Hedging Pressure and Returns in Futures: Evidence Across Asset Classes

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Abstract

The hedging pressure hypothesis contends that commodity futures prices depend on the net positions of hedgers. This paper adopts a time-series and cross-sectional analysis to revisit this hypothesis in the context of commodity markets and additionally to test its empirical validity in equity, currency and fixed income futures markets. Our analysis provides evidence of a significant hedging pressure risk premium in commodity, equity and currency futures markets. The premium correlates with general market movements and with the well-known momentum and carry factors and increases in economic conditions, consistent with the concurrence of greater hedging demand and a lessening of speculator capital flows. In contrast with the currency and fixed income factors, we find that the commodity and equity hedging pressure factors have cross-sectional pricing ability across asset classes, beyond traditional risk factors.

JEL classifications: G13, G14

Keywords: Hedging Pressure; Futures markets; Long-short asset allocation.

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1. Introduction

Public futures markets were established in the 19th century to allow transparent, standardized and efficient *hedging* (or protection against the risk of price fluctuations) of agricultural commodities. Since then they have expanded to include futures contracts for hedging the values of many other commodities, alongside foreign currency, equity and interest rate fluctuations. Futures markets were thus conceived to enable the risk-offsetting needs of hedgers, but they cannot exist without the profit-seeking *speculators* who by performing the risk-bearing role can be beneficial to society.

A long-standing theory of commodity futures pricing centers on the hedging pressure hypothesis of Cootner (1960) and Hirshleifer (1988).[1] This theory argues that commodity futures prices depend on the net positions of hedgers which, in turn, is driven by their relative level of risk aversion. When hedgers are net short or when short hedgers (producers) are more risk-averse than long hedgers (consumers), futures prices are set at a discount to expected spot prices at maturity, the expected future spot price, to entice net long speculation; this market condition is referred to as *backwardation*. Vice versa, when hedgers are net long or when long hedgers are more risk averse than short hedgers, futures prices are set a premium to expected future spot prices at maturity to induce net short speculation; the market is then said to be in *contango*. In both market conditions, according to this "insurance" theory the futures risk premium is the compensation paid by hedgers to speculators for absorbing the net hedging demand, that is, the demand for price risk insurance.[2]

Is the insurance mechanism postulated by the hedging pressure theory pervasively at work in commodity, equity, currency and fixed income futures markets? There is no reason to limit, as the theoretical and empirical literatures implicitly do, the role of hedging demand on the formation of futures prices is confined to commodity futures markets. Hedging demand may plausibly a role in the price formation of currency, equity and fixed income futures contracts too. For example,

[1] The hedging pressure hypothesis generalizes the normal backwardation theory of Keynes (1930) and Hicks (1939). Normal backwardation argues that hedgers are normally net short as commodity producers are more prone to hedge their price risk than commodity consumers.

[2] The backwardation and contango cycle is also an intrinsic concept in the theory of storage of Kaldor (1939), Working (1949) and Brennan (1958) which associates the backwardation (contango) phase of the market with scarce (abundant) inventories and downward (upward)-sloping forward curves.

firms that engage in cross-border trades or that invest in foreign currency-denominated securities may want to hedge their foreign exchange exposure via currency futures. In anticipation of a market correction, equity managers may want to tactically hedge their exposure by taking short (long) positions in equity (fixed income) futures. Given the importance of equity, currency and fixed income futures markets, in order to further our understanding of the price formation mechanisms, it is important to test the hypothesis that the net hedging pressure plays a role.

Measuring *hedging pressure* as the net short positions of hedgers on average over a relatively long 12-month lookback period, we test whether speculators demand a premium for taking on the price risk of hedgers or, equivalently, we assess the cost of the price insurance to hedgers. The analysis is carried out separately for each of four futures markets (commodities, currencies, equity indices and fixed income) through time-series and cross-sectional approaches.

In a purely time-series context, we test the hedging pressure hypothesis first by estimating logit regressions to assess whether hedging pressure is positively associated with the subsequent commodity futures return as the hedging pressure hypothesis predicts; namely, net short (long) hedging activity predicts a subsequent increase (decrease) in futures prices. Next we follow a dynamic hedging pressure strategy to test the hedging pressure hypothesis; at the end of each sample month we form long-short portfolios according to hedging pressure as sorting signal; the idea is to buy (sell) the futures contracts with highest (lowest) past net short hedging demand since according to the hedging pressure theory their subsequent prices will increase (decrease). We subsequently relate the performance of the hedging pressure portfolio to economic activity and to general market risk, momentum, value and carry risk factors (Asness *et al*., 2013; Koijen *et al*., 2017). In a cross-sectional setting, we investigate the pricing ability of hedging pressure risk factors constructed, separately, from commodity, equity, currency and fixed income futures data, while controlling for extant risk factors in the context of several different "off the shelf" models.

Our findings confirm the validity of the hedging pressure hypothesis in *commodity* futures markets and extend the evidence to the *equity* and *currency* futures markets. In all three classes of futures markets, the mean excess returns of the hedging pressure portfolio are indeed found to be positive and statistically significant. Thus, and as the hedging pressure hypothesis predicts, net short (long) hedging is associated with higher (lower) expected futures return. In sharp contrast, there is no evidence of a long-run hedging pressure effect in fixed income futures markets. We further find that the performance of the hedging pressure portfolio for the most part reflects a compensation for market risk, momentum, value and carry risks, suggesting that the incentive to hedge is largely driven by the general market movements, by past performance and/or by the slope of the forward curve. We complement this analysis by looking at the performance of the hedging pressure portfolio over the business cycle and document, in line with the theoretical commodity pricing model of Acharya *et al.* (2013), that the hedging pressure risk premium rises in economic downturns when producers' default risk is likely to be high and speculators face capital constraints. As their model predicts, in periods of heightened volatility long speculators have less capital to invest and producers have stronger incentive to hedge as their risk of default rises; this in turn leads to more pronounced backwardation and thus to a larger hedging pressure risk premium. Finally, the cross-sectional pricing analysis reveals that the hedging pressure factors emanating from commodity and equity futures markets have significant pricing ability across asset classes.

Our article speaks to the mixed empirical literature about hedging pressure as driver of commodity futures premia. Favourable empirical evidence has been adduced by Cootner (1960, 1967), Chang, (1985), Dewally *et al.* (2013),[3] Basu and Miffre (2013), Carter *et al.* (1983), Hirshleifer (1988, 1989), Bessembinder (1992), de Roon *et al.* (2000). In sharp contrast, Gorton et al. (2012), Rouwenhorst and Tang (2012), Daskalaki *et al.* (2014), Szymanowska *et al.* (2014) and Lehecka (2015) find no hedging pressure effects in commodity futures markets. Finally, and aside from the aforementioned long-term hedging pressure premium, namely, the compensation received by speculators for providing long-run insurance to hedgers, Kang *et al.* (2017) detect a short-term premium of opposite nature, namely, the compensation received by hedgers for providing short-run liquidity to impatient speculators. The implication is that the risk premium inferred from an analysis of the net positions of hedgers could be positive or negative depending on the horizon over which hedging pressure is measured. Our paper is based on a *long-term* hedging pressure signal.

[3] Cootner (1960, 1967) provides evidence for wheat and soybeans, Chang (1985) studies corn, soybeans and wheat, and Dewally *et al.* (2013) consider crude oil, heating oil and gasoline.

Against the aforementioned hedging pressure literature, our paper is the first to test for the presence of a hedging pressure premium and cyclicality therein using a dynamic long-short portfolio approch in four asset classes: commodities ($N = 34$), currencies ($N = 11$), equity indices ($N = 17$) and fixed income ($N = 9$). Thus, the present paper extends Bessembinder (1992) and De Roon et al. (2000) who adopt instead the regression (CAPM)-based approach. Using data on 22 futures markets divided into four groups, financial, agricultural, mineral and currency, Bessembinder (1992) finds that the currency and agricultural futures vary with the net holdings of hedgers, after controlling for systematic risk. Using a similar sample of the above four groups of futures and similar CAPM regressions, De Roon et al. (2000) find that there is cross-market predictive content in hedging pressure (namely, both the futures own hedging pressure and cross-market hedging pressures from within the group affect futures returns) and that hedging pressure also contains explanatory power for the returns of the underlying assets.

The paper also contributes to a parallel literature that is concerned with the role played by frictions in the form of speculators' capital constraints (limits-to-arbitrage) in commodity futures markets. Cheng et al. (2015) present evidence of a withdrawal of arbitrage capital in commodity futures markets (i.e., limited speculator capital) during the recent financial crisis. Acharya et al. (2013) develop a theoretical hedging pressure model of commodity spot and futures price determination which incorporates the time-varying risk-bearing capacities of speculators. Assuming in the vein of the Normal Backwardation theory of Keynes (1939) that only producers (but not consumers) hedge via commodity futures, their model predicts a greater futures risk premium when producers' default risk rises which, in turn, increases their hedging demands, and also when speculator activity shrinks due to capital constraints. Etula (2009) shows that high relative growth in intermediaries' (aggregate broker-dealer assets) relative to household asset growth predicts low subsequent commodity futures returns, consistent with the notion that a lessening of speculators' capital constraints leads to a lower commodity futures risk premium.

Finally, the paper adds to extant studies that have shown that commodity market risk can explain the cross-section of equity returns (see e.g. Boons, De Roon and Szymanowska, 2014; Fernandez-Perez et al., 2017).

The rest of the paper unfolds as follows. Section 2 discusses the methodology, and Section 3 the futures markets data for the analysis. Section 4 presents the empirical results first, and then additional robustness tests, before concluding the paper in Section 5.

2. Methodology

2.1 Time-series analysis

The analysis is based on a hedging pressure measure obtained from information on short and long hedgers positions as in de Roon et al. (2000); Basu and Miffre (2013), Szymanowska et al. (2014) and Kang et al. (2017) inter alia. Let N denote the cross-section of futures contracts per asset class ($i = 1, \ldots, N$). At each month end *t* of the sample period, we obtain the *hedging pressure* measure as an average of the monthly hedging pressures observed over a 12-month lookback period

$$HP_{i,t}^{H} \equiv \frac{1}{R}\sum_{j=1}^{R} \frac{Short_{i,j}^{H} - Long_{i,j}^{H}}{Short_{i,j}^{H} + Long_{i,j}^{H}}, \tag{1}$$

where $Short_{i,j}^{H}$ and $Long_{i,j}^{H}$ are the month *j* average short and long open interest, respectively, of large commercial traders (hedgers) on the *i*th futures contract. The choice of 12-months as lookback (or ranking period; $R = 12$) allows us to smooth out the variation in hedging pressure due to the seasonal fluctuations in production that characterize many commodities; namely, the relatively smooth HP measure (1) should ideally reflect the slow evolution of underlying production/consumption decisions in physical markets. More generally across the four asset classes, the choice of a relative long lookback period allows us to mitigate short-run effects (noise) such as the liquidity demands of impatient speculators which may induce variation in hedging pressure that is independent from their price insurance demands (Kang et al., 2017).

As benchmarks for the hedging pressure analysis, we consider the momentum (Asness *et al.*, 2013), value (Asness *et al.*, 2013) and carry (Koijen *et al.*, 2017) signals that have been shown in the literature to capture a premium across asset classes. Specifically, the signals are the average monthly excess return of the futures contract return over the prior 12-months (momentum), the current futures price relative to its price 4.5 to 5.5 years ago (value) and the current roll-yield defined as the difference in the log prices of the front and second nearest contracts (carry).

Our first approach to investigate hedging pressure effects in diverse futures markets is predictive regression analysis to test whether net positions of participants can predict risk premiums. We assess the predictive ability of hedging pressure for subsequent futures price changes through panel logit regressions with individual (contract *i*) and time (month *t*) fixed effects

$$d_{i,t} = G\left(\tau_i + \tau_t + \gamma \cdot HP_{i,t-1}^{H} + \theta \cdot Y_{t-1}\right) + \varepsilon_{i,t}, \tag{2}$$

where $d_{i,t}$ is a binary indicator equal to 1 if the month *t* excess return (or log price change) of the *i*th futures contract is positive $r_{i,t} > 0$, otherwise d_{it} is equal to 0. $HP_{i,t-1}^{H}$ is the corresponding hedging pressure signal calculated according to Equation (1) using information on large commercial traders positions on the prior 12-month lookback period; Y_{t-1} captures well-known drivers of excess returns in futures markets via: *i*) momentum (average monthly excess return over the prior 12-months, Asness *et al.*, 2013), *ii*) value (ratio of the current futures price to its price 4.5 to 5.5 years ago, Asness *et al.*, 2013)[4] or *iii*) carry measured as roll-yield (difference in the log prices of the front and second nearest contracts, Koijen *et al*., 2017); and $\varepsilon_{i,t}$ is an error term; τ_i are the individual fixed effects meant to capture unobserved heterogeneity among contracts, and τ_t are month fixed effects meant to capture variation in the direction of the returns of the futures contracts that is driven by common factors (e.g., "seasonality" effects, and business cycles).

Consistent with the *hedging pressure hypothesis*, our portfolio approach to test for hedging pressure effects unfolds by sorting the *N* available futures contracts by their $HP_{i,t}^{H}$ value at each month end *t*, taking long positions in those contracts in the top tercile ($N/3$ futures contracts with highest HP^{H}) and simultaneous short positions in the bottom tercile ($N/3$ futures contracts with the lowest HP^{H}). The individual futures contracts in the long-short portfolio are equally-

[4] For consistency across asset classes, the value sorting signal for stocks that we employ is not the conventional one based on book-to-market (BM) data. These long-term mean reversion measures of value are motivated by DeBondt and Thaler (1985) who adopt them to identify "cheap" and "expensive" stocks. Fama and French (1996) show that the past 5-year return signal produces portfolios that are highly correlated with *BM* portfolios, and Gerakos and Linnainmaa (2012) document a direct link between past returns and *BM* ratios. A theoretical link has also been established between long-term returns and BM ratios; see, for instance, Daniel, Hirshleifer, and Subrahmanyam (1998), Barberis, Shleifer, and Vishny (1998), Hong and Stein (1999), and Vayanos and Wooley (2012).

weighted, all the positions are fully-collateralized, and the portfolio is held for one month when a new sorting is carried out. For benchmarking, we construct momentum, value and carry portfolios using the same approach but sorting instead the contracts with the corresponding signals described above.

Next in order to gauge the 'pure' hedging pressure premia we measure the *alpha* of the long-short HP portfolios after controlling for risk exposures to the broad market factor (EW_t; excess returns of the long-only equally-weighted portfolios), the momentum factor (Mom_t, excess returns of the long-short momentum portfolios), value factor ($Value_t$, excess returns of the long-short value portfolios) and carry factor ($Carry_t$, excess returns of the long-short carry portfolios). The goal is to ascertain whether the excess returns of the HP portfolios are simply compensation for exposure to well-known (market, momentum, value and carry) risk factors. We estimate the model

$$r_{HP,t} = \alpha + \beta^{HP} EW_t + \beta^{Mom} Mom_t + \beta^{Value} Value_t + \beta^{Carry} Carry_t + \varepsilon_t \qquad (3)$$

where $r_{HP,t}$ denotes the month *t* return of the long-short HP portfolio of commodities, currencies, equity indices or fixed income futures. The alpha and betas (risk exposures) of the HP portfolios captured by the parameter vector $(\alpha, \beta_{HP,EW}, \ldots, \beta_{HP,Carry})'$ are estimated by OLS. Inferences are based on Newey-West robust *t*-statistics.

Acharya *et al*. (2013) develop a hedging pressure model (with elements from the inventory theory also) in which long speculators may face capital constraints and producers incentive to hedge is driven by their default risk. Accordingly, in period of heightened uncertainty (economic downturns and crisis periods) speculators have less capital or, equivalently less risk-bearing capacity; at the same time, producers have stronger incentive to hedge as their risk of default rises. Commodity futures prices are then set at a bigger discount (than in economic expansions or non-crisis periods) from the expected future spot prices at maturity which implies that hedging becomes more expensive, namely, there is an increase in the hedging pressure risk premium captured by speculators for facilitating hedging demands. To examine cyclicality in hedging pressure, we employ the conditional framework of Christopherson et al. (1998) to accommodate time-varying alpha and risk exposures in the previous Equation (3) as follows

$$r_{HP,t+1} = \alpha_t + \beta_t^{EW} EW_{t+1} + \beta_t^{Mom} Mom_{t+1} + \beta_t^{Value} Value_{t+1} + \beta_t^{Carry} Carry_{t+1} + \varepsilon_{t+1} \quad (4)$$

where the time-variation in the coefficients is parameterized as $\alpha_t = \alpha + \alpha_Z Z_t$ with α_t and α denoting, respectively, the conditional and unconditional alpha, and likewise for the risk-factor exposures $=\beta_t^j = \beta^j + \beta_Z^j Z_t$ for j={*EW, Mom, Value, Carry*} factors**.** As in Christoffersen et al. (1998) we define the conditioning variable Z_t as a standardized surprise, $\boldsymbol{Z_t} \equiv (\boldsymbol{X_t} - \bar{X})/\sigma_{\boldsymbol{X}}$ where, X_t, proxies the state of the economy, with moving average $\bar{X}$ and volatility $\sigma_{\boldsymbol{X}}$ measured over the preceding [*t*-60,*t*-1] months. We consider as proxies the Chicago FED National Activity Index (CFNAI), the seasonally-adjusted Industrial Production Index (IPI), and the Kilian's Global Economic Activity index.[5] Motivated by the theory of Acharya *et al.* (2013) but acknowledging that futures markets can be influenced by net short hedging demands ("backwardation") and by net long hedging demands ("contango") over time, we articulate and test the following conjecture in the context of the returns of the long-short hedging pressure portfolios:

H_0: *The expected excess return of the hedging pressure portfolio is constant;*

H_A: *The expected excess return of the hedging pressure portfolio rises in economic downturns.*

According to Equation (4) the unconditional model emerges under the restrictions H_0: $\alpha_Z = \boldsymbol{\beta}_Z = 0$ whereas the alternative hypothesis H_A: $\alpha_Z < 0, \boldsymbol{\beta}_Z < 0$ implies that the alpha α_t and risk exposures β_t magnify during economic contraction $(\boldsymbol{Z_t} < 0)$ periods .

2.2. Cross-sectional asset pricing

We investigate hedging pressure effects through the lens of cross-sectional asset pricing. Let *N* denote the number of test assets. In the spirit of the Fama-MacBeth (1973) two-stage approach, we first measure the risk exposures of each test asset by OLS estimation of *N* time-series regressions

$$r_{i,t} = a_i + \boldsymbol{b}_i \boldsymbol{F}_t + \sum_{j=1}^{J} b_{i,j}^{HP} HP_{t,j} + \varepsilon_{i,t}, t = 1, \ldots, T \text{ months} \quad (5)$$

[5] http://www-personal.umich.edu/~lkilian/paperlinks.html

where $r_{i,t}$ is the month *t* excess return of test asset $i = 1, \ldots, N$. Equation (5) represents an "off the shelf" pricing model with risk factors collected in the vector $\boldsymbol{F}_t$ that we expand with the commodity, currency, equity and fixed income HP factors denoted $\{HP_{t,j}\}_{j=1}^{J}$, with $J = 4$; $\varepsilon_{i,t}$ are the residuals. The OLS estimates $\hat{a}_i$ and $(\hat{\boldsymbol{b}}_i, \hat{b}_{i,1}^{HP}, \ldots, \hat{b}_{i,j}^{HP})'$ are, respectively, consistent measures of the asset pricing error and factor exposures of each test asset.

At stage two, we obtain the prices of risk through cross-sectional OLS regressions

$$r_{i,t} = \lambda_{k,t}^{0} + \boldsymbol{\lambda}_t \hat{\boldsymbol{b}}_i + \sum_{j=1}^{J} \lambda_{t,j}^{HP} \hat{b}_{i,j}^{HP} + \epsilon_{i,t}, i = 1,2, \ldots, N \tag{6}$$

estimated on each month $t = 1, \ldots, T$. We deploy a two-sided test for the significance of the HP risk price, H_0: $\bar{\lambda}_{t,j}^{HP} = 0$, using the Shanken (1992) corrected *t*-statistic; $\bar{\lambda}_{t,j}^{HP}$ denotes the time-averaged price of the HP factor $\{\hat{\lambda}_{t,j}^{HP}\}_{t=1}^{T}$. We also examine the increase in the average cross-sectional explanatory power versus the model without the HP factors that emerges from (6) under the restriction $\lambda_{t,1}^{HP} = \cdots = \lambda_{t,4}^{HP} = 0$; i.e., $\Delta\bar{R}_{CS}^{2} = \bar{R}_{CS}^{2}\%(with\,HP) - \bar{R}_{CS}^{2}\%$ with $\bar{R}_{CS}^{2}\% = \frac{1}{T}\sum_{i=1}^{T} \bar{R}_{t}^{2}$ and $\bar{R}_{t}^{2}$ the adjusted-R^2 of Equation (6) that is, the degrees-of-freedom adjusted explanatory power of the pricing model for the cross-section of month *t* returns.

3. Data Description and Preliminary Statistics

Our analysis is based on futures contracts derived from four asset classes: *i*) commodities (*N*=34), *ii*) currencies (*N*=11), *iii*) equity indices (*N*=17) and *iv*) fixed income and interest rates (*N*=9).. The cross-section dimension N and specific contracts per asset class are dictated by the availability of trading positions data as compiled in the Commodity Futures Trading Commission (CFTC) Commitment of Traders' Report.[6] Appendix A lists the contracts in each of the four cross-sections. The futures settlement prices are obtained from *Thomson Reuters Datastream*.

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[6] An alternative hedging pressure signal in the literature is constructed from large speculators' short and long positions data (Bessembinder, 1992; Rouwenhorst and Tang, 2012; Basu and Miffre, 2013). We present results for a speculators' based hedging pressure signal defined as $HP_{i,t}^{S} \equiv \frac{1}{R}\sum_{j}^{R} \frac{Long_{i,j}^{S} - Short_{i,j}^{S}}{Long_{i,j}^{S} + Short_{i,j}^{S}}$ in the robustness section of the paper. Given that the CFTC reports positions data for groups of traders, large hedgers, large speculators, and small traders (hedgers and speculators), the two hedging pressure measures, $HP_{i,t}^{H}$ in Equation (1) and $HP_{i,t}^{S}$, are highly positively but imperfectly correlated, e.g. at around 84% for commodities, 94% for FX, 79% for equities and 85% for fixed income.

The common period for which data is available across the four asset classes is September 1992 to December 2016.

Appendix A reports the mean and standard deviation of our long-term hedging pressure signal $HP_{i,t}^{H}$ measured on each month end t as the moving average of R=12 past hedging pressures from monthly aggregate open interest data, Equation (1). The penultimate column reports per futures contract the percentage of portfolio formation months when the long-term hedging pressure measure is positive, denoted $\%HP_{i,t}^{H} \equiv \frac{\#HP_{i,t}^{H}>0}{T}$. Since this measure is very aggregate, it may provide a distorted picture of the probability that the net hedging demand for a given futures contract is net short over time (Bessembinder, 1992); namely, the long-term nature of our HP measure smooths the weekly variation in the direction (net short versus net long) of hedging demand. To be conservative, we report in the last column the frequency of positive weekly hedging pressure $\%HP_{i,w}^{H} \equiv \frac{\#HP_{i,w}^{H}>0}{W}$ with $HP_{i,w}^{H} = \frac{Short_{i,w}^{H} - Long_{i,w}^{H}}{Short_{i,w}^{H} + Long_{i,w}^{H}}$ and W is the number of sample weeks.

We observe that $\%HP_{i,t}^{H} > 0.50$ (and $\%HP_{i,w}^{H} > 0.50$) for 30 (29) out of 34 commodities; the exceptions are wheat, milk class 4, cheese, frozen pork and feeder cattle, suggesting that hedgers are predominantly net short both in the long term ($HP_{i,t}^{H}$) and at a weekly horizon ($HP_{i,w}^{H}$). This is consistent with the fact that net speculative capital (e.g. hedge funds) has historically been allocated to long positions; namely, commodity hedging demand is dominated by producers. Likewise, the long-term HP (and weekly HP) is most often positive than negative; $\%HP_{i,t}^{H} > 0.50$ (and $\%HP_{i,w}^{H} > 0.50$) suggesting a larger frequency of net short hedging demand for 14 (12) out of 17 equity contracts and 7 (7) out of 11 currency contracts. The fixed income futures contracts stand in sharp contrast as we observe that only 3 (out of 9) contracts exhibit more frequent long-term $HP_{i,t}^{H} > 0$ and weekly $HP_{i,w}^{H} > 0$ suggesting that hedging demand is more often than not net long. The volatility of the long-term $HP_{i,t}^{H}$ measure (standard deviation of $HP_{i,t}^{H}$ over $t = 1, \ldots, T$) is about 0.13 for both commodities and equities, whereas that of currency futures is the highest at 0.26 and that of fixed income futures the lowest at 0.08.

4. Empirical Results

4.1 Time-series analysis

We first examine the predictive content of *hedging pressure*, denoted $HP_{i,t}^{H}$, for the following month futures excess return, denoted $r_{i,t+1}$, using the logit regression approach. The parameter of interest, γ, in Equation (2), captures the marginal effect of past hedging pressure on the probability of a positive return. Its estimates are obtained by pooling the sampled futures contracts per asset class. We also estimate the *N* individual time-series logit regressions (per asset class) and report the ratio of positive slopes # ($\hat{\gamma}_i > 0$) / #($\hat{\gamma}_i < 0$). The results are reported in Panel A of Table 1.

[Insert Table 1 around here]

The panel logit regression slope is positive for commodity, currency and equity futures (albeit statistically significant in the latter market) suggesting that, after controlling for the predictive ability of momentum, value and carry signals, as the demands for price insurance of short hedgers increase (higher hedging pressure, $HP_{i,t}^{H}$), the probability of positive returns from month *t* to month *t*+1 also increases. Likewise the ratio of positive/negative slopes is larger than 1 for commodity, currency and equity futures. This preliminary analysis reveals that the hedging pressure signal has predictive content for subsequent futures price changes (beyond that of the momentum, value and carry signsls) that is consistent in its direction with the hedging pressure hypothesis. The fixed income futures market stands in sharp contrast with the other three markets in this regard.

Next we adopt a long-short portfolio approach to investigate hedging pressure effects separately per asset class. We begin by summarizing the long-short benchmarks in Panel B of Table 1. The performance and risk of the long-short HP portfolios is summarized in Table 2.

[Insert Table 2 around here]

The significant and positive mean excess return of the long-short HP portfolios of 3.71% per annum (commodity futures), 1.77% p.a. (currency futures) and 4.46% p.a. (equity index futures) confirms that there is a hedging pressure premium; namely futures prices in these markets are primarily driven by the hedgers' demand for price insurance. The long-short HP portfolios of commodity, currency and equity futures offer attractive reward-to-risk profiles as borne out, for instance, in Sharpe ratios of 0.5059, 0.3745 and 0.4858, respectively. In sharp contrast, the fixed-income futures market behaves differently with a negative (albeit insignificant) mean excess return of -0.7% and a Sharpe ratio of -0.2380. As further evidence that the fixed income futures market differs from the commodity, currency and equity futures markets, the long-only EW portfolio for fixed income futures summarized in Table 2 performs much better than the long-short HP portfolio and also than any of the long-short (momentum, value and carry) benchmarks.

In sum, over the sample period September 1992 to December 2016 there is a significant hedging pressure premium in commodity, equity, and currency markets. The commodity HP premia of 3.71% p.a. compares well with the commodity value and momentum premia of 0.52% p.a. and 4.93% p.a., respectively. Likewise, the HP premia of 4.46% p.a. in equity markets compares quite well with the premia captured by the well-documented carry style which reaches 4.62% in the current sample period. Albeit smaller than that in commodity and equity markets, the HP premia in currency markets at 1.77%p.a. is similar to the momentum premium of 1.23% p.a.

Figure 1 (Panel A) shows the evolution of $1 invested in the long-short HP portfolios per asset class (considering the total returns, that is, excess returns plus the 1-month US Treasury bill rate as collateral) from the start of the sample period. The HP strategy performs well for commodities, currencies and equities but poorly so for fixed income. In fact, the HP strategy for equity futures shows a remarkable performance around crisis periods such as after the LTCM collapse on September 1998 and after the bankruptcy filing of Lehman Brothers on September 2008.

[Insert Figure 1 around here]

Next, we seek to measure whether the excess returns of the HP portfolios merely reflect a reward for exposure to general market, momentum, value or carry risk factors. For this purpose, we estimate the unconditional time-series regression model, Equation (3) and present the results in Panel A of Table 3. The HP risk premia emanating from commodity, FX and equity futures markets are found to correlate with market returns and with the returns of the momentum and carry strategies. There is only mild evidence of outperformance beyond this compensation; only the commodity HP portfolio presents a significantly positive alpha. The finding that the excess returns of the HP strategy relates positively to the excess returns of the carry and momentum strategies is not surprising given that, on the one hand, speculators are known to follow trend-following strategies[7] and, on the other hand, it is well known that roll-yield, hedging pressure and momentum signals are able to capture the inexorable backwardation and contango phases of futures markets.

[Insert Table 3 around here]

Table 3 provides in Panels B-D the estimation results of the unconditional time-series regression, Equation (4) using the CFNAI, IPI and Kilian's Global Economic Activity index as conditioning variable, respectively. We find evidence of significant variation over time in the hedging pressure alphas and betas for all asset classes. This would suggest, on the one hand, that the unconditional model is mispecified and, on the other hand, that the expected excess return of the long-short HP portfolio is cyclical. For commodities and equities (as borne out by the significant coefficient α_Z pervasively across models), the alphas of the HP portfolios are found to be larger in worsening economic conditions (i.e., the significant coefficient $\hat{\alpha}_z < 0$ indicates that the alpha is larger when the surprise in CFNAI, IPI or Kilian's Global Economic Activity is negative). Likewise, across all asset classes several of risk exposures exhibit cyclicality (significant $\hat{\beta}_Z < 0$) in the same direction; namely, the expected excess return of the HP portfolio is larger per unit increase in risk during economic contractions. These findings is consistent with the theoretical rationale and evidence in Acharya et al. (2013) suggesting that the commodity futures risk premium that is driven by the price insurance demand of hedgers (in their model by assumption, mainly producers) is greater when producer hedging demand rises and speculative activity shrinks such as, for instance, during stress periods.

We also observe that both in commodity and equity markets there is a 'pure' HP effect that is independent of the systematic risk (EW) and momentum, value and carry risk exposures, which is exacerbated in economic downturns. In sharp contrast, in currency markets there is no 'pure' hedging pressure premium neither in good nor bad economic conditions, namely, both the

[7] Managed futures, commonly associated with commodity trading advisors (CTAs), predominantly adopt trend-following strategies in a wide range of asset classes including fixed income, currencies, equity indices, soft commodities, energy and metals; see Bjardwaj, Gorton and Rouwenhorst (2014), Campbell & Associates (2013) and Moskowitz, Ooi and Pedersen (2012). Preqin Hedger Fund Spotlight (2017) estimates that as of September 2017, about 70% of CTAs adopt momentum styles and a greater proportion (66%) of CTAs trade stock index futures, followed by currencies and energy futures.

unconditional α and conditional α_Z parameters are insignificant in the regression model for the currency HP portfolio returns. More specifically, the excess returns of the currency HP portfolios documented earlier (c.f., Table 2) are mostly compensation for exposure to the carry risk factor.

Thus the evidence suggests that hypothesis H_A in Section 2.1 motivated by the theory of commodity futures pricing with limits to arbitrage (Acharya et al., 2013) is supported empirically both in commodity and equity futures markets. The upshot of the analysis thus far is that there is a 'pure' hedging pressure premium in both *commodity* and *equity* futures markets which improves as the economic conditions deteriorate which is theoretically plausible given that then the hedging demand is likely to increase while speculators are also more likely to face funding constraints.

Next we assess the cross-sectional pricing ability of each of the commodity, equity, currency and fixed income HP factors proxied by the corresponding long-short portfolio returns.

4.2 Cross-Sectional Pricing Analysis

Now we investigate the presence of hedging pressure effects from the perspective of asset pricing. Specifically, we assess the cross-sectional pricing ability of each of the four hedging pressure factors for two sets of test assets. The first set are portfolios of futures obtained by sorting into terciles the four cross-sections of commodity, currency, equity and fixed income futures according to five signals – HP(hedgers), HP(speculators), momentum, value and carry – alongside the four long-only EW portfolios of commodity futures, currency futures, equity index futures and fixed income futures ($N = 3 \times 4 \times 5 + 4 = 64$ portfolios). Our second test assets set are the 25 equity portfolios of Fama-French sorted by size and book-to-market, the 7 Fama bond portfolios, the S&P-GSCI portfolio, and the USD versus major currencies index ($N = 34$ portfolios).

We begin by testing the additional cross-section pricing ability of the four HP factors in a pricing model that includes the global market risk EW factor and global momentum, value and carry factors.[8] Next we test the additional pricing ability of the HP factors in empirical asset

[8] Following Asness et al. (2013), Koijen et al. (2017), Moskowitz et al. (2012), among others, we construct risk-parity global (or 'everywhere') EW, momentum, value and carry portfolios. These portfolios combine the asset-class-specific building blocks with inverse-volatility weighting $\omega_{j,t} =$

pricing models that emanate from the equity pricing literature: i) the CAPM where the market portfolio is proxied by a combination of equities (the US value-weighted equity index from Kenneth French's library), bonds (Barclays' bond index), commodities (S&P-GSCI) and currencies (USD versus major currencies index) with weights 40%, 40%, 10% and 10%, respectively; ii) the 3-factor model of Fama and French (1993), iii) the 4-factor model of Carhart (1997); iv) the liquidity factor model of Pastor and Stambaugh (2003), and v) the 5-factor model of Fama and French (2015). Finally, for completeness we entertain also a set of models stemming from the intertemporal-CAPM pricing literature: vi) the Campbell and Vuolteenaho (2004) model; vii) the Hahn and Lee (2006) model; viii) the Petkova (2006) model; ix) the Bali and Engle (2010) model; and x) the Koijen et al. (2014) model. Appendix B lists the 11 models, the corresponding risk factors and data sources.

We should first remark that the inclusion of the four HP factors in the time-series regression, Equation (5), does not incur collinearity issues in the estimation of the risk exposures; namely, the pairwise correlations among the excess returns of the commodity, currency, equity and fixed income long-short HP portfolios are low ranging from -0.02 (currency, fixed income) to 0.18 (currency, equity). Table 4 reports estimation results for the cross-sectional pricing model, Equation (6), namely, the average prices of the four asset-class-specific HP risk factors in each model and corresponding significance tests, and the average increase in pricing ability.

[Insert Table 4 around here]

It turns out that the HP factors are not subsumed by the 'traditional' factors, namely, they are significantly priced and increase the pricing power of the model at hand. On average across models the pricing ability, $\Delta\bar{R}^2_{CS}$, improves by about 18 percentage points (from 9.4pp to 18.2pp across models) in Panel A, and by about 17pp (from 5.8pp to 20.5pp across models) in Panel B.

$\sigma_{j,t}^{-1}/\sum_{j=1}^{J}\sigma_{j,t}^{-1}$ where $\sigma_{j,t}$ is the volatility of the *j*th asset class obtained at month end *t* as the standard deviation over the past 60 months of the excess returns of the equally-weighted long-only futures portfolio; J =4. Thus each asset class' dollar contribution to the global portfolio is proportional to the inverse of its volatility, but each asset class contributes an equal fraction to the volatility of the 'global' portfolio, ignoring correlations.

Another noteworthy finding is that not all four hedging pressure factors convey pricing information; in particular, and consistent with our earlier findings, the commodity HP and equity HP factors stand out as the most significantly priced (economically and statistically). The results in Panel A suggest that the significant pricing ability of the equity HP factor is ubiquitous (across all models) while the commodity HP factor in priced in some of the models. Given that the 64 test assets in Panel A are commodity, equity, currency and fixed income portfolios in equal number (16 different portfolios per asset class), the results suggest that HP factors constructed from data on the own futures market as well as other futures markets are relevant for explaining futures returns.

The results in Panel B suggest that both the commodity HP factor and equity HP factor (particularly the former, as the ubiquitous evidence from all 11 models bears out) can price the cross-section of equity, bonds, commodity and currency portfolios. These findings suggest that hedging pressure effects are not only relevant to explain the cross-section of futures returns, but also to explain the return on the assets underlying the futures contracts. Since a large number of equity portfolios (25 SMB portfolios) comprise the test assets in Panel B, we can conclude that a commodity hedging pressure factor has good pricing power for equity portfolios confirming prior evidence (see e.g. Fernandez-Perez et al., 2017). This cross-sectional pricing analysis not only confirms that commodity and equity futures markets have in common the presence of hedging pressure effects as predicted by the hedging pressure hypothesis, but also it reveals valuable cross-market information (pricing) content in commodity and equity hedging pressure factors.[9]

4.3 Robustness checks

[9] The only prior study of hedging pressure effects across diverse futures markets we are aware of is by De Roon et al. (2000). They analyze 20 futures divided into four groups (financial, agricultural, mineral and currency) via time-series regressions of the individual futures returns on the contemporaneous S&P500 returns (systematic risk) and the lagged HP signal measured as the past semi-monthy ratio of the net short hedgers' positions over total hedgers' positions. They find that there is cross-market predictive content in hedging pressure (namely, both the futures own hedging pressure and cross-market hedging pressures from within the group affect futures returns)y and that hedging pressure also contains explanatory power for the returns of the underlying assets.

Alternative hedging pressure signals

For completeness, we now deploy the long-short HP strategy using a hedging pressure signal based on speculators positions; $HP_{i,t}^{S} \equiv \frac{1}{R}\sum_{j}^{R}\frac{Long_{i,j}^{S}-Short_{i,j}^{S}}{Long_{i,j}^{S}+Short_{i,j}^{S}}$, the moving average of monthly hedging pressures based on the long/short positions of non-commercial traders over the $R = 12$ months preceding the portfolio formation time *t*. Like with the $HP_{i,t}^{H}$ signal based on hedgers positions, consistent with the Hedging Pressure Hypothesis, we form fully collateralized long-short portfolios at each month end *t* that buy the *N*/3 futures contracts for which we observe the highest net long positions of speculators (i.e., highest $HP_{i,t}^{S}$ corresponding to the most "backwardated" futures) and short the *N*/3 futures contracts for which we observe the lowest net long positions of speculators (i.e., lowest $HP_{i,t}^{S}$ corresponding to the most "contangoed" futures). The portfolio performance is shown in Table 5.

[Insert Table 5 around here]

The results confirm the earlier findings using the hedging pressure measure based on large hedgers data; namely, the long-short portfolios formed according to the $HP_{i,t}^{S}$ signal attain significant positive mean excess returns for commodities, currencies and equities with attractive Sharpe ratios of 0.5793 (commodities), 0.5921 (currencies) and 0.4420 (equities) which compare well with the mean excess returns of the momentum, value and carry strategies. In sharp contrast but also in line with our prior evidence, the *hedging pressure hypothesis* is not supported in the context of fixed income futures markets; namely, increases in net long positions of speculators predict a decrease (instead of an increase) in subsequent fixed income futures prices.

Next, we appraise the performance of the long-short HP(speculators) portfolios using the unconditional model, Equation (3), and conditional model, Equation (4), to estimate their alpha and exposures to market, momentum, value and carry risk factors. The results summarized in Appendix C do not challenge our earlier findings for the long-short HP(hedgers) portfolios. In particular, we observe that the momentum and carry exposures of the HP(speculators) portfolios β^{Mom} and β^{Carry} in Equations (3) and (4) are positive and often statistically significant and thus that the HP risk premium relates to momentum and carry, and thus to the fundamentals of backwardation and contango. We note also a propensity for the outperformance of the HP portfolios to increase in periods of economic downturns, a result consistent with the predictions of the commodity futures premium with limits to arbitrage model of Acharya et al. (2013).

Measuring hedging pressure with data from Disaggregated CoT Report

The analysis conducted thus far focuses on the aggregate positions of commercial market participants (hedgers) and non-commercial market participants (speculators) as provided in the CFTC Commitment of Traders report. The CFTC classifies the futures traders into three main groups: large "commercial" traders, large "non-commercial" traders, and non-reportable (a mix of small traders that take positions for commercial or non-commercial purposes).

The "commercials" category according to the CFTC definition are the traders that take positions in futures to protect against risks associated with their business activities: "[…] engaged in business activities hedged by the use of the futures market". This definition includes 1) the "institutions" such as producers, processors, merchants and users of commodities, firms that sells their products internationally (pricing in local currency and hence, are exposed to foreign currency fluctuations) and bank portfolio managers, and 2) the swap dealers. However, strictly-speaking the swap dealers are not pure hedgers in the sense of Keynes (1930) since they do not have a position in the underlying commodity or, more generally, in the underlying asset.

The (large) "non-commercial" traders category includes, on the one hand, professional money managers (CTAs, CPOs and hedge funds) and, on the other hand, other non-commercial traders which are not professional money managers (e.g., pension funds with long-only positions). Strictly-speaking also, pension funds and long-only indexers are not pure Keynesian speculators since they merely seek passive exposure to financial markets as part of their strategic asset allocation.

The disaggregated Commitment of Traders report (also available from the CFTC website) provides short and long open interest data separately for the aforesaid subcategories. In this section, we reconduct the analysis of hedging pressure effects by excluding the positions of swap dealers from the HP(hedgers) measure. Similarly, we reconduct the analysis of hedging pressure effects by measuring the HP(speculators) signal excluding the positions of other non-commercial traders. Disaggregated data on the positions of pure hedgers and pure speculators are only available since June 13, 2006, which restricts the ensuing analysis to the period June 2006–December 2016.

Unreported results (available from the authors) suggest that our key findings as regards the presence of a sizeable HP premium in commodity and equity markets and cyclicality in the expected excess returns of the long-short HP portfolios (i.e., magnified premia in economic contractions) are not challenged by the exclusion of swap dealers, as non-pure hedgers, and other non-commercials, as non-pure speculators, from the measurement of the and signals.

<u>*Turnover and transaction costs*</u>

To get a sense of how trading intensive each investment strategy is, we measure the portfolio *turnover* (TO) defined as the time average of all the trades incurred

$$TO_j = \frac{1}{T-1}\sum_{t=1}^{T-1}\sum_{i=1}^{N}\left(\left|\tilde{\phi}_{j,i,t+1} - \tilde{\phi}_{j,i,t^+}\right|\right) \tag{7}$$

$t = 1, \dots, T$ denotes each of the (month-end) portfolio formation periods in the sample, $\tilde{\phi}_{j,i,t}$ is the *i*th futures allocation weight dictated at month *t* by the *j*th strategy, $\tilde{\phi}_{j,i,t^+} \equiv \tilde{\phi}_{j,i,t} \times e^{r_{i,t+1}}$ is the actual portfolio weight right *before* the next rebalancing at $t + 1$, $r_{i,t+1}$ is the monthly return of the *i*th futures from month-end t to month-end $t + 1$. Thus, the TO captures the mechanical evolution of the allocation weights due to within-month price dynamics (*e.g.*, $\tilde{\phi}_{j,i,t}$ increases to $\tilde{\phi}_{j,i,t^+}$ when $r_{i,t+1} > 0$). Figure 3, Panel A, shows the TO of the long-short strategies per asset class.

[Insert Figure 3 around here]

The hedging pressure portfolios are generally less trading intensive than the traditional long-short portfolios. The carry portfolios followed by the momentum portfolios exhibit the largest turnover.

The key question is how transaction costs affect the performance of the HP strategy relative to the momentum, value and carry strategies. To address this question, we calculate the net return as

$$\tilde{r}_{P,t+1} = \sum_{i=1}^{N}\tilde{\phi}_{i,t} r_{i,t+1} - TC\sum_{i=1}^{N}\left|\tilde{\phi}_{i,t} - \tilde{\phi}_{i,t-1^+}\right| \tag{8}$$

using a conservative proportional trading costs of 8.6 bps (Marshall et al., 2012). Figure 3, Panel B, shows the net Sharpe ratio of the long-short strategies per asset class. Confirming our prior findings, for commodities and equities the HP strategy is reasonably well-positioned relative to the momentum, value and carry strategies. When implemented in the context of commodity futures, the HP strategy' net Sharpe ratio is more attractive than that of the value strategy and similar to that of the momentum strategy. For equity futures, the net Sharpe ratio of the HP strategy is more attractive than that of the value strategy and similar to that of the momentum and carry strategies.

5. Conclusions

This paper investigates hedging pressure effects in diverse futures markets. Observing four cross-sections of futures contracts, respectively, on commodities, currencies, equity indices and fixed income, from September 1992 to December 2016, we begin by testing whether increases in net hedging pressure anticipate an increase in futures prices. This predictive test is motivated by the hedging pressure hypothesis that establishes a positive (negative) nexus between net short (long) hedging pressure and the expected futures risk premium. Long-short futures portfolios formed using hedging pressure as sorting signal offer significant mean excess returns for commodities, equity and currencies. In both commodity and equity markets, we find evidence of a 'pure' HP premium that is not compensation for the well-known market, momentum, value or carry risk factors; the exposure to these risks are insufficient to fully explain the HP return premium.

We also find that the 'pure' HP premium of commodity and equity markets intensifies when the economic conditions deteriorate possibly because then the hedging demands increase while speculators activity reduces due to funding constraints; both effects naturally makes the price insurance transfer more expensive for hedgers and equivalently, improve the premium received by the speculators. Given the long lookback period (one year) that our hedging pressure signal covers, these findings suggest that a risk-transfer mechanism is at play in both commodity and equity futures markets at least over the long run; namely, long-run variation in hedging pressure reflects the demand for price insurance of hedgers in line with the hedging pressure hypothesis.

Having established the predictive ability of hedging pressure in commodity and equity markets, we finally examine hedging pressure effects from the viewpoint of cross-sectional asset pricing. Testing the incremental pricing ability of futures market-specific HP factors for wide cross-sections of test portfolios in the context of diverse “off-the-shelf” pricing models, we find that both the commodity HP factor and equity HP factor again stand out. These factors have cross-market pricing power, namely, they are able to price portfolios of futures contracts within their class and other asset classes. They have also pricing power for portfolios of the multiple-class assets underlying those futures contracts. While many market-segmented pricing theories exist, these findings may instigate further theoretical research towards pricing global assets across markets.

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Appendix A. Individual futures contracts.

This table reports mean, standard deviation and frequency of positive values for the long-term HP signal measured at each month end as the average of monthly hedging pressures over the prior 12 months, Eq. (1). The last column reports the frequency of positive values for the weekly HP signal.

	Hedging Pressure , Eq. (1)			weekly
	Mean	StDev	$\%HP_t > 0$	$\%HP_w > 0$
Panel A: Commodities (*N* =34)				
Corn	0.0185	0.0942	58%	56%
Oats	0.2991	0.1440	99%	94%
Rough rice	0.0964	0.2017	66%	62%
Soybeans	0.1096	0.1427	76%	73%
Soybean meal	0.1786	0.0909	94%	84%
Soybean oil	0.1215	0.1171	88%	73%
Wheat	0.0194	0.1374	48%	50%
Cocoa	0.1150	0.1168	83%	76%
Coffee C	0.1152	0.0943	89%	75%
Cotton 2	0.0574	0.1206	69%	65%
Sugar 11	0.1321	0.0924	93%	80%
Wheat	0.0718	0.0986	77%	66%
Wheat	0.0743	0.0851	80%	67%
Orange juice	0.2168	0.1490	93%	82%
Coal	0.0440	0.0475	87%	87%
Electricity PJM	0.0493	0.0697	82%	87%
Light crude oil	0.0567	0.0782	79%	70%
Emini-Natural gas	-0.0392	0.1285	57%	50%
Heating oil	0.0731	0.0482	94%	82%
WTI crude cash	0.0512	0.0289	99%	91%
RBOB-Gasoline	0.1218	0.0661	96%	86%
Butter cash	0.0096	0.1998	60%	42%
Milk class 4	-0.0560	0.1277	36%	40%
Feeder cattle	-0.1439	0.1385	20%	22%
Frozen pork bellies	-0.0169	0.2698	41%	56%
Lean hogs	0.0140	0.1182	56%	57%
Live cattle	0.0553	0.0939	63%	69%
Gold 100	0.2441	0.2423	78%	74%
Copper	0.0606	0.1664	61%	60%
Silver 5000	0.4351	0.1410	100%	100%
Palladium	0.3595	0.2915	85%	88%
Platinum	0.5049	0.1668	100%	96%
Lumber	0.1478	0.2692	70%	63%
Cheese	-0.3399	0.1476	0%	3%
Mean	*0.0958*	*0.1331*	*73%*	*68%*
Median	*0.0725*	*0.1242*	*78%*	*72%*

	Hedging Pressure , Eq. (1)			weekly
	Mean	StDev	$\%HP_t > 0$	$\%HP_w > 0$
Panel B: Currencies (N=11)				
Australian dollar	0.2234	0.3484	73%	66%
Canadian dollar	0.1242	0.2590	68%	61%
Euro	0.0690	0.3030	58%	58%
Japanese yen	-0.1555	0.2405	33%	39%
Mexican peso	0.1875	0.2578	82%	66%
New zealand dollar	0.3306	0.3124	82%	75%
Sterling	0.0159	0.2376	48%	47%
Swiss franc	-0.1010	0.2743	38%	42%
Brazilian real	0.1927	0.2143	86%	72%
Russian ruble	0.0819	0.1037	81%	76%
South african rand	-0.2588	0.3123	22%	44%
Mean	*0.0645*	*0.2603*	*61%*	*59%*
Median	*0.0819*	*0.2590*	*68%*	*61%*
Panel C: Equity Indices (N=17)				
AMEX major market index	0.1254	0.1670	76%	25%
DJ industrials index	0.0120	0.1876	59%	44%
E-mini MSCI EAFE index	0.0215	0.1665	77%	66%
E-mini MSCI EM index	0.1387	0.0789	97%	95%
E-mini Russell 2000 index	-0.0767	0.1248	36%	82%
E-mini S&P400 mid-cap index	0.0727	0.1162	80%	36%
E-mini S&P500 index	0.0879	0.1334	80%	77%
Eurotop 100 index	0.0206	0.1748	74%	61%
High technology index	0.1933	0.1565	88%	66%
Mini Dow Jones index	0.0273	0.1469	66%	73%
Nasdaq 100 mini index	0.0963	0.1444	80%	52%
Nikkei 225 index	0.0235	0.1755	66%	70%
Russell 2000 index	0.0156	0.0913	69%	70%
Russell 2000 mini	-0.0491	0.0403	17%	78%
S&P 400 mid-cap index	0.0592	0.0797	76%	42%
S&P500 index	0.0091	0.0593	60%	69%
VIX index	-0.0117	0.2326	24%	22%
Mean	*0.0450*	*0.1339*	*66%*	*60%*
Median	*0.0235*	*0.1444*	*74%*	*66%*
30 yr T-Bond	-0.0165	0.0524	46%	45%
10 yr T-Note	-0.0290	0.0511	23%	30%
2 yr T-Note	-0.0145	0.0620	40%	41%
30 days Fed Fund	0.0381	0.1127	57%	56%
5 yr T-Note	-0.0066	0.0563	46%	46%
1 mth LIBOR	0.0547	0.0799	58%	59%
3 mth Euro$	-0.0041	0.0727	40%	43%
Municipal bond index	0.0321	0.0826	62%	71%
10yr agency note	0.0374	0.1665	22%	23%
Mean	*0.0102*	*0.0818*	*44%*	*46%*
Median	*-0.0041*	*0.0727*	*46%*	*45%*

APPENDIX B. Asset pricing models and risk factors.

Panel I outlines the asset pricing models. Definitions and sources for each of the variables are provided in Panel II. All the variables are measured at the monthly frequency.

Panel I: Asset pricing models

	CAPM	Fama and French (FF1993)	Carhart (C1997)	Pastor and Stambaugh (PS2003)	Fama and French (FF2015)	Campbell and Vuolteenaho (CV2004)	Hahn and Lee (HL2006)	Petkova (P2006)	Bali and Engle (BE2010)	Koijen *et al.* (KLVN2014)
	A. Variables from equity pricing literature					*B. Variables from Intertemporal CAPM literature*				
Mkt	√	√	√	√	√	√	√	√	√	√
SMB		√	√	√	√					
HML		√	√	√	√					
UMD			√							
L				√						
RMW					√					
CMA					√					
TERM						√	√	√	√	√
PE						√				
VS						√				
DEF							√	√	√	
TBILL								√		
DY								√		
FED									√	
CP										√

Panel II: Description of variables

Mkt	Market factor (excess returns of A%US value-weighted equity index; B%Barclays bond index; C%S&P-GSCI; D%USD index with A, B, C and D defined in the text)	K.R. French's website/Datastream
SMB	Size factor (difference in returns between small and large capitalization stocks)	K.R. French's website
HML	Value factor (difference in returns between high and low book-to-market stocks)	K.R. French's website
UMD	Equity momentum factor (difference in returns between winner and loser stocks)	K.R. French's website
L	Innovations in aggregate liquidity constructed by Pastor and Stambaugh (2003)	R. F. Stambaugh's website
RMW	Profitability factor (the average return on the two robust operating profitability portfolios minus the average return on the two weak operating profitability portfolios)	K.R. French's website
CMA	Investment factor (the average return on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios)	K.R. French's website
TERM	Slope of Treasury yield curve (yield spread between the 10 year T-bond and 3 month T-bill)	US Federal Reserve website
PE	Price earnings (ratio of the price of the S&P 500 index to a ten-year moving average of earnings)	R. Shiller's website
VS	Value spread (difference between the log returns book-to-market ratios of small-value and small-growth stocks)	K.R. French's website
DEF	Default spread (difference between the yields on BAA- and AAA-rated corporate bonds)	US Federal Reserve website
TBILL	3-month T-bill rate	US Federal Reserve website
DY	Dividend yield (ratio of the sum of annual dividends to the level of the S&P 500 index)	A. Goyal's website
FED	Federal reserve fund rate	US Federal Reserve website
CP	Cochrane-Piazzesi (2005) bond factor obtained as the fitted value from a regression of excess bond returns on forward rates	M. Piazzesi's website

APPENDIX C. (Un)conditional alpha and betas of hedging factor portfolios (net long speculators data)

This table reports the alpha and betas of the long-short HP portfolios per asset class. Panel A reports estimation results for the unconditional model, Equation (3), with constant alpha and constant exposures to the broad market (EW) risk, momentum, value and carry risk factors. Panels B-D report estimation results for the counterpart conditional model, Equation (4), using as conditioning variable the Chicago FED National Activity Index (CFNAI), (seasonally-adjusted) Industrial Production Index (IPI) and Kilian's Global Economic activity index, respectively. Bold is significant at the 10% level or better. Newey-West *t*-statistics are shown in parentheses. HP is measured at each month end as the average of weekly net long (long minus short) speculators positions over all speculators positions over the *W* weeks comprised in a 12-month lookback period.

	Panel A: Unconditional model				Conditional models											
					Panel B: CFNAI				Panel C: IPI				Panel D: Kilian's Global Econ. Act.			
	Comm	FX	Equity indices	Fixed income	Comm	FX	Equity indices	Fixed income	Comm	FX	Equity indices	Fixed income	Comm	FX	Equity indices	Fixed income
α	0.0019	**0.0008**	0.0002	0.0001	0.0019	**0.0007**	0.0003	0.0000	**0.0039**	0.0007	**0.0020**	-0.0001	0.0019	**0.0007**	0.0000	0.0000
	(1.46)	(1.76)	(0.13)	(0.21)	(1.47)	(1.65)	(0.28)	(-0.02)	(2.69)	(0.82)	(1.65)	(-0.18)	(1.42)	(1.72)	(-0.01)	(0.08)
α_Z					**-0.0033**	0.0001	**-0.0026**	-0.0002	**-0.0021**	0.0001	**-0.0020**	0.0002	-0.0014	0.0001	**-0.0014**	0.0001
					(-3.20)	(0.13)	(-2.17)	(-0.62)	(-2.47)	(0.30)	(-2.75)	(0.80)	(-1.31)	(0.19)	(-1.84)	(0.29)
EW	0.0315	-0.0027	**0.0769**	**-0.4247**	0.0384	-0.0106	0.0356	**-0.4114**	-0.0009	0.0198	**0.0898**	**-0.5067**	0.0427	0.0094	0.0710	**-0.3277**
	(0.94)	(-0.07)	(1.77)	(-3.11)	(1.13)	(-0.30)	(1.04)	(-3.23)	(-0.03)	(0.61)	(2.30)	(-2.93)	(1.45)	(0.29)	(1.58)	(-2.57)
EW*Z					-0.0125	0.0125	-0.0300	-0.0093	0.0347	0.0095	**-0.0494**	0.0959	0.0264	**0.0607**	0.0022	0.0193
					(-0.58)	(0.54)	(-0.93)	(-0.15)	(1.60)	(0.47)	(-2.16)	(0.96)	(1.09)	(2.67)	(0.08)	(0.24)
Mom	**0.2969**	**0.2731**	**0.5215**	-0.0574	**0.3007**	**0.2969**	**0.5703**	0.0125	**0.2554**	0.1685	**0.5271**	0.0063	**0.2980**	**0.2236**	**0.5501**	0.0119
	(4.66)	(4.31)	(5.50)	(-0.60)	(4.53)	(4.85)	(6.65)	(0.16)	(2.80)	(1.64)	(5.76)	(0.07)	(4.86)	(3.92)	(6.05)	(0.14)
Mom*Z					0.0342	**0.0848**	**0.1191**	-0.0017	0.0539	0.0697	-0.0069	0.0349	0.0555	**-0.0800**	-0.0002	0.0216
					(0.63)	(1.75)	(2.72)	(-0.05)	(1.02)	(1.13)	(-0.12)	(0.72)	(1.30)	(-2.49)	(-0.01)	(0.44)
Value	-0.0600	-0.1005	0.0518	**-0.2183**	-0.0535	-0.0840	0.0456	**-0.2898**	**-0.1586**	-0.0303	0.0922	**-0.2037**	-0.0613	-0.0792	0.0819	**-0.2086**
	(-0.93)	(-1.38)	(0.59)	(-2.14)	(-0.86)	(-1.14)	(0.55)	(-3.62)	(-2.28)	(-0.26)	(1.11)	(-3.02)	(-0.99)	(-1.20)	(0.91)	(-2.26)
Value*Z					0.0383	0.0492	0.0165	**-0.1502**	**0.0961**	-0.0643	**-0.1085**	-0.0846	0.0615	-0.0488	0.0103	**-0.1103**
					(0.92)	(0.74)	(0.29)	(-3.61)	(2.18)	(-0.86)	(-1.90)	(-1.11)	(1.16)	(-1.06)	(0.29)	(-2.45)
Carry	0.0730	**0.5556**	**0.1321**	-0.1229	0.0665	**0.5383**	**0.1128**	-0.1846	0.0330	**0.4166**	**0.1238**	-0.2642	0.0756	**0.5765**	0.0864	-0.1605
	(1.18)	(7.53)	(2.00)	(-0.73)	(1.09)	(7.05)	(1.75)	(-1.29)	(0.30)	(3.93)	(1.98)	(-1.41)	(1.33)	(8.36)	(1.13)	(-1.09)
Carry*Z					0.0070	-0.0292	-0.0627	0.0056	0.0294	**0.1175**	-0.0278	0.1391	-0.0675	-0.0284	-0.0521	-0.0732
					(0.13)	(-0.70)	(-1.23)	(0.07)	(0.48)	(1.83)	(-0.69)	(1.30)	(-1.59)	(-0.62)	(-1.42)	(-0.83)
adj-R^2	0.19	0.58	0.44	0.40	0.23	0.60	0.49	0.49	0.23	0.62	0.52	0.68	0.23	0.62	0.47	0.46

Table 1. Directional predictive ability of hedging pressure signal and benchmark long-short portfolios.

Panel A reports estimation results from directional panel logit and time-series logit regressions of excess returns on one-month lagged hedging pressure while controlling for the predictive ability of the momentum, value or carry signal. Panel B summarizes the performance of the benchmark momentum, value and carry portfolios. Mean and StDev of excess returns are both annualized. Newey-West h.a.c. robust *t*-statistics are reported in parentheses for the mean excess returns. Bold signifies significance at the 10% level or better. HP in Panel B at each month end is the average of weekly net short (short minus long) hedging positions over all hedging positions over the *W* weeks in a 12-month lookback period, Equation (1). The sample period is September 2012 to December 2016.

	Momentum				**Value**				**Carry**			
	Comm	FX	Equity indices	Fixed income	Comm	FX	Equity indices	Fixed income	Comm	FX	Equity indices	Fixed income
Panel A: Directional predictive ability of past hedging/speculative pressure (logit regressions)												
Beta HP (2-way fixed effects model)	**0.4733**	**0.3292**	0.0389	-0.0214	**0.5677**	**0.4652**	0.3509	0.4739	**0.4885**	**0.3835**	0.1601	-0.1122
	(2.98)	(1.71)	(0.13)	(-0.03)	(3.66)	(2.44)	(0.82)	(0.74)	(3.19)	(2.41)	(0.53)	(-0.19)
Time-series models:												
ratio positive/negative betas HP	1.6154	1.7500	1.1250	0.5000	1.1250	2.6667	1.0000	0.3333	1.8333	1.2000	1.4286	0.5000
Panel B: Summary statistics of long-short portfolios												
Mean	**0.0493**	0.0123	**0.0534**	0.0074	0.0052	**0.0261**	-0.0285	0.0004	**0.0555**	**0.0322**	**0.0462**	**0.0133**
	(2.91)	(1.11)	(2.80)	(1.19)	(0.27)	(2.59)	(-1.45)	(0.06)	(3.65)	(2.66)	(2.15)	(1.94)
StDev	0.0803	0.0495	0.0962	0.0334	0.0862	0.0448	0.0949	0.0343	0.0731	0.0551	0.0932	0.0319
Skewness	-0.0857	**-1.2018**	**-0.5514**	**-0.3444**	0.0768	-0.0297	-0.1531	**-0.4631**	**0.2845**	**-0.6022**	**-0.2962**	**-0.4552**
	(-0.58)	(-8.20)	(-3.76)	(-2.35)	(0.52)	(-0.20)	(-1.04)	(-3.16)	(1.94)	(-4.11)	(-2.02)	(-3.10)
Excess kurtosis	0.2790	**6.3260**	**4.9847**	**1.5122**	0.2082	**1.4444**	**5.2826**	**1.7010**	0.0236	**1.7017**	**5.5207**	**2.0677**
	(0.95)	(21.57)	(17.00)	(5.16)	(0.71)	(4.92)	(18.01)	(5.80)	(0.08)	(5.80)	(18.82)	(7.05)
99% VaR (Cornish-Fisher)	0.0527	0.0581	0.1006	0.0272	0.0572	0.0326	0.1028	0.0295	0.0395	0.0455	0.0984	0.0272
% of positive months	0.5878	0.5699	0.5735	0.5412	0.4910	0.5950	0.4767	0.5269	0.5520	0.6022	0.5950	0.5448
Maximum drawdown	-0.1515	-0.1834	-0.2151	-0.0649	-0.3704	-0.1060	-0.5378	-0.1862	-0.1385	-0.1482	-0.2813	-0.0864
Sharpe ratio	0.6135	0.2496	0.5555	0.2221	0.0604	0.5823	-0.3000	0.0120	0.7596	0.5850	0.4956	0.4170
Sortino ratio (0%)	0.9801	0.3133	0.7324	0.3163	0.1006	0.8907	-0.3808	0.0174	1.5106	0.7882	0.6658	0.5758
Omega ratio (0%)	1.5782	1.2118	1.5717	1.1845	1.0456	1.5689	0.7758	1.0090	1.7459	1.5578	1.5016	1.3794
CER	0.0329	0.0060	0.0292	0.0046	-0.0133	0.0210	-0.0521	-0.0025	0.0420	0.0244	0.0238	0.0107

Table 2. Long-short hedging pressure portfolios

The table summarizes long-short hedging pressure (HP) portfolios in Panel A, and equally-weighted (EW) monthly rebalanced long-only portfolios in Panel B, separately for four asset classes. The cross-sections are listed in Appendix A. HP is measured at each month end as the average of weekly net short (short minus long) hedging positions over all hedging positions over the *W* weeks comprised in a 12-month lookback period, Equation (1). Mean denotes annualized mean excess return, StDev is annualized standard deviation of excess returns. Bold signifies significance at the 10% level or better. Newey-West h.a.c. robust *t*-statistics are reported in parentheses for the mean returns. The sample period is September 1992 to December 2016.

	Panel A: long-short HP portfolios				Panel B: long-only EW portfolios			
	Commodities	FX	Equity indices	Fixed income	Commodities	FX	Equity indices	Fixed income
Mean	**0.0371**	**0.0177**	**0.0446**	-0.0070	-0.0150	0.0093	0.0197	**0.0191**
	(2.43)	(1.77)	(2.11)	(-1.19)	(-0.49)	(0.52)	(0.64)	(2.78)
StDev	0.0733	0.0472	0.0917	0.0293	0.1240	0.0778	0.1353	0.0330
Skewness	0.1066	**-1.0752**	-0.2173	**-0.3678**	**-0.7443**	**-0.5062**	**-0.8245**	-0.1344
	(0.73)	(-7.33)	(-1.48)	(-2.51)	(-5.08)	(-3.45)	(-5.62)	(-0.92)
Excess kurtosis	0.0789	**6.0074**	**5.2924**	**6.0796**	**3.7833**	**2.4655**	**1.9487**	**2.1820**
	(0.27)	(20.48)	(18.04)	(20.73)	(12.90)	(8.41)	(6.64)	(7.44)
99% VaR (Cornish-Fisher)	0.0448	0.0542	0.0944	0.0341	0.1283	0.0707	0.1207	0.0263
% of positive months	0.5305	0.5878	0.5520	0.4839	0.5269	0.5412	0.5448	0.5556
Maximum drawdown	-0.1398	-0.1404	-0.3194	-0.2314	-0.5207	-0.3017	-0.6090	-0.0698
Sharpe ratio	0.5059	0.3745	0.4858	-0.2380	-0.1213	0.1191	0.1456	0.5784
Sortino ratio (0%)	0.8792	0.4419	0.6925	-0.3072	-0.1546	0.1607	0.1815	0.8784
Omega ratio (0%)	1.4566	1.3562	1.4946	0.8150	0.9076	1.0976	1.1200	1.5565
CER	0.0236	0.0119	0.0229	-0.0091	-0.0572	-0.0063	-0.0299	0.0163

Table 3. (Un)conditional alpha and betas of hedging factor portfolios.

This table reports the alpha and betas of the long-short HP portfolios per asset class. Panel A reports estimation results for the unconditional model, Equation (3), with constant alpha and constant exposures to the broad market (EW) risk, momentum, value and carry risk factors. Panels B-D report estimation results for the counterpart conditional model, Equation (4), using as conditioning variable the Chicago FED National Activity Index (CFNAI), (seasonally-adjusted) Industrial Production Index (IPI) and Kilian's Global Economic activity index, respectively. Bold is significant at the 10% level or better. Newey-West *t*-statistics are shown in parentheses. HP is measured at each month end as the average of weekly net short (short minus long) hedging positions over all hedging positions over the *W* weeks comprised in a 12-month lookback period.

	Panel A: Unconditional model				Conditional models: Panel B: CFNAI				Conditional models: Panel C: IPI				Conditional models: Panel D: Kilian's Global Econ. Act.			
	Comm	FX	Equity indices	Fixed income	Comm	FX	Equity indices	Fixed income	Comm	FX	Equity indices	Fixed income	Comm	FX	Equity indices	Fixed income
α	**0.0024**	0.0000	0.0007	0.0000	**0.0025**	0.0000	0.0011	-0.0001	**0.0052**	-0.0006	**0.0025**	-0.0002	**0.0023**	0.0000	0.0005	-0.0001
	(1.80)	(0.00)	(0.59)	(-0.07)	(1.98)	(0.03)	(1.00)	(-0.12)	(2.89)	(-0.82)	(1.73)	(-0.37)	(1.82)	(-0.02)	(0.37)	(-0.24)
α_Z					**-0.0038**	0.0000	**-0.0020**	-0.0002	**-0.0025**	0.0006	**-0.0017**	0.0002	**-0.0022**	0.0003	**-0.0019**	0.0001
					(-2.56)	(-0.09)	(-1.67)	(-0.50)	(-2.33)	(1.19)	(-1.93)	(0.84)	(-1.94)	(0.73)	(-2.09)	(0.22)
EW	**0.0910**	0.0258	**0.1997**	-0.2029	**0.0938**	0.0064	**0.0732**	-0.1634	0.0448	0.0391	**0.2358**	**-0.5073**	**0.1121**	0.0350	**0.1684**	-0.0840
	(2.26)	(0.72)	(3.41)	(-0.95)	(2.10)	(0.23)	(1.78)	(-0.82)	(1.08)	(1.25)	(3.43)	(-2.60)	(2.95)	(0.91)	(3.13)	(-0.48)
EW*Z					-0.0270	-0.0037	**-0.0808**	0.0502	0.0378	0.0037	**-0.0827**	**0.2839**	0.0352	**0.0447**	**-0.0469**	0.0835
					(-1.20)	(-0.16)	(-2.52)	(0.60)	(1.27)	(0.15)	(-1.91)	(2.15)	(0.98)	(1.73)	(-2.22)	(0.61)
Mom	**0.2310**	**0.2267**	**0.3503**	-0.1136	**0.2277**	**0.2674**	**0.4408**	0.0012	**0.2947**	0.1574	**0.3375**	0.0247	**0.2321**	**0.1781**	**0.4252**	-0.0215
	(3.81)	(3.01)	(2.50)	(-0.94)	(3.71)	(4.42)	(3.62)	(0.01)	(3.51)	(1.04)	(2.34)	(0.29)	(3.74)	(2.43)	(4.00)	(-0.20)
Mom*Z					0.0364	0.1015	**0.1794**	-0.0660	-0.0411	0.0519	0.0443	0.0099	0.0289	**-0.0912**	-0.0256	0.0188
					(0.70)	(1.55)	(2.47)	(-1.37)	(-0.86)	(0.57)	(0.60)	(0.19)	(0.66)	(-2.49)	(-0.60)	(0.20)
Value	-0.0386	**-0.1293**	0.0288	-0.1550	-0.0372	**-0.1081**	-0.0076	**-0.2482**	**-0.1614**	-0.1399	0.0410	**-0.1297**	-0.0290	**-0.1148**	0.1208	**-0.1938**
	(-0.47)	(-1.76)	(0.21)	(-1.17)	(-0.45)	(-1.72)	(-0.07)	(-2.68)	(-1.83)	(-1.02)	(0.23)	(-1.71)	(-0.35)	(-1.76)	(1.10)	(-1.79)
Value*Z					0.0379	0.0442	0.0689	**-0.2189**	**0.1259**	0.0150	-0.0715	-0.1031	0.0911	**-0.0791**	0.0567	**-0.1360**
					(0.60)	(0.56)	(0.96)	(-3.97)	(2.28)	(0.16)	(-0.67)	(-1.03)	(1.37)	(-1.71)	(1.28)	(-2.43)
Carry	-0.0377	**0.5782**	**0.2894**	-0.1337	-0.0405	**0.5482**	**0.2798**	-0.2565	-0.1692	**0.5247**	**0.2697**	-0.1627	-0.0219	**0.5997**	**0.1402**	-0.1983
	(-0.48)	(8.64)	(2.55)	(-0.60)	(-0.53)	(8.49)	(2.70)	(-1.34)	(-1.30)	(4.78)	(1.95)	(-0.82)	(-0.29)	(9.03)	(1.68)	(-1.06)
Carry*Z					0.0902	-0.0372	0.0318	0.0156	0.1070	0.0421	-0.0015	0.0473	-0.0135	0.0070	**-0.1805**	-0.0917
					(1.10)	(-1.03)	(0.62)	(0.16)	(1.37)	(0.60)	(-0.02)	(0.40)	(-0.24)	(0.17)	(-4.45)	(-0.82)
adj-R^2	0.11	0.58	0.34	0.19	0.15	0.61	0.48	0.33	0.16	0.60	0.42	0.60	0.15	0.61	0.47	0.29

Table 4. Cross-sectional asset pricing of hedging pressure factor.
This table reports the average price and Shanken-corrected t-statistics (in parentheses) for the asset-class-specific HP risk factors per model; see Appendix B. $\Delta adjR^2$ is the incremental pricing ability achieved by the HP risk factors. In Panel A, the test assets are 64 futures portfolios (terciles of commodity, currency, equity and fixed income futures sorted by HP (hedgers), HP (speculators), momentum, value and carry, and long-only EW portfolios per asset class). In Panel B, the test assets are 34 portfolios (25 SMB equity portfolios of Fama-French, 7 Fama bond porfolios, S&P-GSCI and the USD versus major currencies index). The HP signal to construct the factors is obtained at each month end as the average of weekly net short hedging pressure in the past 12 months, Equation (1).

	Momentum, value and carry factor model	Risk factors from traditional equity pricing literature					Risk factors from iCAPM literature				
		CAPM	FF1993	C1997	PS2003	FF2015	CV2004	HL2006	P2006	BE2010	KLVN2014
Panel A: Porfolios of futures contracts (N=64 test assets)											
$\lambda_{HP\ Comm}$	**0.0034**	0.0012	0.0022	0.0024	**0.0031**	**0.0027**	0.0028	0.0028	0.0020	0.0022	0.0018
	(2.24)	(0.71)	(1.21)	(1.37)	(1.76)	(1.72)	(1.56)	(1.32)	(0.87)	(1.05)	(0.86)
$\lambda_{HP\ FX}$	**0.0020**	-0.0001	0.0012	0.0013	0.0011	0.0014	0.0016	0.0015	0.0016	0.0015	0.0004
	(2.06)	(-0.04)	(0.97)	(1.14)	(0.82)	(1.33)	(1.43)	(1.14)	(1.12)	(1.07)	(0.23)
$\lambda_{HP\ EQ}$	**0.0039**	**0.0040**	**0.0057**	**0.0059**	**0.0050**	**0.0057**	**0.0063**	**0.0051**	**0.0051**	**0.0051**	**0.0041**
	(1.99)	(2.22)	(2.80)	(2.81)	(2.31)	(2.85)	(2.90)	(2.02)	(1.84)	(1.89)	(1.80)
$\lambda_{HP\ FI}$	0.0013	-0.0002	-0.0008	-0.0008	**-0.0017**	-0.0008	-0.0007	0.0003	0.0005	0.0005	-0.0007
	(0.82)	(-0.29)	(-0.99)	(-0.95)	(-1.77)	(-1.03)	(-0.75)	(0.26)	(0.45)	(0.40)	(-0.75)
$\Delta adjR^2$	17.91%	18.21%	12.02%	11.37%	12.35%	9.39%	12.01%	16.79%	13.14%	14.75%	16.73%
Panel B: 25SMB portfolios, 7 Fama bond portfolios, S&P-GSCI and USD index (N=34 test assets)											
$\lambda_{HP\ Comm}$	**0.0179**	**0.0156**	**0.0171**	**0.0179**	**0.0143**	**0.0149**	**0.0147**	**0.0144**	**0.0165**	**0.0145**	**0.0169**
	(1.73)	(2.71)	(2.82)	(2.94)	(2.58)	(2.16)	(2.20)	(2.85)	(2.42)	(2.81)	(2.58)
$\lambda_{HP\ FX}$	-0.0034	0.0030	-0.0032	**-0.0061**	-0.0031	-0.0058	-0.0030	0.0021	0.0058	0.0025	-0.0020
	(-0.49)	(0.68)	(-0.60)	(-1.68)	(-0.56)	(-1.26)	(-0.66)	(0.54)	(1.33)	(0.67)	(-0.45)
$\lambda_{HP\ EQ}$	0.0006	-0.0023	0.0085	0.0028	**0.0149**	0.0087	**0.0167**	-0.0047	0.0016	-0.0010	-0.0067
	(0.04)	(-0.21)	(0.99)	(0.36)	(1.83)	(1.00)	(1.89)	(-0.48)	(0.13)	(-0.09)	(-0.55)
$\lambda_{HP\ FI}$	0.0047	0.0003	-0.0009	0.0003	-0.0017	-0.0001	-0.0007	0.0003	-0.0011	-0.0002	0.0015
	(1.15)	(0.18)	(-0.48)	(0.19)	(-0.95)	(-0.05)	(-0.37)	(0.19)	(-0.58)	(-0.12)	(0.68)
$\Delta adjR^2$	16.70%	20.47%	12.49%	5.81%	10.34%	10.03%	7.65%	10.02%	8.56%	9.33%	10.26%

Table 5. Performance of long-short hedging pressure portfolios (net long speculators data)

The table summarizes long-short hedging pressure (HP) portfolios formed according to a hedging pressure signal based on positions of large speculators. HP is measured at each month end as the average of weekly net long (long minus short) speculators positions over all speculators positions over the *W* weeks comprised in a 12-month lookback period. Mean denotes annualized mean excess return, StDev is annualized standard deviation of excess returns. Bold signifies significance at the 10% level or better. Newey-West h.a.c. robust *t*-statistics are reported in parentheses for the mean returns. The sample period is September 1992 to December 2016.

	Commodities	FX	Equity indices	Fixed income
Mean	**0.0404**	**0.0275**	**0.0366**	**-0.0092**
	(2.46)	(2.90)	(2.23)	(-1.65)
StDev	0.0698	0.0465	0.0828	0.0285
Skewness	-0.0474	**-1.0080**	**-0.4667**	**0.4377**
	(-0.32)	(-6.87)	(-3.18)	(2.98)
Excess kurtosis	**1.0538**	**6.8743**	**7.5604**	**5.6465**
	(3.59)	(23.44)	(25.78)	(19.25)
99% VaR (Cornish-Fisher)	0.0491	0.0553	0.1010	0.0275
% of positive months	0.5484	0.6129	0.5412	0.4516
Maximum drawdown	-0.2545	-0.1481	-0.2305	-0.2211
Sharpe ratio	0.5793	0.5921	0.4420	-0.3225
Sortino ratio (0%)	0.9076	0.7040	0.6111	-0.4459
Omega ratio (0%)	1.5583	1.6334	1.4421	0.7552
CER	0.0281	0.0219	0.0188	-0.0112

Figure 1. Future value of $1 invested in long-short and long-only portfolios.

Panel A plots the evolution of $1 invested in long-short asset-class-specific hedging pressure portfolios (total returns, excess plus collateral) of either commodities, FX, equities or fixed income futures.

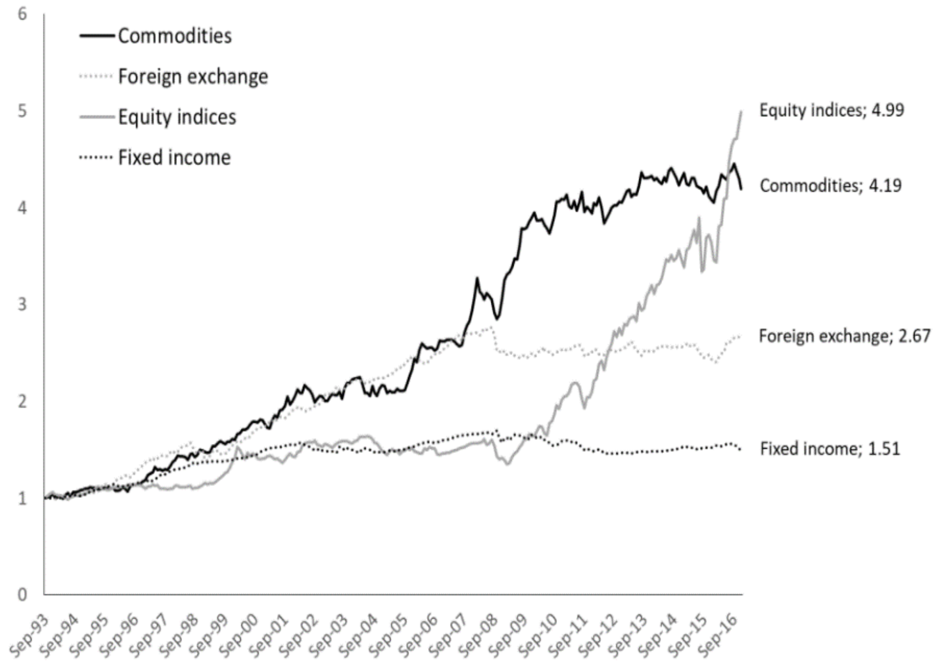

Figure 2. **Turnover and net Sharpe ratio of the long-short portfolios per futures class.**