Carry Strategies In Global Asset Classes*

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Abstract

We study the risk-return properties of carry trades in four global asset classes: equities, fixed income, foreign exchange, and commodities. We form carry portfolios that are long in assets where the current futures price is lower than the current spot price and short where the futures price is above the spot. We show that the carry trade does not only work in foreign exchange, as extensively documented before, but is as profitable in equity, fixed income and commodity markets, with Sharpe ratios varying between 0.5 and 1.0 per year. The correlation between strategy returns across asset classes is low and the Sharpe ratio of a diversified cross-asset carry portfolio is 1.4. We study the dynamics of the carry across asset classes and link it to movements in macro-economic variables. We find in particular that the average carry for stocks and bonds, which are measures of risk premia across global equity and fixed income markets, are counter-cyclical.

Keywords: Carry Trade, Stocks, Bonds, Currencies, Commodities

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1 Introduction

We study the risk-return properties of carry trades in four global asset classes: equities, fixed income, foreign exchange, and commodities. We form carry portfolios that are long in assets where the current futures price is lower than the current spot price and short where the futures price is above the spot. We show that the carry trade does not only work in foreign exchange, as extensively documented before, but is as profitable in equity, fixed income and commodity markets, with Sharpe ratios varying between 0.5 and 1.0 per year. The correlation between strategy returns across asset classes is low and the Sharpe ratio of a diversified cross-asset carry portfolio is 1.4. We study the dynamics of the carry across asset classes and link it to movements in macro-economic variables.

The carry trade is well known once applied to currency markets. The currency carry trade borrows money in currencies with low interest rates and invests in currencies with high interest rates. Historically, this strategy produced high average returns and Sharpe ratios, see for instance Jurek (2009) and Lustig, Roussanov, and Verdelhan (2010). One way to view the carry trade is to use the difference between the spot price and the futures price as a measure of expected returns. If the current spot price relative to the futures price is high, then either prices are expected to fall or risk premia are high. This logic can be extended to other asset classes for which futures data is available. We focus in particular on stocks, bonds, and commodities.

At the end of each month, we form a portfolio of futures contracts within an asset class. The weight of each futures contract is determined by the corresponding carry. We then study the properties of expected and realized returns on the carry strategies across the four global asset classes, and the joint behavior of the average carry. The sample periods we consider differ across asset classes, where the longest (shortest) time series is available for commodities (government bonds), but in all cases the sample contains at least 20 years of data. Our sample ends for all asset classes in December 2010. In addition, we have a rich cross-section of contracts within each asset class. We consider 13 equity indices, 10 government bonds of different countries, 20 currencies, and 23 commodity contracts. This allows us also to pool across the different contracts to gain power for some of the tests we perform.

We find that the (annualized) Sharpe ratios for the carry strategies are high for all four asset classes: 0.55 for currencies, 1.18 for stocks, 0.90 for bonds, and 0.62 for commodities if we focus on the sample period for which we have data for all asset classes. In addition, we find that the returns on these strategies are fairly uncorrelated. An equally-weighted strategy across all four asset classes then results in an annualized Sharpe ratio of 1.40.

We also study the joint dynamics of the average carry across asset classes. At a given point in time, we compute the cross-sectional average of the carries within a given asset class. We study the dynamics of the four resulting time series of the average carry and relate them to macro-economic conditions. To measure current economic conditions, we use the Chicago FED National Activity Indicator (CFNAI). The CFNAI is a weighted average of 85 existing monthly indicators of national economic activity. We find that the average carry of stocks and bonds are highly correlated (64%), but both are negatively correlated with the average carry of currencies. The correlation of CFNAI with the carry of stocks and bonds is negative, which implies that global equity and bond risk premia are counter-cyclical. By contrast, the correlation with the average carry of currencies and commodities is positive.

The average carry fluctuates substantially over time, which suggests that either expected price changes fluctuate or risk premia move over time. To study the fluctuations in risk premia over time, we consider a series of predictive regressions in which we regress futures returns on the carry. For each asset class, we find strong evidence pointing towards variation in risk premia. The predictive coefficients typically have the positive sign as suggested by theory. To gain further power, we pool the data within each asset class and uncover strong predictability of futures returns. The predictive coefficient is positive for all four asset classes.

Our paper also contributes to a growing literature studying the risk-return trade-offs in global asset markers. Asness, Moskowitz, and Pedersen (2010) study value and momentum-based strategies within and across country equity indices,[1] government bonds,[2] currencies,[3] and commodities.[4] Moskowitz, Ooi, and Pedersen (2010) document time-series momentum in equity index, currency, commodity, and bond futures. Fama and French (2011) study versions of the Fama and French (1992) 3-factor model, potentially augmented with a momentum factor, in four major regions (North America, Europe, Japan, and Asia Pacific). Even though the local models provide a reasonable description of the cross-section of local stock returns, the pricing models do not seem to be integrated across regions.

This paper continues as follows. In Section 2, we use a simple no-arbitrage framework to illustrate why forward discounts in general may contain valuable information about risk premia. Section 3 describes the data we are using. Section 4 summarizes the cross-section of carry trade returns. In Section 5, we study the predictability of carry trade returns across asset classes. Section 6 shows how the average carry relates to aggregate macro-economic conditions. Section 7 concludes. All tables and figures are presented in Appendix A.

[1]Studies focusing on international equity returns include Chan, Hamao, and Lakonishok (1991), Griffin (2002), Griffin, Ji, and Martin (2003), Hou, Karolyi, and Kho (2010), Rouwenhorst (1998), and Fama and French (1998).

[2]Studies focusing on government bonds across countries include Ilmanen (1995) and Barr and Priestley (2004).

[3]Studies focusing on currency returns include Burnside, Eichenbaum, and Rebelo (2009), Burnside, Han, Hirschleifer, and Wang (2010), Jurek (2009), and Lustig, Roussanov, and Verdelhan (2010).

[4]Studies focusing on commodities returns include Fama and French (1987), Bailey and Chan (1993), Bessembinder (1992), Acharya, Lochstoer, and Ramadorai (2010), Gorton, Hayashi, and Rouwenhorst (2007), Tang and Xiong (2010), and Hong and Yogo (2010).

2 Framework

We outline our basic framework in this section. In Section 2.1 we show how we compute the carry. In addition, we show how to decompose the carry into expected price changes and a risk premium. Next, in Section 2.2, we discuss in detail how we use the carry to construct a portfolio strategy.

2.1 Interpreting carry

We denote the stochastic discount factor by M_t. We focus on futures contracts on financial assets first and discuss commodities below. In the absence of arbitrage opportunities, it holds:

$$E_t\left(M_{t+1}S_{t+1}\right) = E_t\left(M_{t+1}F_t\right), \tag{1}$$

where S_{t+1} denotes the asset price and F_t the futures price. We assume that (M_{t+1}, S_{t+1}) are jointly log-normally distributed:

$$\begin{bmatrix} m_{t+1} \\ s_{t+1} - s_t \end{bmatrix} \sim N\left(\begin{bmatrix} \mu_{m,t} - \frac{1}{2}\sigma^2_{m,t} \\ \mu_{s,t} - \frac{1}{2}\sigma^2_{s,t} \end{bmatrix}, \begin{bmatrix} \sigma^2_{m,t} & \sigma_{ms,t} \\ \sigma_{ms,t} & \sigma^2_{s,t} \end{bmatrix}\right),$$

where lower-case letters denote logs. We can then write the no-arbitrage condition in (1) as:

$$f_t - s_t = \mu_{s,t} + \sigma_{ms,t},$$

where $\mu_{s,t}$ is the expected price appreciation and $\sigma_{ms,t}$ is the negative of the risk premium on investing in the futures contract. We define the carry as:

$$\begin{aligned} C_t &= \frac{S_t}{F_t} - 1 \\ &\simeq -\mu_{s,t} - \sigma_{ms,t}. \end{aligned} \tag{2}$$

Hence, a high carry corresponds to low expected growth in prices $(-\mu_{s,t})$ or a high risk premium $(-\sigma_{ms,t})$.

In case of futures on commodities, the arbitrage condition in (1) does not need to hold due to a convenience yield (see for instance Acharya, Lochstoer, and Ramadorai (2010)). This implies that the carry now fluctuates due to expected price changes, a risk premium component, and the convenience yield. If the variation in the convenience yield is sufficiently strong, this make the signal we can derive from the carry weaker. However, if fluctuations in the carry are largely due to variation in risk premia, the carry strategy can be applied to commodities as well. In addition, we study the predictive power of a portfolio of commodities, or any of the other three asset classes, using the carry. To the extent that the convenience yield is not moving systematically across all commodities, fluctuations therein average out in this approach.

2.2 Portfolio construction

We implement the carry strategy separately in the four different asset classes. At time t, there are N_t assets available in a given asset class. We then directly choose the positions in the different forward contracts as deviations from the average carry within a given time period:

$$w_{it} = N_t^{-1} \left(C_{it} - \bar{C}_t \right),$$

where $\bar{C}_t = N_t^{-1} \sum_{i=1}^{N_t} C_{it}$ denotes the average carry. As we take positions in forward contracts, this is a zero-dollar investment strategy and returns are to be interpreted as excess returns. We implement the strategy at a monthly frequency. However, futures with a one-month horizon may not be available. In this case, we linearly interpolate the futures prices to approximate the one-month price.

We scale the final weights in such a way that the long positions sum to 1 (and the short positions to -1 as a consequence). We only consider time periods where the number of cross-sectional observations (N_t) exceeds 2. The first observation for the carry strategy returns are therefore March 1988 for equities, November 1991 for fixed income, November 1983 for foreign exchange, and January 1970 for commodities.

In constructing the carry strategies, we have considered two alternatives to ensure the robustness of our results. First, we use the cross-sectional rank of the carry rather than the carry itself in portfolio construction as in Asness, Moskowitz, and Pedersen (2010). Second, we form three equally-weighted portfolios and take long positions in the 1/3 of the assets with the highest carry and short positions in the 1/3 of the assets with the lowest contracts. The results are very similar to main results and are available upon request.

3 Data

In this section, we describe the data we are using to implement the carry strategy based on equity, fixed income, currencies, and commodities.

3.1 Equity

We have equity index futures data from 13 countries: the U.S. (S&P 500), Canada (S&P TSE 60), the UK (FTSE 100), France (CAC), Germany (DAX), Spain (IBEX), Italy (FTSE MIB), The Netherlands (EOE AEX), Norway (OMX), Switzerland (SMI), Japan (Nikkei), Hong Kong (Hang Seng), and Australia (S&P ASX 200). The source is Bloomberg. We use spot indices and nearest-to-expiry futures contracts to create one-month futures prices by linear interpolation. Carry is defined as the percent difference of the spot price and the one-month futures price and return as the percent difference between the spot price and the pervious period's futures price.

Equity futures start dates vary from May 1982 for the S&P 500 to March 2005 for the OMX. Most of the series available from the beginning of the nineties. Annualized volatilities are consistently in the range of 15% to 20%. Mean returns vary strongly between -2% for the Nikkei to 13% for the IBEX Index.

3.2 Fixed income

Bond futures are only available for a very limited number of countries and for a relatively short sample period. We therefore create synthetic futures returns for 10 countries: the US, Australia, Canada, Germany, the UK, Japan, New Zealand, Norway, Sweden, and Switzerland. We collect zero coupon 10-year, 9-year, and 3-month constant maturity yields from Bloomberg. Each month, we calculate the price of the 10-year zero coupon bond and a bond with a remaining maturity of nine year and 11 months (by linearly interpolating the 9- and 10-year yields). Our fixed income carry measure is the percent price difference between these two bonds, minus the short rate to bring it to a non-funded basis comparable to futures. The rate of return is defined similarly. For countries with bond futures data, the correlation between actual futures returns and our synthetic futures returns is in excess of 0.95.

Most of the return series start in January 1995, although Japanese and German data is available before and Norwegian data after this date. Mean returns range between 2% (New Zealand and Norway) and almost 7% (Sweden) per annum and volatilities between 5.5% (Switzerland) and almost 10% (Australia).

3.3 Currencies

Spot and one-month forward rates come from Datastream for Austria, Belgium, Finland, France, Germany, Greece, Italy, The Netherlands, Portugal, and Spain (all replaced with the Euro from January 1999), Australia, Canada, Denmark, Japan, New Zealand, Norway, Sweden, Switzerland, and the UK. All exchange rates are defined as foreign currency per USD. Carry is defined as the percent difference of the spot price and the one-month forward price and return as the percent difference between the spot price and last period's forward rate. If the spot exchange rate is higher than the forward price, this thus indicates that US interest rate is higher than the foreign interest rate and vice versa.

The summary statistics table shows that the Australian dollar is the most volatile and the Canadian dollar the least volatility exchange rate in the sample. The sample starts mid eighties for some of the pairs and mid nineties for all exchange rates (except for the Euro, obviously).

3.4 Commodities

Since there are no reliable spot prices for commodities, we use nearest- and second-nearest-to-expiry futures prices. The source is Bloomberg. We use these prices to create spot and one-month futures prices by linear interpolation and define carry as the percent difference between the spot and one-month futures price, and return as the percent difference between the spot price and the one-month futures price from the previous period. The universe consists of 23 commodities, six in metals (aluminum, copper, nickel, zinc, lead, and tin), six in energy (crude oil, gasoil, WTI crude, RBOB gasoline, heating oil, and natural gas), eight in agriculture (cotton, coffee, cocoa, sugar, soybeans, Kansas wheat, corn, and wheat), and 3 in livestock (lean hogs, feeder cattle, and live cattle).

Some of the commodity futures are available since the beginning of the seventies and all of them since mid nineties. Commodity futures returns and volatilities vary widely. Natural gas, for example, has an annualized return of -4.5% and a volatility of more than 60 percent. Feeder cattle, on the other hand, has an annualized return of 5.5% and a volatility of 18.5%.

4 Cross-sectional results

We document in this section the main characteristics of the carry trade returns. Table 5 reports the summary statistics of all four carry strategies. Panel A reports the results for the longest sample period for each of the strategies and Panel B for the data period for which we have data on all four strategies (October 1991 until December 2010). For the overlapping data, the data is constrained by bonds. In reporting the carry, we compute $S_t/F_t - 1$.

The first four columns report the summary statistics of the average carry within a certain asset class over time. The average carry is negative for currencies, stocks, and commodities, but positive for bonds. The average carry tends to be quite volatile. The last four columns report the properties of carry trade returns in the four asset classes. We find that the average monthly returns vary between 0.5% for currencies and fixed income to 1% stocks. The monthly Sharpe ratio varies between 0.13 (0.45 annualized) for commodities to 0.30 (1.04 annualized) for stocks. Perhaps surprisingly, we find that the Sharpe ratios of carry strategies based on stocks and bonds are almost twice as high as the returns on the carry strategy for currencies. The results in Panel B show that the comparison using the full sample results is unaffected by restricting attention to the most recent sample period only.

Figure 1 displays the cumulative returns of the carry strategy. We display the cumulative returns on a logarithmic scale for clarity. Both stocks and commodities have high average returns, but the return on commodities is more variable. It may not come as a surprise that the carry trade strategy works not as well for commodities as the carry is affected by expected price appreciation, the risk premium, and the convenience yield. The other three strategies do not have the third component, which may result in a measure that is closer to the actual risk premium.

To illustrate how the average carry within each asset class fluctuates over time, we present in Figure 3 the average carry in each month in the top panel and the 12-month moving average in the bottom panel. The 12-month moving average of the equity and fixed income carry display strong co-movement. Their time-series correlation equals 64%. The full correlation matrix between the 12-month moving averages are summarized in

Panel A of Table 6. The average carry of currencies is negatively correlated with the average carry of all other strategies. The correlation between the average carry of bonds and commodities is fairly positive at 24%.

As another way to study the co-movement between the average carry, we rotate the four moving average of monthly average carries into four principal components. The first principal component explains 51% of all variation, the second 26%, the third 19%, and the fourth picks up the remaining 4%. The weights that each of the principal components puts on each of the four asset classes is presented in Figure 2. The first principal component puts most weight on commodities, which is the most variable average carry (see Table 5). The second factor puts substantial weight on currencies, equity, and bonds. The sign for currencies is the opposite as for equity and fixed income due to their negative correlation.

We report the correlations between carry trade returns across asset classes in Panel B of Table 6. We find that the returns of the various carry trade returns are virtually uncorrelated, apart from the correlation between currencies and bonds for which the correlation is 20%.

The low correlation between carry strategies suggests that combining the four carry strategies can substantially improve the risk-return trade-off. As a first simple illustration, we consider an equally-weighted strategy of the four strategies. This strategy results in an average monthly return of 0.7% (8.9% annualized), a monthly standard deviation of 1.8% (6.4% annualized), which implies a monthly Sharpe ratio of 0.40 (1.40 annualized).

To further illustrate the value-added of using the information in the carry to form strategies, we compare the returns on the carry strategies to an equally-weighted portfolio of all contracts within each asset class. The results are presented in Table 7. The first four columns of Panel A present the results for the equally-weighted strategy and the last four columns present the results of the carry strategy. We report the (annualized) means, standard deviations, and Sharpe ratios. The Sharpe ratios are in all cases higher for the carry strategy than for the equally-weighted strategy.

To better understand the co-movement and risk compensation of the carry strategy and the equally-weighted strategy, we regress the returns on the carry strategy (r_t^{Carry}) on a constant and the return on the equally-weighted strategy (r_t^{EW}):

$$r_t^{Carry} = \alpha + \beta r_t^{EW} + \epsilon_t. \tag{3}$$

The estimates of α and β are reported in Panel B of Table 7. We find that the betas are in all cases close to zero. This implies that the carry strategies provide large alphas relative to the standard equally-weighted strategies in all asset classes, thereby illustrating the value-added of carry strategies across markets.

5 Return predictability

The results in the previous section provide strong evidence that the carry strategies produce high average returns and Sharpe ratios in all four global asset classes. In this section, we extend our results by studying the predictive power of the carry for future returns. Starting with Hansen and Hodrick (1980) and Fama (1984), there is a large literature indicating that forward exchange rate are biased predictors of future exchange rates, pointing to a risk-premium component that fluctuates over time.[5]

We extend this evidence to other asset classes and examine whether forward discounts and premiums (or simply 'carry') have predictive power for subsequent returns. We consider the following regression:

$$\frac{S_{t+1}}{F_t} - 1 = a + \beta \left(\frac{S_t}{F_t} - 1 \right) + \epsilon_{t+1}. \tag{4}$$

[5]Recent contributions include Lustig, Roussanov, and Verdelhan (2010), Burnside, Han, Hirschleifer, and Wang (2010), and Burnside, Eichenbaum, and Rebelo (2009).

If risk premia do not fluctuate over time, or if changes in expected price changes offset fluctuations in risk premia, then $b = 0$. We first estimate the regression (4) separately for all futures contracts in our sample.

The results for equities are reported in Table 8. The table reports the point estimates of the intercept and the predictive coefficient β in (4). We use OLS standard errors to compute the t-statistics. For equities, it is straightforward to show that the carry equals the price of the one-month dividend normalized by the current index value.[6] Hence, using the carry to predict stock returns follows a long tradition in which valuation ratios are used to forecast future stock returns.[7] We find that the predictive coefficient is significantly positive at the 10%- (5%-) level for 7 (4) out of the 13 indices we consider.

Table 9 to Table 11 reports the same results for currencies, commodities,[8] and fixed income, respectively. For currencies 8 out 20 regressions are significant at the 5% level, for commodities this is 5 out of 23, and for fixed income in 2 out of the 10 return series consider.

However, most series are fairly short, so we can gain significantly in power by pooling series cross-sectionally. Table 12 estimates the pooled regression for the four asset classes. Pooling the various series allows us to uncover strong predictability of futures returns by the carries. We find the predictive coefficient to be positive in all four asset classes. Our decomposition of the carry in (2) implies that a high carry is either due to low growth expectations of prices or the risk premium (or both). Hence, based on this decomposition, we expect the sign of the predictive regression to be positive if fluctuations in risk premia are sufficiently important in explaining variation in the carry.

[6] See for instance Binsbergen, Brandt, and Koijen (2010).

[7] See Fama and French (1988), Campbell and Shiller (1988), Cochrane (1991), Cochrane (2008), Lettau and Van Nieuwerburgh (2008), Pástor and Stambaugh (2006), Binsbergen and Koijen (2010), and Binsbergen, Brandt, and Koijen (2010).

[8] Other studies using the carry to forecast commodity returns include Fama and French (1987) and Hong and Yogo (2010).

6 Average carry and macro-economic conditions

In this section, we study how the average carry relates aggregate macro-economic conditions. Within in each asset class, at a given point in time, we compute the cross-sectional average carry. We relate the time series of the average carry to the Chicago FED National Activity Indicator (CFNAI). The CFNAI is a weighted average of 85 existing monthly indicators of national economic activity.

Figure 4 plots the 12-month moving average of the average monthly carry for the four asset classes together with the CFNAI. The time-series correlation of CFNAI with the average carry equals 15.9% for currencies, -25.6% for stocks, -8.1% for bonds, and 18.7% for commodities. If we connect these correlations with the predictive regressions results of the previous section, then we find that the risk premium on the equity and bond carry strategy are counter-cyclical, whereas the risk premium on the currency and commodity carry strategy are pro-cyclical. In interpreting these results, it is important to keep in mind that CFNAI measures the economic conditions in the United States, whereas we strategies we consider are global across countries and asset classes.

7 Conclusions

We study the risk-return properties of carry trades in four global asset classes: equities, fixed income, foreign exchange, and commodities. We form carry portfolios that are long in assets where the current futures price is lower than the current spot price and short where the futures price is above the spot. We show that the carry trade does not only work in foreign exchange, as extensively documented before, but is as profitable in equity, fixed income and commodity markets, with Sharpe ratios varying between 0.5 and 1.0 per year. The correlation between strategy returns across asset classes is low and the Sharpe ratio of a diversified cross-asset carry portfolio is 1.4. We study the dynamics of the carry across asset classes and link it to movements in macro-economic variables. We find in particular that the average carry for stocks and bonds, which are measures of risk premia, are counter-cyclical.

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A Tables and figures

Equities	First Obs.	Ann. mean	Ann. st.dev.
SPX Index	May-82	7.91	15.56
SPTSX60 Index	October-99	6.42	16.33
UKX Index	March-88	4.55	14.82
CAC Index	January-89	5.49	19.55
DAX Index	December-90	6.51	21.39
IBEX Index	August-92	13.20	21.54
FTSEMIB Index	April-04	-0.12	20.38
AEX Index	February-89	7.45	19.96
OMX Index	March-05	8.79	19.97
SMI Index	November-91	5.11	15.31
NKY Index	October-88	-2.03	21.93
HSI Index	May-92	11.72	27.10
AS51 Index	June-00	4.77	14.55

Table 1: The table presents an overview of the equity indices used in the analysis alongside the starting date as of which the equity indices are available. The last two columns provide the mean and standard deviation of the returns. The end of the sample period is in all cases December 2010.

Fixed income	First Obs.	Ann. mean	Ann. st.dev.
Australia	January-95	4.24	9.83
Canada	January-95	6.08	7.49
Germany	November-91	4.35	6.62
UK	January-95	3.95	7.84
Japan	May-89	4.23	7.49
New Zealand	January-95	2.33	9.11
Norway	August-98	2.33	7.23
Sweden	January-95	6.89	8.36
Switzerland	January-95	4.69	5.53
US	January-95	4.75	9.60

Table 2: The table presents an overview of the government bonds used in the analysis alongside the starting date as of which the data are available. The last two columns provide the mean and standard deviation of the returns. The end of the sample period is in all cases December 2010.

Currencies	First Obs.	Ann. mean	Ann. st.dev.
Australia	January-85	-3.31	12.10
Austria	January-97	6.49	9.43
Belgium	January-97	7.18	9.51
Canada	January-85	-1.76	7.12
Denmark	January-85	-3.34	11.08
Finland	January-97	8.41	9.58
France	January-97	7.15	9.39
Germany	January-97	7.47	9.32
Greece	January-97	1.97	11.32
Italy	January-97	4.84	9.12
Japan	November-83	-0.31	11.48
Netherlands	January-97	7.95	9.46
New Zealand	January-85	-5.61	12.28
Norway	January-85	-3.51	10.92
Portugal	January-97	6.65	9.07
Spain	January-97	5.30	9.26
Sweden	January-85	-2.33	11.60
Switzerland	November-83	-0.38	11.84
UK	November-83	-1.53	10.62
Euro	February-99	-0.74	10.71

Table 3: The table presents an overview of the currencies used in the analysis alongside the starting date as of which the data are available. The last two columns provide the mean and standard deviation of the returns. The end of the sample period is in all cases December 2010.

Commodities	First Obs.	Ann. mean	Ann. st.dev.
Aluminum	August-97	0.34	20.20
Copper	August-97	14.74	27.83
Nickel	August-97	18.93	38.03
Zinc	August-97	2.47	28.74
Lead	August-97	13.83	31.84
Tin	August-97	16.67	23.98
Crude Oil	July-88	18.15	34.48
Gasoil	August-89	17.84	34.49
WTI crude	April-83	12.85	35.05
RBOB gasoline	November-05	16.73	41.09
Heating oil	August-86	19.89	37.28
Natural gas	May-90	-4.60	60.50
Cotton	January-70	5.30	29.51
Coffee	September-72	7.63	39.58
Cocoa	January-70	7.27	34.01
Sugar	January-70	10.97	46.28
Soybeans	January-70	5.96	29.77
Kansas wheat	February-70	5.91	26.61
Corn	January-70	-1.45	27.65
Wheat	January-70	1.91	28.83
Lean Hogs	June-86	-7.83	39.76
Feeder Cattle	January-72	5.44	18.53
Live Cattle	January-70	6.20	20.69

Table 4: The table presents an overview of the commodities used in the analysis alongside the starting date as of which the data are available. The last two columns provide the mean and standard deviation of the returns. The end of the sample period is in all cases December 2010.

Panel A: Longest sample

	Average carry				Returns			
	FX	Stocks	Bonds	Commodities	FX	Stocks	Bonds	Commodities
Mean	-7.8%	-6.9%	14.1%	-32.6%	0.5%	1.0%	0.5%	0.9%
St.dev.	19.6%	23.9%	9.9%	33.3%	2.7%	3.3%	1.8%	7.2%
Sharpe ratio					0.18	0.30	0.26	0.13
Skewness	-0.02	-0.05	0.15	0.46	-0.84	0.28	-0.18	0.42
Kurtosis	-0.27	-0.14	-0.54	0.52	1.91	1.50	1.58	5.28

Panel B: Overlapping sample

	Average carry				Returns			
	FX	Stocks	Bonds	Commodities	FX	Stocks	Bonds	Commodities
Mean	-3.9%	-3.9%	14.1%	-35.3%	0.4%	1.1%	0.5%	1.0%
St.dev.	16.1%	22.3%	9.9%	27.4%	2.6%	3.3%	1.8%	5.5%
Sharpe ratio					0.16	0.34	0.26	0.18
Skewness	-0.80	-0.07	0.15	0.55	-0.82	0.31	-0.18	0.35
Kurtosis	0.88	-0.28	-0.54	-0.05	1.64	1.56	1.58	0.40

Table 5: The table reports the summary statistics of the average carry within a period and the returns of the carry strategies for four asset classes: currencies ('FX'), stocks, bonds, and commodities. Panel A presents the results for the longest sample period available, whereas Panel B reports the results for the sample with overlapping data (October 1991 until December 2010).

Panel A: 12-month moving average of monthly average carry

	FX	Stocks	Bonds	Commodities
FX	100.0%	-10.1%	-22.2%	-15.1%
Stocks	-10.1%	100.0%	63.8%	-4.5%
Bonds	-22.2%	63.8%	100.0%	23.6%
Commodities	-15.1%	-4.5%	23.6%	100.0%

Panel B: Returns carry strategy

	FX	Stocks	Bonds	Commodities
FX	100.0%	6.7%	20.0%	3.3%
Stocks	6.7%	100.0%	-5.6%	0.6%
Bonds	20.0%	-5.6%	100.0%	1.9%
Commodities	3.3%	0.6%	1.9%	100.0%

Table 6: The table reports in Panel A the correlation between the 12-month moving average of the monthly average carry across four asset classes: currencies ('FX'), stocks, bonds, and commodities. Panel B displays the correlations between the returns on the strategies. The sample period is from October 1991 until December 2010, which is the longest overlapping sample available.

Panel A: Summary statistics

	Equally-weighted				Carry trade			
	FX	EQ	FI	Comm.	FX	EQ	FI	Comm.
Mean	-0.9%	6.8%	4.8%	6.4%	5.0%	13.4%	5.6%	11.7%
St.dev.	8.1%	15.7%	6.2%	14.3%	8.9%	11.5%	6.2%	18.9%
Sharpe ratio	0.12	0.43	0.77	0.45	0.57	1.16	0.89	0.62

Panel B: Pricing models

	FX	EQ	FI	Comm.
α	5%	14%	5%	11%
β	-0.31	-0.04	0.05	0.06

Table 7: The table reports n Panel A the properties of returns on an equally-weighted and carry strategy in each of the four asset classes: currencies ('FX'), stocks ('EQ'), bonds ('FI'), and commodities ('Comm.'). Panel B reports the estimates of the pricing model in equation (3) in the main text. The sample period is from October 1991 until December 2010, which is the longest overlapping sample available.

Equities	Intercept	T-value	Beta	T-value	R-squared	No. of Obs.
SPX Index	0.85	3.19	1.27	1.71	0.84	346
SPTSX60 Index	0.36	0.87	-2.07	-1.47	1.57	137
UKX Index	0.45	1.66	0.46	0.83	0.25	275
CAC Index	0.50	1.43	-0.25	-0.26	0.03	257
DAX Index	0.84	1.66	0.92	0.95	0.37	243
IBEX Index	0.86	1.99	1.29	2.06	1.97	213
FTSEMIB Index	-0.10	-0.16	2.08	1.46	2.58	83
AEX Index	0.61	1.73	0.87	1.37	0.71	263
OMX Index	0.57	0.95	1.88	1.84	4.80	69
SMI Index	0.53	1.68	1.68	2.14	2.34	193
NKY Index	-0.17	-0.44	1.37	1.76	1.17	264
HSI Index	0.62	1.22	1.98	2.35	2.44	222
AS51 Index	0.18	0.54	4.15	4.57	14.22	128

Table 8: The table reports the estimation results of the predictive regression in (4) for equities. The table reports the intercept (with t-statistic), the predictive coefficient (with t-statistic), R-squared value, and the number of observations. We use OLS standard errors to compute the t-statistics.

Currencies	Intercept	T-value	Beta	T-value	R-squared	No. of Obs.
Australia	0.16	0.55	1.61	2.07	1.36	314
Austria	-0.83	-0.1	7.66	0.16	0.12	24
Belgium	0.87	1.15	-1.36	-0.56	1.40	24
Canada	-0.01	-0.12	1.88	2.5	1.97	314
Denmark	-0.13	-0.71	1.52	2.42	1.84	314
Finland	0.8	0.8	-0.41	-0.12	0.07	24
France	0.54	0.54	0.21	0.07	0.02	24
Germany	0.15	0.16	1.66	0.64	1.81	24
Greece	-1.57	-1.55	-3.87	-2.18	17.82	24
Italy	0.55	1	-3.35	-1.29	7.02	24
Japan	-0.64	-2.39	2.44	3.08	2.84	327
Netherlands	0.11	0.12	1.77	0.73	2.39	24
New Zealand	0.21	0.73	1.73	2.95	2.74	311
Norway	-0.18	-0.84	0.49	0.77	0.19	313
Portugal	0.45	0.73	0.98	0.4	0.74	24
Spain	1.34	1.99	-18.3	-2.09	16.63	24
Sweden	-0.01	-0.07	1.3	2	1.26	314
Swiss	-0.3	-1.3	1.64	1.98	1.19	328
UK	0.15	0.76	1.83	3.03	2.74	328
Euro	-0.15	-0.58	3.7	1.87	2.38	145

Table 9: The table reports the estimation results of the predictive regression in (4) for currencies. The table reports the intercept (with t-statistic), the predictive coefficient (with t-statistic), R-squared value, and the number of observations. We use OLS standard errors to compute the t-statistics.

Commodities	Intercept	T-value	Beta	T-value	R-squared	No. of Obs.
Aluminum	-0.06	-0.09	-0.28	-0.28	0.05	162
Copper	1.18	1.87	1.46	1.55	1.48	162
Nickel	1.39	1.57	-0.01	0.00	0.00	156
Zinc	0.03	0.03	-0.62	-0.36	0.08	161
Lead	1.5	1.98	2.10	2.21	3.03	158
Tin	1.4	2.53	-0.17	-0.13	0.01	161
Crude Oil	1.81	2.83	0.98	1.46	0.98	217
Gasoil	2.14	3.13	1.48	2.27	2.50	204
WTI crude	1.25	2.03	1.03	1.68	1.13	249
RBOB gasoline	1.21	0.65	-1.33	-0.73	1.33	42
Heating oil	2.48	3.16	1.41	1.87	1.81	192
Natural gas	0.39	0.21	1.74	1.02	0.84	124
Cotton	0.47	1.07	0.09	0.22	0.01	428
Coffee	1.71	2.69	1.31	2.23	1.34	368
Cocoa	0.89	1.70	1.08	2.06	0.97	434
Sugar	0.58	0.81	-0.62	-0.90	0.23	359
Soybeans	0.43	0.96	-0.08	-0.15	0.00	458
Kansas wheat	1.13	2.71	0.81	2.01	0.93	435
Corn	0.25	0.45	0.31	0.68	0.11	420
Wheat	0.82	1.52	0.44	0.97	0.24	397
Lean Hogs	-0.18	-0.20	-0.98	-1.25	1.57	99
Feeder Cattle	0.68	2.74	-0.13	-0.47	0.06	401
Live Cattle	0.56	1.81	-0.03	-0.12	0.00	343

Table 10: The table reports the estimation results of the predictive regression in (4) for commodities. The table reports the intercept (with t-statistic), the predictive coefficient (with t-statistic), R-squared value, and the number of observations. We use OLS standard errors to compute the t-statistics.

Bonds	Intercept	T-value	Beta	T-value	R-squared	No. of Obs.
Australia	-0.03	-0.09	4.04	2.00	2.04	194
Canada	0.31	1.11	0.96	0.83	0.36	194
Germany	0.21	1.16	1.05	1.16	0.59	232
UK	0.27	1.59	0.94	1.19	0.73	194
Japan	-0.01	-0.07	1.97	2.59	2.52	262
New Zealand	0.14	0.72	1.57	1.41	1.03	194
Norway	0.10	0.50	1.22	1.09	0.79	151
Sweden	0.29	0.86	1.57	0.99	0.51	194
Switzerland	0.07	0.23	1.51	1.18	0.72	194
US	0.20	0.74	1.41	1.16	0.70	194

Table 11: The table reports the estimation results of the predictive regression in (4) for bonds. The table reports the intercept (with t-statistic), the predictive coefficient (with t-statistic), R-squared value, and the number of observations. We use OLS standard errors to compute the t-statistics.

Pooled	Intercept	T-value	Beta	T-value	R-squared	No. of Obs.
Equities	0.57	5.35	1.16	5.31	1.04	2693
Currencies	-0.05	-0.86	1.22	7.03	1.50	3248
Commodities	0.89	7.30	0.53	4.31	0.03	6116
Fixed income	0.15	2.18	1.52	4.70	1.10	1984

Table 12: The table reports the estimation results of a pooled predictive regression in (4) for each asset class. The table reports the intercept (with t-statistic), the predictive coefficient (with t-statistic), R-squared value, and the number of observations. We use OLS standard errors to compute the t-statistics.

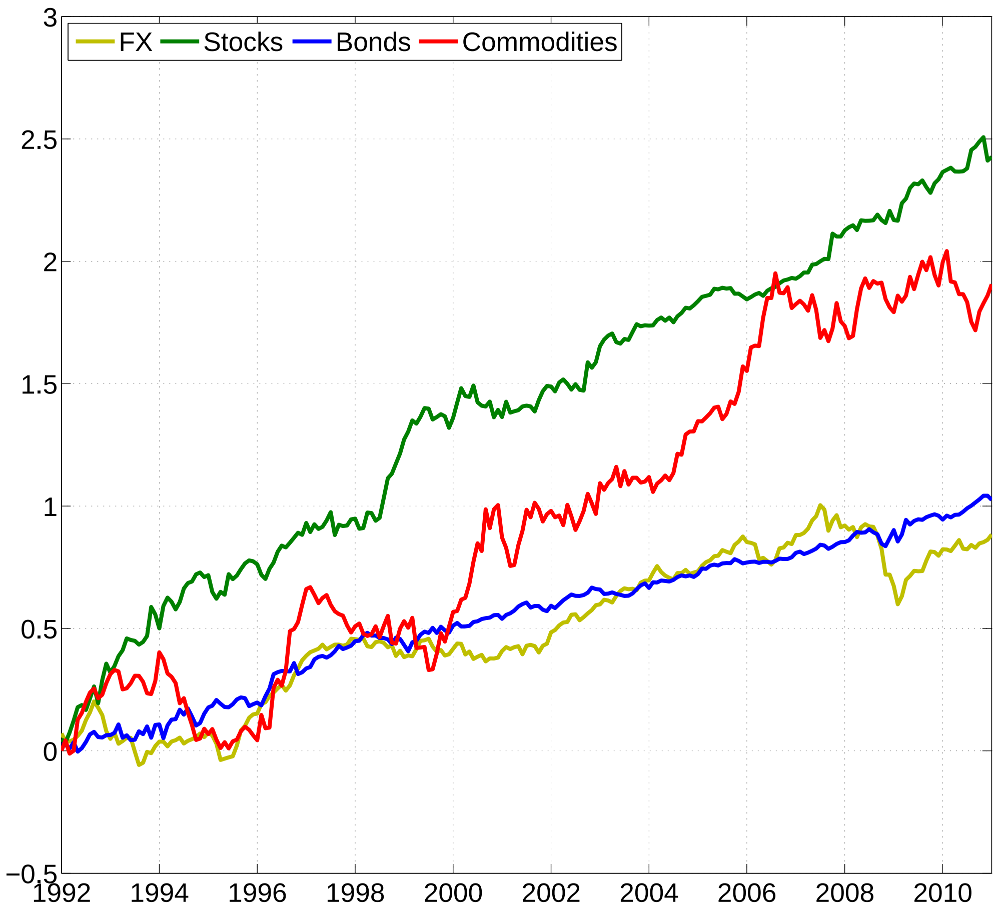

Figure 1: The figure displays the logarithm of the cumulative return of the carry strategies for four asset classes: currencies ('FX'), stocks, bonds, and commodities. The sample period is from October 1991 until December 2010, which is the longest overlapping sample available.

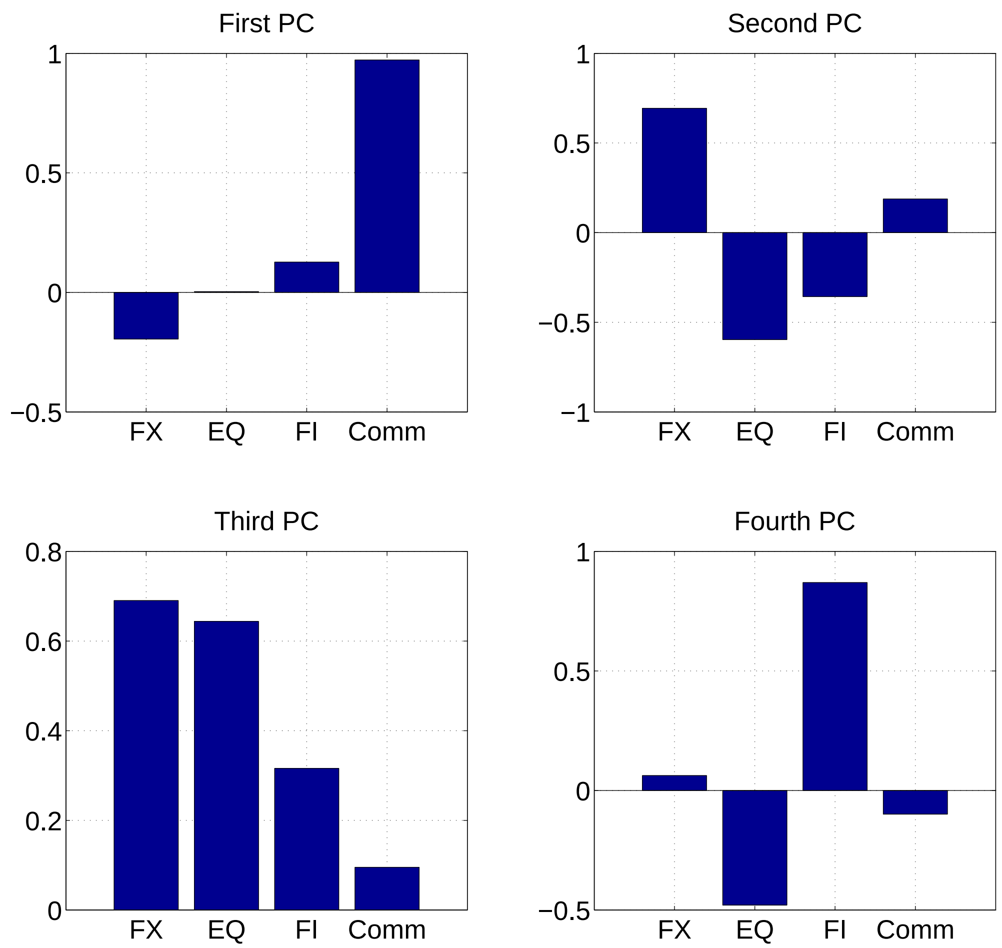

Figure 2: The figure displays the weights that each of the principal components put on each of the four asset classes: currencies ('FX'), stocks ('EQ'), bonds ('FI'), and commodities ('Comm.'). The sample period is from October 1991 until December 2010, which is the longest overlapping sample available.

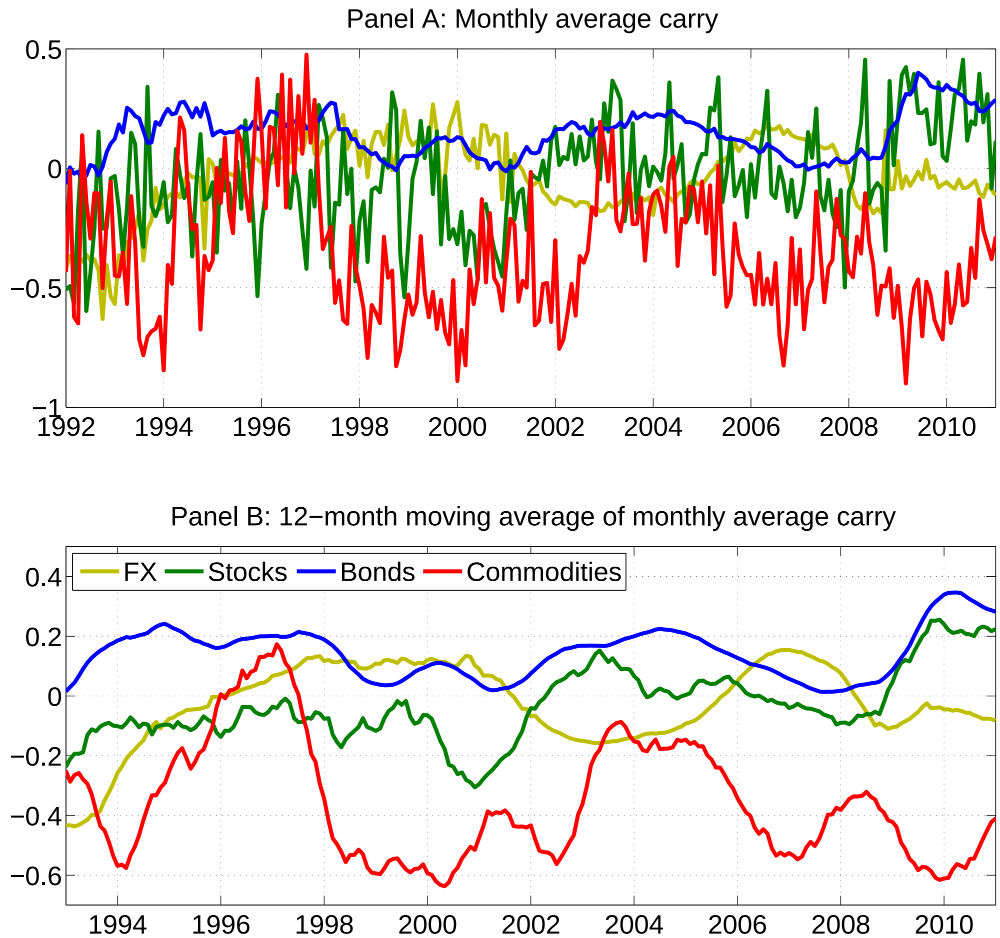

Figure 3: The figure displays the average monthly carry and the 12-month moving average of the average monthly carry for four asset classes: currencies ('FX'), stocks, bonds, and commodities. The sample period is from October 1991 until December 2010, which is the longest overlapping sample available.

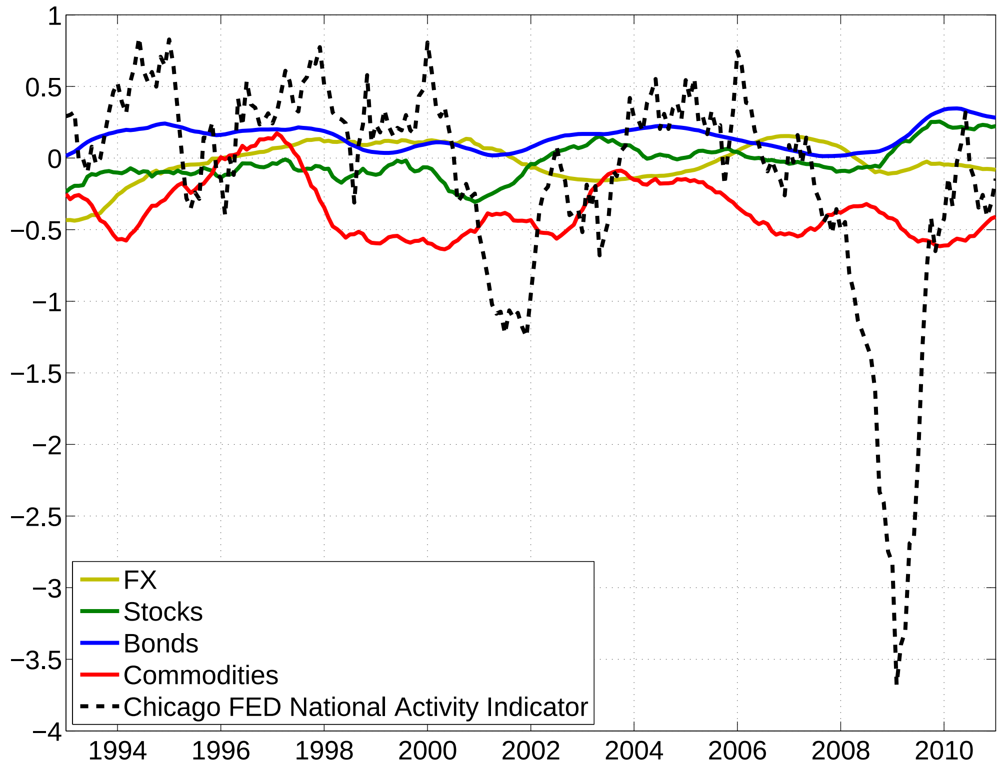

Figure 4: The figure displays the 12-month moving average of the average monthly carry for four asset classes: currencies ('FX'), stocks, bonds, and commodities. In addition, we plot the time series of the Chicago FED National Activity Indicator (CFNAI). The sample period is from October 1991 until December 2010, which is the longest overlapping sample available.