample returns. Ex-post “beta” and “alpha” are estimated relative to the S&P 500\textsuperscript{13}, and the return on the 1-month T-bill is used as a proxy for the risk-free rate. All figures are annualized. For the estimates of “alpha”, the t-statistics are shown in parentheses, with asterisks indicating significance at the 5% (*) or 1% (**) level, respectively. Column (5) shows the analogous results for a strategy that is constructed as an equally-weighted portfolio of the two strategies from Columns (1) and (3).

\textsuperscript{13} In the 1997-2007 out-of-sample period, the S&P 500 achieved an average annualized return of 3.58% with a volatility of 16.38%, and a Sharpe ratio of –0.02.
The top panel of this figure shows the out-of-sample cumulative returns (heavy-weight line) of the timing strategy that uses the S&P 500 as risky asset and commercial hedging pressure as the predictive instrument (this strategy corresponds to Column 1 in Table 3), over the 1999-2007 period. Also shown is the cumulative return on the S&P 500 index (light-weight line) over the same period. The bottom panel shows the portfolio weights of the strategy (the heavy-weight line is the weight on the S&P 500, while the light-weight line is the weight on the risk-free asset). The predictive model is estimated over the 1993-97 (“in-sample”) period, and the strategy is constructed (as described in Section 2 and Appendix A.1) on the basis of the estimated model parameters. The strategy is then “run” throughout the 1997-2007 (“out-of-sample”) period, rebalanced weekly in response to changes in the predictive variable. The performance of this strategy is also summarized in Column 1 of Table 3.
Figure 3:
Cumulative Returns and Portfolio Weights of the Timing Strategy, using the S&P 500 and T-Bill as Base Assets, and Non-Reportable Hedging Pressure as Predictive Instrument

The strategy in this figure is identical to that in Figure 2, except that it uses non-reportable instead of commercial hedging pressure as predictive instrument. The top panel shows the out-of-sample cumulative returns (heavy-weight line) of the timing strategy that uses the S&P 500 as risky asset and non-reportable hedging pressure as the predictive variable (this strategy corresponds to Column 3 in Table 3), over the 1999-2007 period. Also shown is the cumulative return on the S&P 500 index (light-weight line) over the same period. The bottom panel shows the portfolio weights of the strategy (the heavy-weight line is the weight on the S&P 500, while the light-weight line is the weight on the risk-free asset). The predictive model is estimated over the 1993-97 (“in-sample”) period, and the strategy is constructed (as described in Section 2 and Appendix A.1) on the basis of the estimated model parameters. The strategy is then “run” throughout the 1997-2007 (“out-of-sample”) period, rebalanced weekly in response to changes in the predictive variable. The performance of this strategy is also summarized in Column 3 of Table 3.
Table 4:
Performance of Timing Strategies,
using the S&P 500, the Bond Index, and Risk-Free T-Bills as Base Assets

<table>
<thead>
<tr>
<th>Instrument(s)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CHP</td>
<td>CHP</td>
<td>NRHP</td>
<td>NHRP</td>
<td>EW</td>
</tr>
<tr>
<td>Mean Return</td>
<td>16.92%</td>
<td>21.99%</td>
<td>20.29%</td>
<td>24.28%</td>
<td>23.14%</td>
</tr>
<tr>
<td>Volatility</td>
<td>13.94%</td>
<td>16.33%</td>
<td>17.57%</td>
<td>17.66%</td>
<td>16.33%</td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>0.85</td>
<td>1.00</td>
<td>0.84</td>
<td>1.02</td>
<td>1.04</td>
</tr>
<tr>
<td>Beta</td>
<td>0.01</td>
<td>0.23</td>
<td>–0.11</td>
<td>0.08</td>
<td>0.14</td>
</tr>
<tr>
<td>Alpha</td>
<td>11.84%</td>
<td>16.17%</td>
<td>14.65%</td>
<td>17.99%</td>
<td>17.08%</td>
</tr>
<tr>
<td></td>
<td>(2.55**)</td>
<td>(3.02**)</td>
<td>(2.50**)</td>
<td>(3.06**)</td>
<td>(3.14**)</td>
</tr>
</tbody>
</table>

This table shows the analogous results to Table 3, with a Treasury bond index added as a second risky asset. The predictive instruments used are commercial hedging pressure (CHP, Column 1), non-reportable hedging pressure (NRHP, Column 3), and each of the hedging pressure variables combined with the VIX (Columns 2 and 4), respectively. For each (set of) instrument(s), the predictive model is estimated over the 1993-97 (“in-sample”) period. Based on the estimated model coefficients, dynamic market-timing strategies are constructed (as described in Section 2 and Appendix 1). The strategies are then “run” throughout the 1999-2007 (“out-of-sample”) period, re-balanced weekly in response to any changes in the predictive instruments, and their performance is measured on the basis of their realized out-of-sample returns. Ex-post “beta” and “alpha” are estimated relative to the S&P 500, and the return on the 1-month T-bill is used as a proxy for the risk-free rate. All figures are annualized. For the estimates of “alpha”, the t-statistics are shown in parentheses, with asterisks indicating significance at the 5% (*) or 1% (**) level, respectively. Column (5) shows the analogous results for a strategy that is constructed as an equally-weighted portfolio of the two strategies from Columns (1) and (3).

\[14\] In the 1999-2007 out-of-sample period, the bond index had an average return of 0.48% with a volatility of 5.28%, and achieved a Sharpe ratio of –0.63. See Table 3 for the corresponding results for the S&P 500.
The top panel of this figure shows the out-of-sample cumulative returns (heavy-weight line) of the strategy that uses the S&P 500 and the bond index as risky assets, and commercial hedging pressure as the predictive instrument (this strategy corresponds to Column 1 in Table 4), over the 1999-2007 period. Also shown is the cumulative return on the S&P 500 index (light-weight line) over the same period. The bottom panel shows the portfolio weights of the strategy (the heavy-weight line is the weight on the S&P 500, the dashed line is the weight on the bond index, while the light-weight line is the weight on the risk-free asset). The predictive model is estimated over the 1993-97 (“in-sample”) period, and the strategy is constructed (as described in Section 2 and Appendix A.1) on the basis of the estimated model parameters. The strategy is then “run” throughout the 1997-2007 (“out-of-sample”) period, rebalanced weekly in response to changes in the predictive variable. The performance of this strategy is also summarized in Column 1 of Table 4.
The strategy in this figure is identical to that in Figure 4, except that it uses non-reportable instead of commercial hedging pressure as predictive instrument. The top panel shows the out-of-sample cumulative returns (heavy-weight line) of the strategy that uses the S&P 500 and the bond index as risky assets, and non-reportable hedging pressure as the predictive instrument (this strategy corresponds to Column 3 in Table 4), over the 1999-2007 period. Also shown is the cumulative return on the S&P 500 index (light-weight line) over the same period. The bottom panel shows the portfolio weights of the strategy (the heavy-weight line is the weight on the S&P 500, the dashed line is the weight on the bond index, while the light-weight line is the weight on the risk-free asset). The predictive model is estimated over the 1993-97 (“in-sample”) period, and the strategy is constructed (as described in Section 2 and Appendix A.1) on the basis of the estimated model parameters. The strategy is then “run” throughout the 1997-2007 (“out-of-sample”) period, rebalanced weekly in response to changes in the predictive variable. The performance of this strategy is also summarized in Column 3 of Table 4.
Table 5:
Performance of the Elementary Timing Strategies

<table>
<thead>
<tr>
<th>Instrument(s)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Return</td>
<td>11.78%</td>
<td>14.22%</td>
<td>12.48%</td>
</tr>
<tr>
<td>Volatility</td>
<td>10.84%</td>
<td>12.70%</td>
<td>9.10%</td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>0.73</td>
<td>0.82</td>
<td>0.95</td>
</tr>
<tr>
<td>Beta</td>
<td>0.08</td>
<td>-0.04</td>
<td>-0.01</td>
</tr>
<tr>
<td>Alpha</td>
<td>7.91%</td>
<td>11.00%</td>
<td>8.66%</td>
</tr>
<tr>
<td></td>
<td>(2.21*)</td>
<td>(2.59**)</td>
<td>(2.85**)</td>
</tr>
</tbody>
</table>

This table reports the performance of elementary “switching” strategies (as described in Section 3.2.1), using the S&P 500 and the risk-free asset as base assets. The predictive instruments are commercial hedging pressure (CHP, Column 1) and non-reportable hedging pressure (NRHP, Column 2). The CHP strategy (Column 1) goes long the S&P 500 in a given week if the previously observed value of CHP was above the 80th percentile of the empirical distribution of CHP over the preceding 12 months, short the S&P 500 if CHP was below the 10th percentile, and invests 100% in the risk free asset otherwise. The NRHP strategy (Column 2) goes short the S&P if the last observed value of NRHP was above the 70th percentile, long if it is below the 20th percentile, and invests 100% in the risk-free asset otherwise. The strategy shown in Column (3) is obtained by combining the signals from both hedging pressure variables. Specifically, this strategy goes long the S&P 500 only if both CHP and NRHP strategies would be long (i.e. if CHP is above its 80th percentile and NRHP is below its 20th percentile), and goes short only if both CHP and NRHP strategies would be short (i.e. if CHP is below its 10th percentile and NRHP is above its 70th percentile). All figures are annualized. For the estimates of “alpha”, the t-statistics are shown in parentheses, with asterisks indicating significance at the 5% (*) or 1% (**) level, respectively.

15 Note that the “long / short” signal is reversed for NRHP, compared to CHP.
Appendix A.1: Efficient Portfolio Weights

To specify a dynamically managed trading strategy, we denote by $\theta_k^t = \theta_k^t(Z_{t-1})$ the fraction of portfolio wealth invested in the k-th risky asset at time t-1, given as a function of the vector $Z_{t-1}$ of (lagged) predictive instruments. The return on this strategy is given by,

$$r_i(\theta) = r_f + \sum_{k=1}^{n} (r^k_i - r_f) \theta_k^{t-1}.$$  

where $r^k_i$ denotes the return on the risky asset and $r_f$ the return on the conditionally risk free asset. The difference in time indexing indicates that, while the return on the risk-free asset is known at the beginning of the period, the returns on the risky assets are uncertain \textit{ex-ante} and only realized at the end of the period. It is shown in Abhyankar, Basu and Stremme (2007) that the weights of any unconditionally efficient managed strategy can be written as

$$\theta_{t-1}^* = \frac{w - r_f^{t-1}}{1 + H_{t-1}^2 \Sigma_{t-1}^{-1}(\mu_{t-1} - r_f) \Sigma_{t-1}}.$$  

Here $\mu_{t-1}$ denotes the conditional mean of the assets as functions of the predictive variables and $\Sigma_{t-1}$ their conditional variance-covariance matrix and $H_{t-1}^2$ denotes the conditional Sharpe ratio of the assets given by $\left(\mu_{t-1} - r_f\right) \Sigma_{t-1}^{-1} \left(\mu_{t-1} - r_f\right)$. w is a constant which can be chosen appropriately to track a given mean in our maximum return strategies.